CORPORATE WATER ACCOUNTING

An Analysis of Methods and Tools for Measuring Water Use and Its Impacts

UNEP

The CEO Water Mandate

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Preface

The United Nations Environment Programme's Division of Technology, Industry, and Economics (UNEP DTIE) commissioned this report from the Pacific Institute in its capacity as part of the CEO Water Mandate Secretariat. The report is one component of the broader UNEP Water Footprint, Neutrality, and Efficiency (WaFNE) Umbrella Project.

The CEO Water Mandate is a UN Global Compact initiative designed to help the private sector better understand and address its impacts on and management of water resources. Recognizing the urgency of the emerging global water crisis, the UN Secretary-General, in partnership with a number of international business leaders, launched the Mandate in July 2007. Endorsing CEOs acknowledge that in order to operate in a more sustainable manner, and contribute to the vision of the UN Global Compact and the realization of the Millennium Development Goals, they have a responsibility to make water resources management a priority, and to work with governments, UN agencies, non-governmental organizations, and other stakeholders to address this global water challenge.

The Pacific Institute is dedicated to protecting our natural world, encouraging sustainable development, and improving global security. Founded in 1987 and based in Oakland, California, the Institute provides independent research and policy analysis on issues at the intersection of development, environment, and security and aims to find real-world solutions to problems like water shortages, habitat destruction, global warming, and environmental injustice. The Pacific Institute conducts research, publishes reports, recommends solutions, and works with decision-makers, advocacy groups, and the public to change policy.

The Institute for Environmental Research and Education undertakes and disseminates comprehensive, fact-based research for use in the development of responsible environmental policy, programs, and decisions. The American Center for Life Cycle Assessment, the professional society for LCA in the United States, is its flagship program.

UNEP established the WaFNE Project in order to enhance water efficiency and water quality management through the refinement and pilot testing of several existing water accounting methods and supporting management tools. This project will encourage convergence of practice and compatibility among these methods. This $4 million project—established in March 2009—will be implemented over the course of three years with supporting partners including the UN Global Compact/CEO Water Mandate, Stockholm International Water Institute, Water Footprint Network, Society of Environmental Toxicology and Chemistry, World Business Council for Sustainable Development, World Economic Forum, International Water Association, National Cleaner Production Centre Network, UNESCO, and the UN-Water Secretariat. In addition to the stocktaking exercise, this WaFNE Project will:

- Map and refine methodologies and related management tools for the water footprint and water neutrality concepts;
- Build capacity and raise awareness among the public and private sectors in order to apply water accounting and neutrality concepts on a greater scale and with greater consistency;
- Demonstrate the applicability of harmonized concepts in enhancing water efficiency and improving water quality in water-intensive industries and water-stressed regions.

Some of the key outputs from this project will include: methodologies and tools for water accounting, dialogue platforms at the global and local level, a capacity platform with online knowledge management and guidance materials for water accounting methods, country-level pilot testing of methods, and awareness raising activities. The pilot testing will look at the implementing of corporate water accounting methods—in possibly six countries spanning multiple continents and at least four industry sectors.

As an initial step to the WaFNE Project, UNEP has commissioned a stocktaking exercise of existing methodologies and supporting tools for corporate water accounting. The findings of this stocktaking exercise are the subject of this report.

Table of Contents

Executive Summary **6**

I. Introduction **11**

Problem statement 11

Project background 11

Corporate water accounting in context 13

II. Understanding Water Accounting Needs and Mechanisms **15**

Operational efficiency, product eco-design, sustainable manufacturing 15

Water risk assessment/identification (e.g., “hotspotting”) 16

Managing water impacts/water stewardship response 17

Communicating water risk/performance with stakeholders 18

III. Origins, Objectives, and Structure of Methods and Tools **19**

Water Footprinting (as managed by the Water Footprint Network) 19

Life Cycle Assessment 21

WBCSD Global Water Tool 23

GEMI Water Sustainability Tools 24

Financial and personnel requirements for water accounting methods and tools 25

IV. Identifying Water-Related Business Risks **28**

The interplay between water-related impacts and business risks 28

The range of water risks 28

Water Footprinting 29

Life Cycle Assessment 30

WBCSD Global Water Tool 30

GEMI Water Sustainability Tools 31

V. Understanding and Responding to Impacts on Watersheds, Ecosystems, and Communities **32**

Limitations with water-related impact assessments 32

Water Footprinting 33

Life Cycle Assessment 34

WBCSD Global Water Tool 35

GEMI Water Sustainability Tools 35

VI. Accounting for Industrial Effluent and Water Quality **36**

Dilution water and the gray Water footprint 36

Direct assessment of contaminant load into waterways / LCA approach to water quality 37

WBCSD Global Water Tool 38

GEMI Water Sustainability Tools 38

VII. Conveying Water Information to Stakeholders **40**
- Third-party water disclosure metrics and protocols 40
- Water Footprinting 41
- Life Cycle Assessment 42
- WBCSD Global Water Tool 42
- GEMI Water Sustainability Tools 43

VIII: Data Limitations **44**

IX. Water Accounting and Other Sustainability Accounting Methods **46**
- Carbon accounting 46
- Ecological Footprinting 47
- Compatibility of sustainability accounting methodologies 47

X. Advancing Corporate Water Accounting Practices **49**

Works Cited **52**

Appendix A: List of Research Advisory Committee Members **53**

Appendix B: Key Players in Corporate Water Accounting **54**

Appendix C: Acronyms **58**

LIST OF BOXES

Box 1: SABMiller and Water Footprinting 20

Box 2: Unilever, Water Footprinting, and LCA 23

Box 3: Dow Chemical’s Use of The WBCSD & GEMI Online Tools 24

LIST OF FIGURES

Figure 1: The Role of Water Accounting in Advancing Sustainable Water Management 14

Figure 2: Examples of Water-related Risk Throughout the Value Chain 29

Figure 3: An Example of Water Footprinting Study Visualization 41

LIST OF TABLES

Table 1: Summary of Objectives, Scope, and Structure for Major Corporate Accounting Methodologies and Tools 27

Table 2: Summary of Accounting Approaches to Water-related Impacts 35

Table 3: Summary of Accounting Approaches for Water Quality and Industrial Effluent 39

Executive Summary

Problem Statement

Water as a natural resource is facing many challenges at the local, regional, and global levels. Human water use is increasingly having negative impacts on human health, economic growth, the environment, and geopolitical stability. In recent years, concerns over growing water scarcity, lack of access to water to meet basic human needs, degraded ecosystem function, and the implications of climate change on the hydrologic cycle have brought water to the forefront as a strategic concern for companies around the world.

Companies' ability to measure and account for their water use and wastewater discharges throughout the value chain is a critical component in their risk assessment and mitigation efforts, as well as their broader ambitions to become responsible water stewards. Corporate water accounting also allows consumers, civil society groups, and the investment community to compare different companies' social and environmental impacts in order to inform their actions and decision making. In sum, the ability to effectively account for corporate water use and impacts is essential in helping companies drive improvement and become aligned with external stakeholders' expectations, as well as their efforts to advance sustainable water management.

However, collecting and disseminating meaningful water-related information is a complicated and difficult undertaking. And while corporate water accounting methods and tools have been under development for the past decade, there is still near universal agreement that current methods—though a good start—are inadequate and need to be refined.

Project Objectives and Methodology

This stocktaking exercise—a joint effort of the United Nations Environment Programme (UNEP) and the CEO Water Mandate—aims to assess existing and emerging water accounting methods and tools being used in the private sector, with the goals of:

- Elucidating commonalities and differences among emerging methods and practice;
- Identifying gaps and challenges;
- Suggesting where accounting methods might benefit from harmonization and increased field testing.

Our analysis focuses primarily on four main methods/tools:

- **The Water Footprint Network's "water footprint":** A method for measuring the volume of water used by any group of consumers (including a business or its products) that is intended to help those consumers better understand their relationship with watersheds, make informed management decisions, and spread awareness of water challenges.
- **Life Cycle Assessment:** A systems analysis tool designed specifically to measure the environmental sustainability of products (including water use/discharge and many other resource uses/emissions) through all components of the value chain.
- **WBCSD Global Water Tool:** A free online platform that couples corporate water use, discharge, and facility information input with watershed- and country-level data as a means of assessing water-related risk.
- **GEMI Water Sustainability Planner/Tool:** Two free online tools meant to help companies better understand their water-related needs and circumstances. The Water Sustainability Tool assesses a company's relationship to water, identifies associated risks, and describes the business case for action. The Water Sustainability Planner helps elucidate a facility's dependence on water and the status of the local watershed.

In an appendix to this report, we provide a brief overview of several water accounting methods that are regionally/nationally specific, industry-sector specific, or proprietary and therefore not included in our analysis. In addition, the International Organization for Standardization (ISO) is currently developing a standard for water accounting that is highly relevant to this research, though is not included here because the standard is in its early stages.

Water accounting—as well as companies' need for and use of it—has evolved significantly over time. In exploring these needs and their evolution in recent years, we summarize when and for what reasons companies are seeking to use existing methods and tools, along with the questions they are asking with regard to their corporate water use/discharge and the resulting impacts and business risks. Because current water accounting methods and tools all have different histories, intended objectives, and outputs, we explicate these origins and core functions in order to shed light on the circumstances for which various methods and tools may (or may not) be appropriate and effective.

Corporate water accounting today can be seen as serving four general, inter-related applications:

- Operational efficiency, product eco-design, sustainable manufacturing
- Water risk assessment/identification
- Managing water-related social and environmental impacts and water stewardship response
- Communicating water risk/performance with stakeholders

These areas of interest to companies represent the broad types of methods and tools available and are motivated by a number of factors, including pursuit of reduced costs, strategic planning, brand management/corporate reputation, and corporate ethics/philanthropy. However, at their root, they are all driven by the desire to identify and reduce water-related business risk (and seize opportunities), whether through building competitive advantage, ensuring long-term operational viability, or maintaining and/or improving social license to operate. Because understanding and mitigating the inter-related issues of water risk and impact is a core driver for emerging water accounting methods and tools, they are explored extensively in this analysis.

Findings

Our analysis has resulted in a number of key findings, including those pertaining to: 1) the areas in which corporate water accounting in general is lacking, 2) the similarities across all four general applications covered in the study, and 3) the characteristics, strengths, and weaknesses of specific methodologies and tools. Conclusions about the four application areas and water accounting in general are listed below, while conclusions regarding the main methods/tools assessed are summarized in Table ES-1. We conclude with a list of recommendations for improving corporate water accounting in the future.

OVERARCHING CONCLUSIONS

- **Terminology confusion:** The term "water footprinting" is frequently used by different interests to mean very different things. Most notably, for many, it is used as an umbrella term for all water accounting methods connoting a volumetric measurement of water use that reflects water-related impacts. This usage of the term is similar to the way that many understand carbon footprinting. However, water footprinting—as defined by the Water Footprint Network (WFN)—is in fact fundamentally different from carbon footprinting in a number of key ways, especially with regard to the assessment of impacts, which the WFN excludes. Because of this varied understanding, any claims or conclusions made about "water footprinting" should be scrutinized carefully.
- **Shift toward external factors:** The extent to which a company has water-related business risks is largely dependent on the socio-political, environmental, and geo-hydrologic contexts in which the company and its suppliers operate. As such, corporate water accounting has transitioned from a primarily inward focus on production processes to an outward focus that entails the social, political, environmental conditions of the watersheds in which companies operate.
- **Lack of harmonization:** Being a nascent field, the approaches used by businesses to measure and report water-related risks and impacts vary significantly among companies and industry sectors. In addition, methods for characterizing watershed conditions are still largely underdeveloped. As such, it is often difficult for companies to compare their water risks and impacts, and benchmark their progress against that of other companies. Furthermore, it makes it difficult for external stakeholders to accurately assess companies' risk and impacts.
- **Supply chain issues underemphasized:** Companies are increasingly recognizing that a significant portion of their water-related risks and impacts can occur in their supply chain rather than their direct operations. Yet this component of corporate water accounting remains relatively underdeveloped. This is due partly to the challenge of collecting and managing data from often hundreds of different suppliers,

as well as the fact that many companies (e.g., those that source supplies in global commodity markets) are not able to track water issues relating to their supplies.

- **Inadequate data:** A lack of sufficient data is in many cases the greatest factor limiting the ability of corporate water accounting to provide meaningful information on water-related impacts and risks. This is most often due to inadequate databases, lack of access to existing data, or insufficient granularity of data.
- **The water-energy-carbon nexus:** Companies are increasingly acknowledging that water-related impacts and risks are inextricably linked to their energy use and carbon emissions. Sustainability accounting methods are only beginning to develop efficient ways to align such assessments and highlight linkages.

FINDINGS REGARDING THE FOUR APPLICATION AREAS

Operational efficiency, product eco-design, sustainable manufacturing

Companies simply seeking to improve the efficiency of their operations with respect to water use and discharge may require relatively little knowledge of watershed conditions in which they operate. Although the need for operational efficiencies may be greater in certain locations due to water stress, the process through which these improvements are achieved is typically not dependent on the local context. Thus, companies can often track operational efficiencies using internal production data alone. That said, efforts to make "eco-friendly" products are predicated on assessing external factors, which will require watershed-level, local context data.

Water risk assessment/identification

Water-related business risks are associated not only with the impacts of corporate water use/discharge on the surrounding environment, but also changing external social, environmental, and political conditions in places where the company operates. As such, risk can be effectively assessed using a number of different approaches, including the four main methods/tools evaluated in this study. Conducting a simple "first-tier" risk screen that identifies at-risk operations or value chain stages that are likely to have water issues is quick and relatively inexpensive, and can be done without extensive detailed internal or external data. However, conducting a comprehensive assessment that considers the specific local social, environmental, and political conditions that create risk in a particular locale requires detailed data on both internal water use/discharge and local watershed conditions. Such data collection requirements can be resource intensive and are often hindered by a paucity of primary data.

Managing water-related social and environmental impacts and water stewardship response

Accurately assessing the social and environmental impacts of a company's water use/discharge is an important component in any comprehensive corporate water accounting exercise. Yet methods for assessing such water-related impacts are currently underdeveloped. This is partly due to the data limitations mentioned above, but also due to a lack of agreement among practitioners on the appropriate range of social and environmental impacts that must be addressed, as well as consensus on the methods by which such impacts are characterized. A detailed assessment of impacts could consider a number of different environmental and social factors, including physical abundance of water, human access to water, affordability of water services, human health issues, and ecosystem function/biodiversity, among others. However, at present there is no consensus in the field of corporate water accounting as to the appropriate scope of such impact assessments.

Communicating water risk/performance with stakeholders

Companies are increasingly using their water accounting outputs to support their disclosure to key stakeholders and the general public as a strategy for improving transparency and accountability. Traditionally, quantitative water data disclosed has focused on indicators such as total water use, discharge, and/or recycling. This information alone is now widely considered inadequate as it does not address the local contexts in which the water is used. As corporate water accounting has evolved from an inward to outward focus over the years, a corollary shift in demand for supporting information has taken place. New initiatives, such as the Carbon Disclosure Project, underline that such disclosure of risk-related and location-specific information is now an expectation of companies.

ES-1 Summary of Findings on Corporate Water Accounting Methods and Tools

Application:	Water Footprint	Life Cycle Assessment	WBCSD Global Water Tool	GEMI Water Sustainability Tools
General Strengths	• Good tool for "big picture" strategic planning purposes • Easily understood by non-technical audiences • Best for water use assessments, as opposed to water quality	• Uniquely well-suited for cross-media environmental assessments • Mature science-based methods for assessing water-quality impacts	• Good first-tier risk screen • Inexpensive, fast, and does not require company expertise • Simple inventory for companies to compile their water data	• Useful for companies just beginning to think about water stewardship • Inexpensive, fast, does not require expertise
General Weaknesses	• Generic, aggregated blue-green-grey WF[1] figures are misleading • Grey WF deemed ineffective by many companies	• No universally accepted method of assessing water use impacts • Results can be difficult to communicate to non-technical audiences	• Does not address water quality/discharge-related risks • Does not address impacts • Assessments provide only rough estimates of risk	• Rudimentary assessment of relative risks • No quantified results
Assessing Water-Related Business Risks	• Identifies "hotspots" linking corporate consumptive water use and source water data • Green/blue WF distinction helps shed light on nature of risk	• Uses science-based impact assessment as the starting point for understanding business risk • Operational "hotspots" used for product design improvement, technical improvements	• Emphasizes place-based water metrics that contextualize company water use and that serve as the basis for under-standing risk • Identifies "hotspots" by mapping facilities against external water and sanitation data	• The Planner assesses external factors that affect specific facilities • The Tool helps companies identify business-wide water-related risks
Understanding and Responding to Water Use and Quality Impacts	• WF calculation does not attempt to quantify water-related impacts • Green/blue WF distinc-tion illustrates general extent and type of impact • Gray WF underdevel-oped/ underutilized – focuses on primary pollutant and calculates theoretical volume of dilution water needed to reach regulatory standards	• Situates water impacts within a broader under-standing of sustainability impacts • Characterizes water use data based on relative water stress to quantify impacts • Measures individual contaminant loads • Does not typically quantify impact to specific local receiving bodies	• Does not characterize corporate water use or otherwise attempt to assess impacts • Does not assess water quality issues	• Provides a compilation of information that can help better understand and identify impacts, but does not quantify them • Provides questions that help companies understand their effects on quality of water bodies
Conveying Water Information to Stakeholders	• Can be an effective public-awareness building tool • Conducive to business engagement with water resource managers	• In many instances, particularly in North America, is used for internal purposes only • Awareness levels in both business and the public vary greatly • Used to inform ecolabel programs	• Results of "hotspotting" are more frequently being included in CSR reports • Automatically calcu-lates water-related GRI indicators to be used for CSR reports	• Is not intended for use as a communication tool, nor is it commonly used as one

Recommendations

In our analysis, we identified six key areas in which water accounting practices can be improved through emerging practice. These improvements can manifest themselves through the field testing that UNEP is planning within its multi-year WaFNE Project, or the efforts of other corporate water stewardship initiatives.

- **Common definitions:** Reaching broad consensus on an acceptable definition of the term and concept of "water footprinting" is essential moving forward in order to clarify communication of important information among companies and allow non-technical audiences, including consumers and investors, to more easily understand and engage with this field.
- **Assessment of local water resource context:** Corporate water accounting must better measure and more consistently characterize the local external contexts in which companies operate. In particular, a better understanding of the social dimensions (e.g. accessibility, affordability) of water resources is needed. Companies, practitioners, and other stakeholders stand to benefit from reaching agreement on appropriate and effective "local context" metrics and better ways of working together to collect and manage the relevant watershed-based information.
- **Harmonized reporting criteria:** In order to support companies' and stakeholders' ability to assess corporate water risks, impacts, and performance and guide future corporate water stewardship practices, a more consistent approach to measuring and communicating water-related information must be developed. Such information should be relevant across industry sectors and regions and must be valuable for companies themselves, while addressing external stakeholder needs.
- **Improved data collection:** Since many corporate water accounting efforts are limited by insufficient corporate water use and external watershed data, emerging best practice should focus on building the capacity of operations managers to develop and manage more robust information systems.
- **Assessment of supply chain:** More robust and systematic ways to address suppliers' water issues must be developed. Building out this relatively underdeveloped aspect of corporate water footprinting can be accomplished by focusing on standardized and improved data collection systems in complex supply chains—and innovative ways to communicate and incentivize this focus to suppliers.
- **Addressing water quality:** Priority should be given to developing more effective ways of accounting for wastewater discharge/water quality, assessing related impacts on ecosystems and communities, and "characterizing" ambient water quality in the watersheds in which companies operate.
- **Cooperation among companies:** There is an opportunity for companies to pool resources in their efforts to better measure and contextualize their relationship with water resources and contribute to sustainable water management. Companies can expedite the advancement of water accounting practices by sharing policies and programs, watershed and supplier data, innovative technologies, and effective reporting criteria.

I. Introduction

Problem statement

Water as a natural resource is facing many challenges at the local, regional, and global levels. Human water use is increasingly having negative impacts on human health, economic growth, the environment, and geopolitical stability. Rising demands for fresh water stem from a variety of factors, including population growth; industrial activities; increasing standards of living, particularly in emerging economies; and the effects of climate change. Current patterns of human water use are unsustainable; 5-to-25 percent of global freshwater use exceeds long-term accessible supplies, requiring overdraft of groundwater supplies or engineered water transfers (Millennium Ecosystem Assessment 2005). In specific regions, such as North Africa and the Middle East, up to one-third of all water use is unsustainable (Millennium Ecosystem Assessment 2005). Additional water stress is projected in Asia, which supports more than half the world's population with only 36% of the world's freshwater resources. If current trends continue, 1.8 billion people will be living in countries or regions with water scarcity by 2025, and two-thirds of the world population could be subject to water stress (UN News Centre 2009).

In recent years, concerns of growing water scarcity, lack of access to water to meet basic human needs, damaged ecosystems, human health issues, and the implications of climate change on the hydrologic cycle have brought water to the forefront as a strategic concern for companies around the world. Companies are realizing they are no longer able to easily access relatively cheap and clean water and that they must more closely consider limited supplies and the implications of their water use and discharge on watersheds, ecosystems, and communities. Further, pronounced water scarcity in key geographic regions, along with heightened expectations among important stakeholders including consumers and investors, has created a compelling business case for companies to actively pursue corporate water stewardship as a strategy that drives down water-related impacts and the subsequent business risks.

Companies' ability to measure and account for their water use and wastewater discharges throughout the value chain is a critical component in their risk assessment and mitigation efforts, as well as their broader ambitions to become responsible water stewards. Effective water accounting allows companies to determine the impacts of their direct and indirect water use and discharges on communities and ecosystems, evaluate material water-related risks, track the effects of changes in their water management practices, and credibly report their trends and impacts to key stakeholders. Water accounting also allows consumers, civil society groups, and the investment community to compare different companies' water risks and impacts in order to inform their actions and decision making. In sum, the ability to effectively account for corporate water use and impacts is essential in helping companies drive improvement and become aligned with external stakeholders' expectations, as well as their efforts to advance sustainable water management.

However, collecting and disseminating meaningful water-related information is a complicated and difficult undertaking. As this analysis will demonstrate, corporate water accounting methods and tools have been under development for the past decade, yet there is near universal agreement that current methods—though a good start—are inadequate and need to be refined.

Project background

RESEARCH OBJECTIVES

In response to this desire for improved corporate water accounting, several methods and supporting tools have emerged. The different origins, functionality, and evolving applications of the various approaches are currently poorly understood by stakeholders. There is a perceived need among businesses, civil society, and academia alike to elucidate the relation of these methods and tools to one another in order to help companies determine which approaches are best suited for particular applications. Improved clarity should also minimize duplication of efforts and promote coordination among the initiatives developing such methodologies.

This stocktaking exercise, a joint effort of UNEP and the CEO Water Mandate, will fulfill the need to clarify commonalities and differences among existing and emerging water accounting methodologies and tools being used in the private sector. Specifically, this report is intended to:

- Elucidate commonalities and differences among emerging methods and practice;
- Identify gaps and challenges;
- Suggest where accounting methods might benefit from harmonization and increased field testing.

Though this analysis will cover a number of water accounting methods and tools of relevance to businesses, it will emphasize perhaps the two most significant methods: 1) water footprinting (as managed by the Water Footprint Network) and 2) emerging water-related practice in the field of Life Cycle Assessment.

The authors note that the term "water footprinting" in and of itself is the source of confusion in this fast-evolving field and that it is currently being used to mean different things in various settings and arenas. The term "water footprint" was coined almost a decade ago by Professor A.Y Hoekstra of the University of Twente and refers to a specific methodology for water-use measurement. Since that time a community of practice has emerged that has built on Hoekstra's methodology. In the last couple of years the term has increasingly been used metaphorically by laypeople broadly referring to the concept of water accounting. There is seldom a formal definition associated with this lay usage of the term, and indeed, it is likely the concept is understood differently depending on the circumstance and individual user. Because of the lack of a formal definition, the authors have given little weight to this vague use of the term in common vernacular. In that same time span, the term has also entered the lexicon of Life Cycle Assessment (LCA) practitioners who have had a newfound interest in water. In this LCA context, the term is often used similarly to the term "carbon footprinting," insofar as it includes the characterization of water-use volumes according to local or regional context.

Nonetheless, for sake of clarity, unless otherwise specified, the term "water footprint" will be used in this report only in reference to the formal methodology developed by Hoekstra and currently managed by the Water Footprint Network (see page 11), as this is the longest-standing use of the term. That said, the way in which this term is used and understood by water accounting practitioners, water resource managers, and the general public in the future is still to be determined. The authors have no judgment on the most appropriate use of this term, but note the urgent need for experts and practitioners in both the LCA and WFN communities to come together to derive a shared understanding of this concept.

In addition to water footprinting and LCA, this analysis examines in lesser detail the WBCSD Global Water Tool and GEMI's on-line water sustainability tools. It also provides a cursory comparison of the ecological and carbon footprinting methods, particularly as they relate to corporate water accounting. Metrics such as those in the Global Reporting Initiative's G3 Guidelines and Carbon Disclosure Project's Water Disclosure Information Request may be an important starting point for communicating corporate water accounting results to external audiences. However, as they do not provide methodologies or tools through which to measure or assess water use (but rather a framework and indicators through which to report those types of measurements), they are not included among the accounting methodologies assessed in this report.

This study does not offer specific recommendations for the advancement of each method, but rather provides general comparisons that will help stakeholders to identify the best prospective applications for each method and support the developers of these methods to work in a more coordinated and integrated fashion.

RESEARCH METHODOLOGY

The project's research methodology included: a review of current literature; interviews with numerous academics, industry representatives and practitioners; attendance at relevant water accounting gatherings; and conversations with various organizations working in the field. It emphasized an iterative and inclusive data collection and analytical process, whereby key stakeholders were engaged throughout the project to help develop the project work plan, the methodological approach, and report drafting. This engagement was done primarily through a Research Advisory Committee (RAC) which included stakeholders from the private sector (including numerous CEO Water Mandate endorsers); civil society organizations; academia;

the standards-setting community; as well as representatives from the Water Footprint Network and the LCA community. A prior iteration of this study was sent out for public comment from November 16 to December 11, 2009 and was discussed at a workshop in Paris on November 23-24, 2009 organized by UNEP, during which experts were encouraged to provide feedback and debate the contents of the draft and other components of the broader UNEP WaFNE Project.

The methods and tools explored in this analysis were selected based on the degree to which they are publically available and specifically designed to account for water use and discharge, as well as their applicability to a wide variety of geographic locations and industry sectors. In the process of selecting methods to be analyzed, we discovered a number of water accounting methods that are regionally/nationally-specific, industry-sector specific, or proprietary. Though these methods and tools were not included in our analysis, we have provided of brief summary of some of them in Appendix B. In addition, the International Organization for Standardization (ISO) is currently developing a standard for water accounting that is highly relevant to this research (not included because it is in early stages of development).

The four main methods/tools that serve as the focus of our analysis—Water Footprinting, Life Cycle Assessment, the WBCSD Water Tool, and GEMI Water Sustainability Planner/Tool—were assessed using a number of criteria designed to be broadly applicable to all relevant water accounting methods. They informed the development of the analysis, but not necessarily the structure of the final report due to their inherently inter-related and overlapping nature. These criteria are as follows:

PURPOSE, OBJECTIVES, AND APPLICABILITY:
- For what internal and external purposes is the method or tool intended?
- What are the questions companies are trying to answer with this method?
- To what ends can companies currently use this method effectively?
- What is the level of maturity and market acceptance of the method? What components of the method are currently under development and not yet operational or effective?

CALCULATIONS, METHODS, AND OUTPUTS
- What broad types of data and information does this method intend to gather/assess?
- How does the method divide/categorize data and information contained in the final product?

WATER QUALITY/INDUSTRIAL EFFLUENT
- What broad approach to accounting for water quality does this method/tool take?
- What specific water quality-related data and information is (and is not) accounted for in this approach?

ASSESSMENT OF IMPACTS TO WATERSHEDS, ECOSYSTEMS, AND COMMUNITIES
- What criteria does each method use to measure local water resource context data and information?
- What is the method able (and not able) to communicate and quantify through its approach to impacts?

ASSESSMENT OF WATER-RELATED BUSINESS RISKS AND OPPORTUNITIES
- How, if at all, does the method account for and quantify business risks and opportunities associated with water-related impacts on watersheds, ecosystems, and communities?
- Does the method recommend specific actions to reduce water-related business risks?

This analysis does not delve deeply into technical aspects of any of the methods, but rather provides a general overview of the concepts that underpin them. It uses the ten stakeholder interviews conducted as the basis for assertions of most and least effective applications of these methodologies and tools.

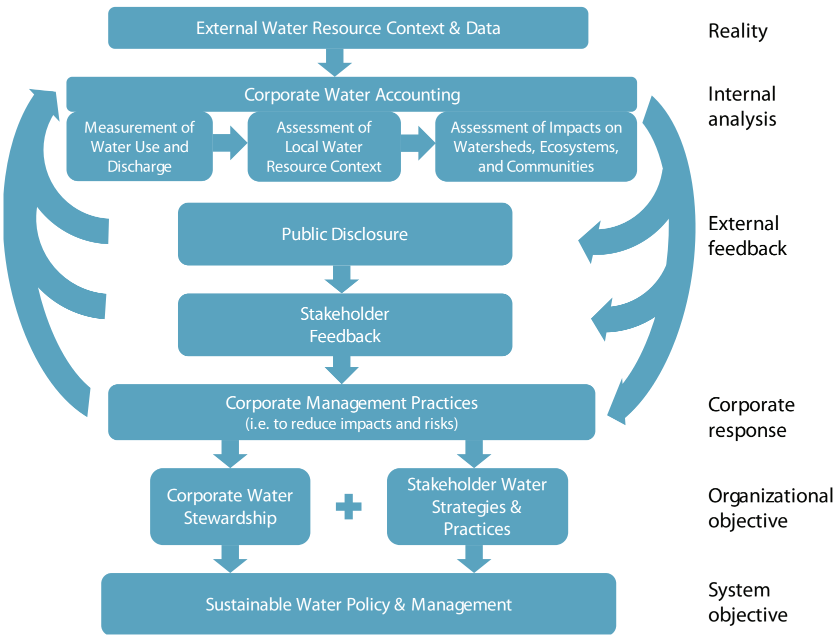
Corporate water accounting in context

Comprehensive corporate water accounting requires a number of different types of data and assessments in order to derive meaningful information. However, in order to contribute to improved corporate management practices and ultimately the sustainable management of water resources, corporate water accounting must also work in unity with a number of other components. While companies have direct control over some of these aspects, they have limited ability to influence others. That said, understanding this broader context—and how water accounting fits into it—is essential for companies seeking to reduce and mitigate water-related risks. Key components of this broader framework are:

- **External Water Resource Context and Data:** A foundational component of this framework is the real-world characteristics and conditions of the watersheds, ecosystems, communities, government, and economy in which businesses exist.
- **Corporate Water Accounting:** Accounting allows companies to measure and understand the water systems in which their business and suppliers operate, as well as the volume, timing, location, and impacts of their water use and discharge. This provides a basis from which to plan strategically, assess management practices, track performance over time, and communicate with stakeholders.
- **Public Disclosure and Stakeholder Feedback:** Once corporate water use and impacts are accounted for, companies disclose quantitative and qualitative information to affected communities, investors, consumers, civil society, and other stakeholders. This allows stakeholders to evaluate companies' approaches to reducing impacts and addressing risk and to hold companies accountable for their management practices. Stakeholder feedback in turn helps companies identify and prioritize material issues and improve the processes through which they mitigate negative impacts and thereby address water-related business risks.
- **Corporate Water Management and Stewardship:** Accounting is intended to inform more responsible and efficient corporate water management practices. Once these management responses successfully address negative impacts on ecosystems and communities, the company may be considered a good steward of water resources.
- **Stakeholder Water Practices and Strategies:** Corporate water stewardship alone cannot ensure sustainable water management within a region. This component is comprised of all the players (i.e., communities, policymakers, water managers, and other stakeholders) that must take action in order to move toward sustainable water management of a locality or watershed.
- **Sustainable Water Management:** When companies and other stakeholders in a watershed are effectively and collectively implementing responsible water practices and managers prioritize needs (i.e., industrial, agricultural, municipal, and environmental) based on resource availability and account for long-term risks (e.g., population growth and climate change), the system is positioned to reach a sustainable state—the overarching goal of corporate water stewardship and water management in general.

While the primary focus of this analysis is on the water accounting component of this framework, we will touch upon some of these components described above. Specifically, we will consider the degree to which current water accounting methods and tools are positioned to address external stakeholders' water-related information needs. We will also touch upon the emergence of corporate water stewardship approaches targeted at addressing water impacts, and evaluate the state of water resource data that currently hampers the evolution of water accounting practice.

THE ROLE OF WATER ACCOUNTING IN ADVANCING SUSTAINABLE WATER MANAGEMENT



II. Understanding Water Accounting Needs and Mechanisms

Water accounting—as well as companies' need for and use of it—has evolved significantly over time. In exploring these needs and their evolution in recent years, we summarize when and for what reasons companies are seeking to use existing methods and tools, along with the questions they are asking with regard to their corporate water use/discharge and the resulting impacts and business risks. This review is divided into four inter-related categories, which will also serve as the thematic structure used throughout the latter sections of the report:

- Operational efficiency, product eco-design, sustainable manufacturing (Section II)
- Water risk assessment/identification (Section IV)
- Managing water impacts and water stewardship response (Sections V & VI)
- Communicating water risk/performance with stakeholders (Section VII)

These categories are somewhat artificial and have a great deal of overlap, but do represent the broad types of applications for which these methods and tools are used, as well as the evolution of corporate water accounting over time. These areas of interest to companies are influenced by a number of factors, including the pursuit of operational efficiencies, strategic planning, brand management/corporate reputation, and corporate ethics/philanthropy. However, at their root, they are all driven by the desire to identify and reduce water-related business risk (and seize opportunities), whether that be through building competitive advantage, ensuring long-term operational viability, or maintaining and/or improving social license to operate. Because understanding and mitigating the inter-related issues of water risk and impact is a core driver for emerging water accounting methods and tools, they are explored in detail in Sections IV to VI.

It should be noted that companies' various accounting needs (e.g. product-level, company-wide, and impact assessments) all require different types and amounts of data. Product-level and company-wide assessments require internal production data from many different watersheds around the world. They can also utilize watershed data, but this is typically only cursory data taken from global indexes. Due to the variety of potentially impacted watersheds, these assessments do not attempt to comprehensively address complex local issues, but rather to drive sustainable production and consumption practices (and in doing so reduce the pressure on freshwater systems). Place-based assessments look specifically at water use in one (or a few) watersheds in order to gain a better understanding of that system. They can be used to assess a company's impacts on that watershed as well as the business risks created by external conditions. These assessments rely on watershed data regarding water stress, pollution, environmental flows, access to water services, etc.

Operational efficiency, product eco-design, sustainable manufacturing

The most basic (and well-developed) sphere of corporate water accounting relates to internal management and decision-making, which in this report encompasses issues such as operational efficiency, product eco-design, and sustainable manufacturing. As a starting point, companies often measure the amount of water they use and discharge directly at the facilities they own or operate. This practice has been demanded by law and regulations in many developed countries since at least the 1970s and is often carried over to facilities in less-developed countries. These measurements have been largely driven by a desire to maximize operational efficiencies (e.g., decrease the amount of water-related infrastructure needed and to reduce costs and/or energy needed for production processes and/or wastewater treatment). To this end, companies typically look at the efficiency of their direct operations in terms of volume of water withdrawn/consumed and amount and quality of wastewater discharged per unit of production or unit of sales. Companies are increasingly applying these same measurements to their key suppliers in order to better assess the water requirements for products and operations throughout the value chain. Eventually, such measurements can be used as the basis for operational "hotspotting," where companies can identify the components of their value chain that use and discharge the most water.

Key questions companies ask with regard to accounting for their water use/discharge for internal management purposes include:

- How much water do we use in all of our owned/operated facilities?
- How efficiently is this water use normalized to production?
- How much wastewater is discharged to the natural environment and of what quality is it when it leaves the facility? What are the major contaminants released?
- How much water do my suppliers use? How efficiently? How much wastewater do they discharge and of what quality?
- In which segments of my value chain does my company use/discharge the most water?

Because approaches to internal water measurement typically vary depending on the company and/or are proprietary, we do not explore this area of water accounting in much detail, nor do we analyze the topic in a standalone section in this report. That said, the authors recognize that such internal water measurement typically provides the foundation (i.e., inventory) for corporate water accounting methods such as WF and LCA that we review in detail in this assessment. Likewise, we acknowledge that some aspects of improved operational efficiencies and sustainable manufacturing are informed by real or perceived business risks and a science-based understanding of the actual environmental and social impacts associated with the company's water use/discharge. The discussions of risk and impact assessment as a management decision support tool are included in Sections V and VI. Lastly, to the degree to which companies communicate commonly used metrics associated with their water use/discharge (e.g., GRI reporting), we address such water measurement in Section VII.

Water risk assessment/ identification (e.g., "hotspotting")

As global freshwater scarcity has become more pronounced and as the supply chains of most major companies have spread across the globe, concerns have mounted among companies regarding their continued access to water resources. Further, companies recognize that their water practices might be negatively impacting communities or ecosystems, thus creating business risks. However, the simple measurement of corporate water use and discharge does not speak to a company's water risks or impacts per se. Water risks depend on the highly variable local context (i.e., watersheds, ecosystems, communities, and water users) in which the company and its suppliers operate.

Understanding water-related business risk means considering the local context in which companies find themselves. In the 1980s and 90s, companies first started assessing the status of water resources in locations of key operations, though these assessments typically only took into account physical water availability (i.e., the amount of natural water available on an annual average basis, perhaps normalized to population). However, while this broad measure of physical supply can provide useful contextual information, it is widely considered inadequate as an approximation of risk.

More holistic examinations of local context (i.e., watershed status) evaluate factors such as the percent of available water used for human purposes, the amount of water allocated to meet in-stream environmental flow needs, the adequacy of local water management and governance capacity, and the ability of nearby communities to access (and afford) water services, among other things. These "local context" factors ultimately lead to a better understanding of a watershed's relative water abundance or scarcity, as well as the company's water-related risks. By using geographic "hot-spotting" techniques to identify facilities located in watersheds considered to be water stressed, companies can begin to prioritize the locations in which to invest in operational efficiencies, contingency planning, policy engagement, community outreach, or other risk-mitigation measures.

Companies manage business risks through a number of different avenues depending on the nature of their impacts, the nature of their operations, and the watershed in which they are located. However, there are a few broad stewardship activities that may lessen impacts and drive down many types of risks. For instance, improving operational efficiency (using less water or re-using it or discharging cleaner water per unit production) decreases demand for water supplies and therefore alleviates water stress (and corollary scarcity risks) and/or reduces production costs. This efficiency may also help companies assure their continued water use by providing sufficient economic value per unit water so as to justify that allocation by policy makers. They also work with their suppliers to ensure that their goods are responsibly produced throughout their life cycle. If the most pressing risks are posed by external conditions, companies may respond by engaging with communities and public water managers within their region in order to simultaneously improve their efficient and continued access to water resources and build trust-based relationships that may help prevent future allocation debates and/or garner goodwill and positive reputation as a responsible business.

Some of the key questions companies are asking with regard to assessing water business risks associated with their operations include:

- Which of my facilities are located in water-stressed regions (including physical, economic, and social scarcity)?
- What is the nature of our water use and discharge (and possible corollary business risks) in various locations?
- What percent of this watershed's available water do my facilities use?
- What percent of the available water in this particular watershed is used for human purposes and what are the allocations among sectors?
- In which locations are water governance and management capacity a concern?
- How secure/reliable is our legal access to water in those locations?
- In which locations is there a high potential for reputational risk due to insufficient environmental flows or inadequate access to water services among local communities?
- How can I expect my exposure to water-related risks to change due to population growth, climate change, economic development, and other factors?

Managing water impacts/water stewardship response

It is widely accepted that volumetric measures of water use alone are not an adequate indicator of a company's water-related business risks or social and environmental "impacts" as they do not consider the aforementioned local water context. The necessary, yet by far most complex component, of corporate water accounting is the assessment of the actual impacts to watersheds, ecosystems, and communities caused by corporate water use and discharge. In this context, "impacts" refer to the extent to which the volume of water used/discharged by a company in a specific watershed actually affects the availability of that water for other uses (e.g., meeting basic human needs or in-stream flows) or harms human health or ecosystems in any other way. Corporate water use can potentially have positive impacts as well (e.g., improving water quality or recharging aquifers), however most water accounting methods tend to focus on negative impacts of water use.

Identifying and measuring water-related impacts (both quantitatively and qualitatively) is key to enabling companies to make effective management decisions based on accurate comparisons of water use in different watersheds, across different products, or in different components of the value chain or product life cycle. It is also crucial to understanding which facilities or products pose the greatest threat to nearby communities and ecosystems, and consequently present the most concerning business risks that must be managed.

Current methods for assessing environmental impacts (e.g. effect on freshwater biodiversity or environment flows) are considerably more developed than methods for social impacts (e.g. effect on incidence of disease or human access to water). However, social impacts are equally important as environmental impacts (if not more so) with respect to business risks. Even in water-rich areas, companies are likely to be exposed to reputational and regulatory risks if they operate in an area where there is insufficient access to water services or if their industrial effluent causes human health problems.

Some of the key questions companies ask in order to manage their water impacts include:

- Which of my facilities or products pose the greatest social and environmental impacts?
- Which components of my value chain or product life cycle result in the greatest impacts?
- How do my operations in a specific watershed affect ecosystem functions and/or in-stream flows?
- How do my operations in a specific watershed affect the ability of communities to access or afford adequate water services?

- How do my operations in a specific watershed affect human health?
- How might these various impacts expose us to business risks?

Communicating water risk/ performance with stakeholders

Once an internal assessment of corporate water use and related risks/impacts is completed, companies are increasingly disclosing this information (or part thereof) to their stakeholders and the public at large. Such reporting allows companies to be transparent and accountable regarding their water use and wastewater discharge, and also allows various stakeholders to track and provide feedback on corporate practices and performance. In Section VII we discuss the links among various water accounting methods/tools and corporate water disclosure.

Some of the key questions companies ask in regard to their disclosure of water-related information include:

- Are there well-established/harmonized metrics with which consumers, investors, and affected communities expect us to report our water-related data?
- What accounting methods are easily understood by non-technical audiences?
- What kind of information is most helpful for consumers hoping to make an informed purchasing decision? Do available methods provide this?
- What kind of information is most helpful for investors looking to assess water-related risk and/or to put money in an "ethical" company? Do available methods provide this?
- What kind of information is most helpful in reassuring potential affected communities and therefore supporting our social license to operate? Do available methods provide this?

III. Origins, Objectives, and Structure of Methods and Tools

Current water accounting methods and tools all have different histories, intended objectives, and outputs. This section will explicate these origins and core functions in order to shed light on the circumstances for which various methods and tools may (or may not) be appropriate and effective for purposes of corporate water accounting. In doing so, we attempt to assess the scope of the method/tool and its intended objectives and subjects/audiences, as well as the information captured in the end product/analysis.

Water footprinting (as managed by the Water Footprint Network)

ORIGINS

Water footprinting—a methodology introduced in 2002 and developed primarily by researchers at the University of Twente (Netherlands)—measures the total annual volume of freshwater used to produce the goods and services consumed by any well-defined group of consumers, including a family, village, city, province, state, nation, and more recently, a business or its products. Water footprints (WFs) are intended to allow these entities to better understand their relationship with watersheds, make informed management decisions, and spread awareness of water challenges worldwide. Throughout this decade, the water footprinting method has been refined, beginning to incorporate ways to achieve more reliable and spatially and temporally explicit data and to better account for water quality and impacts, among other things.

Water footprinting was originally developed as an accounting tool for water resources management (WRM) and is currently well-established as a leading methodology in this field. WRM accounting to this day remains one of the primary roles of water footprinting, with the WF measure allowing policymakers, planners, and managers to map various water uses in a system (e.g. agricultural, municipal, industrial), as well as the amount of water used by the community, country, region, etc. to produce the goods and services they consume. For WRM, the actual volume of water used is critical information as it allows decision-makers to, for instance, understand how water use relates to overall supply volumes; how water is allocated among users within their system (and if it is allocated equitably); which needs (e.g. environmental, basic human) are being met; and which water uses are providing the most economic value per unit volume. Armed with WFs, policymakers and water managers are better positioned to make water allocation and other decisions.

Water footprinting in the context of WRM was born out of and is underpinned by the concept of virtual water—the volume of water used to produce individual goods and services (most notably crops) throughout all stages of production. One critical aspect of virtual water is that it accounts for the water needed to make the goods and services that are imported into a system. Thus WFs in the WRM context account for virtual water trade through the notion of internal and external WFs, which track how much of a region's water resources are used for goods and services consumed in that area versus how much foreign water is used for those same purposes. The volume-focused virtual water concept (measured by means of the WF) has proven quite helpful for water managers and policymakers as they consider the merits of domestic food and/or industrial production versus importing (and/or not exporting) water-intensive goods, in conjunction with shifting water allocations to uses with more economic value in water-stressed areas.

Only in the last couple of years has the private sector begun to use WF to assess their direct and indirect water use, bringing with them the new questions and needs of the accounting method. A key distinction is that water footprinting for WRM focuses on providing information that helps water managers understand all volumetric needs (i.e., communities, ecosystems, businesses) and prioritize those needs in the face of scarcity based on societal, environmental, and economic values. In contrast, companies are typically concerned with the ability of available water supplies to meet their own needs and understanding their risks and impacts associated with the WF across multiple different watersheds. This is because of their desire to

SABMILLER AND WATER FOOTPRINTING

In 2008 and 2009, SABMiller—a South Africa brewing company—conducted water footprints of its South African and Czech operations. These two locations were selected due to their large volume of product and because they are both in water stressed regions. This analysis allowed SABMiller to identify geographic locations and production stages with particularly high water use, and also to compare these very different supply chains to understand how their mitigation strategy might differ depending on location.

These two analyses demonstrated important differences in SABMiller's water use in different locations. The studies estimated that it takes 155 liters of water to produce one liter of beer in South Africa, while it takes only 45 liters to produce the same amount of beer in the Czech Republic. The analysis revealed that this discrepancy is not due primarily to different production efficiencies, but rather climatic differences, the amount of imported crops, and packaging. For instance, whereas the Czech operations import about 5% of their crops, the South Africa operations import 31% of their total crops mainly from the United States, Argentina, and Australia. Further, blue water comprised about 34% of water use in South Africa, but only 6% in the Czech Republic, which instead was heavily reliant upon green water for grain production. This does not ultimately change the total water footprint, but does have significant implications in terms of the impacts of that water use and potential risks due to competition and scarcity. The vast majority of water use (over 90%) in both locations occurred in the crop cultivation stage. Even within the individual countries, the study found significant regional differences. In the some parts of South Africa, barley and maize production relied on irrigation/blue water for 90% of their water consumption. In others, those same crops were grown using only green water.

These studies have helped shape SABMiller's sustainability strategy for the future. For instance, in South Africa, the company is piloting its "water neutral" concept in two regions identified as posing particular water-related risks. Furthermore, after identifying that agricultural water use is the greatest area of water intensity, the company has been looking into toolkits for sustainable agricultural practices and is employing agricultural extension workers to improve yield management and water efficiency.

understand their indirect water use (i.e., the water embedded in their supply chains) and because of the global reach of most corporations' value chains.

SCOPE, STRUCTURE, AND OUTPUTS

Water footprinting focuses solely on providing a method for companies to measure their water use and discharge; within the context of the Water Footprint Network, the WF itself does not aim to assess the status of watersheds or water-related impacts per se. A WF captures the volume, location, and timing of water uses and discharges. WFs are divided into three separate components—the blue, green, and gray—all of which are expressed in terms of water volume. These components are meant to be considered both separately and together as a total WF (i.e., the sum of the blue, green, and gray water footprints). The three WF components are defined as follows:

- **Blue water** — the volume of consumptive water use taken from surface waters and aquifers.
- **Green water** — the volume of evaporative flows (found in soils rather than major bodies of water) used.
- **Gray water** — the theoretical volume of water needed to dilute pollutants discharged to water bodies to the extent that they do not exceed minimum regulatory standards.

The green and blue components of a WF focus on consumptive water use (i.e., the volume of water removed from local water system by evaporation, inclusion in a product, water transfer, or otherwise). They do not include those uses of water that are eventually returned to the same system from which they are withdrawn (i.e., non-consumptive uses). To the degree to which non-consumptive water use is addressed, it is done within the gray water component.

A WF as described above is only one component of a larger water footprint assessment. A WF is purely a volumetric account of water appropriation. A broader WF assessment looks at the sustainability of that appropriation and steps that can be taken to make it more sustainable. A full water footprint assessment is divided into four stages:

- Setting goals and scope
- WF accounting (the traditional "water footprint")
- WF sustainability assessment
- WF response formulation

The first phase sets the boundaries of the assessment. The second phase is the traditional water footprint where water uses are measured by volume. The third phase is essentially an impact assessment where water use is compared with local water availability data. In the final stage, response options such as strategies, targets, or policies are formulated. The "water footprint" and "water footprint assessment" terminology is the source of some confusion. For the purpose of this report, "water footprint" refers solely to the second phase presented here. Current practice in corporate water accounting has in most cases consisted of only the first two stages. "Sustainability assessments" are important, but are not yet common practice.

Corporate WFs measure the total volume of water used directly and indirectly to run and support a business. They are typically scoped to focus at the company-wide or facility level but can also focus on specific products and their water use throughout a company's value chain (e.g. raw material production, manufacturing, distribution). Corporate WFs are meant to be divided between their operational and supply chain components; however, comprehensive assessments of water use in a company's supply chain through water footprinting are not widely practiced to date due to the difficulty in obtaining data for large supplier networks.

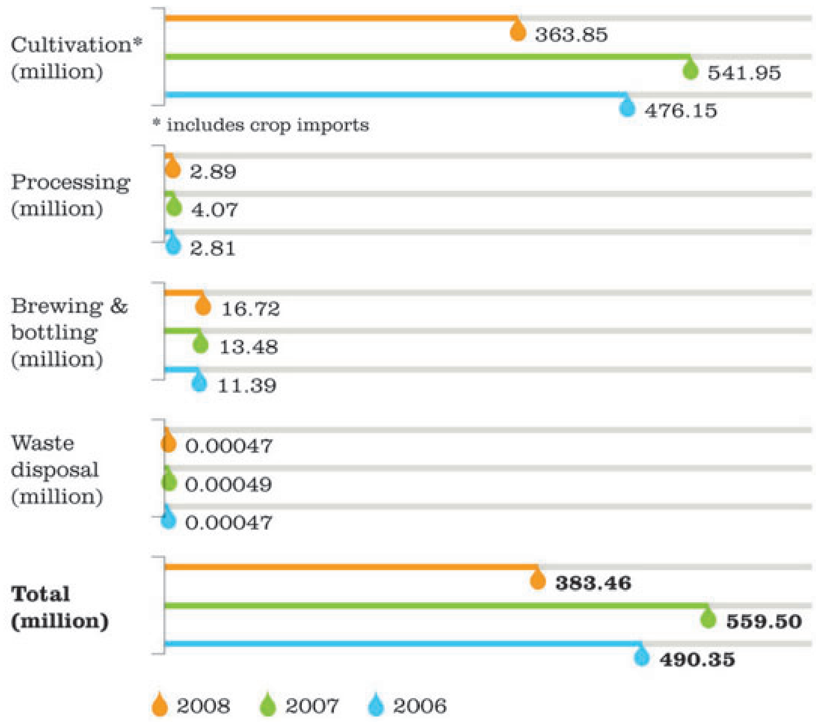
Life Cycle Assessment

ORIGINS

Historically geared toward and used by the private sector, Life Cycle Assessment (LCA) is a systems analysis tool which was designed specifically to measure the environmental sustainability of products and services through all components of the value chain. LCA is an input-output tool, measuring resource use and emissions that can be allocated to a particular product. In addition to its use by the private sector, LCA has also been very successfully used as a national and even international policy tool, and is imbedded in many laws in the EU, Japan, Malaysia, Australia, and elsewhere. LCAs can be set to analyze environmental impacts at many different scales (e.g. watersheds, counties, or countries). Properly done, an LCA allows companies and other interested parties (including consumers) to make comparisons among products and services. LCA is a decision-support tool that has primarily been used for three kinds of decisions:

- **Engineering decisions for product/process improvement:** Also called design for environment or eco-efficient manufacturing, this allows companies to identify opportunities for environmental improvement/optimization and measure the improvement along the entire supply chain. With LCA practice, this is often linked to hotspot analysis or identifying which parts of the product life cycle have the greatest environmental impacts.
- **Policy decisions at the company or governmental level:** This allows companies to develop a more rational and holistic view of the environmental impacts of their activities. In this context, economic input-output life cycle analysis—though actually not applied at the company level—has proven to be a very useful economy-wide tool, permitting one (typically government entities) to calculate estimates of the impacts of marginal production in the different economic sectors. Use of LCA in the context of national rulemaking is countenanced within the World Trade Organization as not creating a technical barrier to trade, providing that the relevant international standards are followed.
- **Environmental purchase and sales decisions:** This occurs either as a support for environmental claims or as the supporting

SABMILLER'S WATER FOOTPRINT IN THE CZECH REPUBLIC



Source: Water Footprinting: Identifying & Addressing Water Risks in the Value Chain. SABMiller and WWF-UK. August 2009.

information for LCA-based ecolabels. Use of LCA in communicating environmental issues with external stakeholders is discussed in detail in Section VII. Environmentally preferable purchasing programs often make use of LCA as a decision-support tool.

WATER AND LCA

Hundreds of thousands of LCA studies have been published in the last 40 years. The field of agricultural LCA has been especially prolific, and several international conferences have been devoted to the LCA of foods. However, traditionally, water use has not been accounted for within this method in any sort of detailed or comprehensive fashion. If measured at all, water use has typically been accounted for strictly as an inventory of a product's total water withdrawal (rather than consumption) that is neither locally specific nor features any impact assessment. However, given companies' growing concerns over water scarcity in the last decade, the development of better ways of accounting for water use within LCA has become a priority. Further, consensus appears to have been reached among LCA practitioners on the importance of better differentiating between consumptive and non-consumptives water uses in LCA studies. Also recognized is the need to understand and specify the geographic location of water use, the sources of the water (e.g., lake/river, groundwater, rainwater) and whether those sources are renewable or non-renewable.

There is currently an abundance of research on water scarcity and life cycle impact assessment modeling of the resource, along with the health effects and ecosystem damage associated with water scarcity. LCA practitioners have put forward different ways of characterizing the impacts of water use, though these have varied from study to study. Some of the impact categories proposed in these methods include water sufficiency for different users, ecosystem quality, resource consumption, and human health, among others. LCA's approach to impact assessment is discussed in detail in Section V.

SCOPE, STRUCTURE, AND OUTPUTS

Unlike water footprinting, which focuses on a single environmental resource (i.e., water), LCA was designed as a method that enables cross-media evaluations and comparisons across many different types of environmental resources, emissions, and their impacts. Indeed, the ability to assess impacts across a range of environmental categories is LCA's core function and value. These analyses require a much more comprehensive process than the strict water-related measurements seen in water footprinting. LCAs are typically comprised of four basic stages:

- **Goal and scope:** The goals and scope of study in relation to the intended application are specified. This includes establishing the boundaries of the system being assessed (i.e., determining what is being measured) and defining the functional unit of the product for the purpose of the study, a measure of the product or service being assessed.
- **Life cycle inventory:** Environmental inputs and outputs (e.g., water use, GHG emissions) that may have subsequent impacts are measured. In respect to water, this is the stage where the volume; timing; type (i.e., stocks, flows); location of use; and the volume/mass of contaminants released to waterways (among other things) may be captured.
- **Life cycle impact assessment:** The environmental inputs and outputs measured are translated into impacts (e.g., contribution to global warming, fresh water depletion, human health concerns). Emissions and resource uses from a variety of different sources are collected and assigned into their relevant impact categories, then characterized by the relevant impact factors developed through resource management and fate and transport models.
- **Interpretation:** The final stage further translates the quantification of impacts determined in the previous stage into meaningful conclusions and recommendations to improve the environmental performance of the product or service.

As discussed, LCA provides information on different types of environmental activities and different impact categories which those flows can affect. This allows LCA to quantify and compare the multiple types of impacts caused by one type of use or emission, as well as the various resource uses or emissions that contribute to one type of impact (e.g., the various business activities that contribute to eutrophication of water bodies). Typically, life cycle inventory data reflects the volume of water used at a given unit process. The challenge for evaluating the impact of water use is that often one does not know where that unit process occurs.

WBCSD Global Water Tool

ORIGIN, OBJECTIVES, AND SCOPE

Unlike water footprinting and LCA, which are comprehensive methodologies for assessing water use and discharge, the WBCSD Global Water Tool* is an implementation platform. Launched in 2007 and developed by WBCSD member CH2M HILL, the Global Water Tool is a free online module that aims to couple corporate water use, discharge, and facility information input with watershed and country-level data. It compiles such information to evaluate a strict measurement of water use in the context of local water availability (based on the Tool's watershed and country-level databases). This process is intended to allow companies to assess and communicate their water use and risks relative to water availability in their global operations and supply chains. The WBCSD estimates that more than 300 companies worldwide have used the Tool since its launch.

STRUCTURE AND OUTPUTS

The Tool has been developed to provide a number of distinct outputs that, while pertaining to related issues (i.e., corporate water use and management), are not aggregated and do not build on each other in the way water footprints and LCA do. A full use of the Global Water Tool produces the following outputs:

- **Output GRI Indicators:** GRI Indicators—total water withdrawals (Indicator EN8); water recycled/reused (Indicator EN10); and total water discharge (Indicator EN21)—are calculated for each site, country, region, and total.
- **Output Country Data:** Displays site water usage information and connects country water and sanitation availability for each site.
- **Output Watershed Data:** Displays site water usage information and connects watershed information for each site.
- **Combined Country and Watershed Metrics:** Combines site information and external country data and reports metrics for the company's portfolio of operations through graphs. For example, the Tool

* To access the WBCSD Global Water Tool, go to: www.wbcsd.org/web/watertool.htm

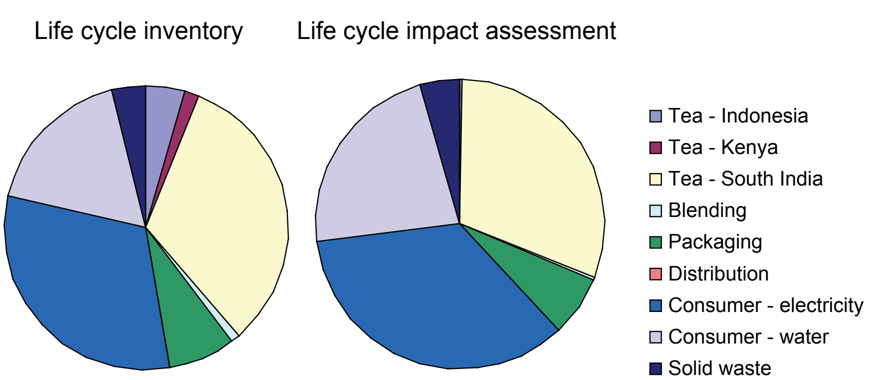
UNILEVER, WATER FOOTPRINTING, AND LCA

Unilever recently conducted two case studies that piloted the accounting and impact assessment components of both water footprinting and LCA for two of its products: tea and margarine. It aimed to compare the two accounting approaches in terms of functionality, determine how the results can be practically implemented, test impact assessment methods, and contribute to methods development.

The WF study measured the blue, green, and gray water footprints, while separating them into supply chain and operational components. Though impact assessment is typically not included in WFs, this study attempted to assess impacts by mapping areas of significant water use on a water stress index (i.e., ratio of water withdrawals to water availability) map. This was not used to calculate impact indexes (or "scores") but rather simply to identify hotspots.

The LCA study used a variety of different data inputs. It used WF calculations (i.e., evaporative uses of blue and green water) as the basis for its crop water use measurements, Unilever data as the basis for its manufacture and end use phases measurements, and databases from the Ecoinvent Centre for data on background processes. The main differences between the two methods for this stage were that WF does not include energy-related water use and LCA tended to overestimate certain water uses because it looked at abstracted water instead of consumed water. Like the WF study, the LCA study used a water stress index using the ratio of withdrawals to availability to determine impacts. However, unlike the WF study, the LCA study calculated impacts in order to get a quantified assessment of impacts across different production processes. The LCA study also included an assessment of impacts on eutrophication and ecotoxicity resulting from pollution caused by the products. Despite some differences, Unilever found that the methods were ultimately quite similar in the hotspots they identified.

FRESHWATER ECOSYSTEMS IMPACTS IN LIPTON YELLOW TEA PRODUCTION



Source: Source: Donna Jefferies, Ivan Muñoz, Vanessa King, Llorenç Milà i Canals (2010): Unilever Water Footprint Pilots for Tea and Margarine. Final report. Safety and Environmental Assurance Centre, Unilever.

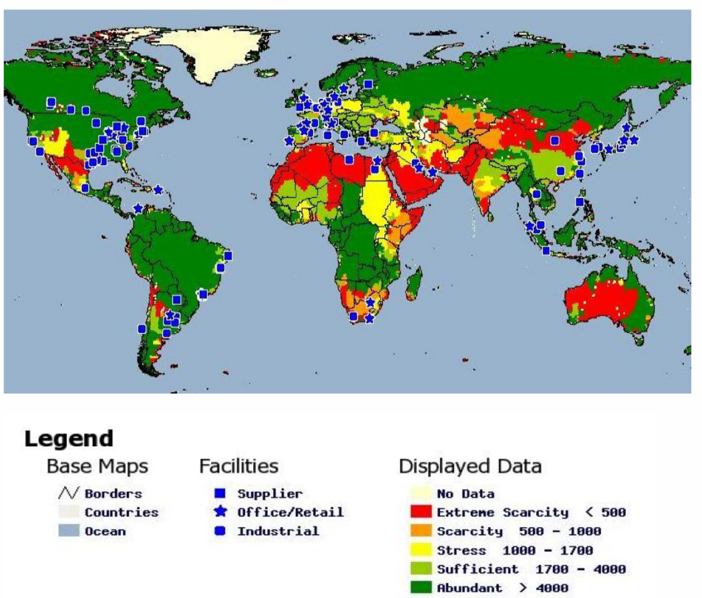
DOW CHEMICAL'S USE OF THE WBCSD & GEMI ONLINE TOOLS

In 2006, the Dow Chemical Company used the WBCSD Global Water Tool and GEMI Water Sustainably Planner as the bases for a water-related risk assessment for all of its facilities worldwide. At the time, Dow was experiencing greater infrastructure costs and other impacts from drought in many of its facilities. However, the resources and time necessary to individually assess the situation at each of its roughly 160 facilities worldwide were prohibitive. As a result, they decided to use the available, open-source tools from WBCSD and GEMI to guide their analysis.

Dow used the WBCSD Tool's Google-powered "global address look-up capability" to map all of these sites and overlay them with water stress information, both current and predictions for 2025. This allowed them to quickly and efficiently identify its facilities that were at greatest risk of water stress and associated problems. Using the Tool, Dow was able to complete this phase in a number of weeks.

After mapping all of its sites, Dow gathered water use data for all the sites which it determined to be at risk of water stress. As part of the data collection process, Dow sent the risk survey found in the GEMI Water Sustainably Planner to experts at each of the targeted sites. The Planner provided conceptual thinking regarding possible drivers and local issues that inform water stress and resource planning. It also generated risk factor scores for each of the following areas: Watershed, Supply Reliability, Social Context, Compliance, Efficiency, and Supply Economics. These scores were used to create risk profiles for each site that could be used to determine appropriate mitigation strategies.

DOW'S USE OF THE WBCSD GLOBAL WATER TOOL TO IDENTIFY WATER RISK HOTSPOTS



Sources: (1) Use of the WBCSD Global Water Tool to Assess Global Water Supply Risk and Gain Valuable Perspective. Water Environment Foundation WEFTEC 2008 Proceedings. October 2008; (2) Personal correspondence: Van De Wijs, Peter Paul. Dow Chemical Company. Global Government Affairs and Public Policy Expertise Leader. January 19, 2010.

produces a graph that shows the number of facilities, workers, and suppliers a company has in areas of extreme scarcity, water-stressed areas, water-rich areas, etc.

- **Visualization of Data:** Displays site locations compared to local water context in form of maps and through Google Earth.

GEMI Water Sustainability Planner and Tool

The Global Environmental Management Initiative (GEMI), a collection of dozens of mostly North American-headquartered companies working toward more responsible corporate environmental stewardship, has developed two tools to advance corporate understanding of water issues. Released in 2002, the Water Sustainability Tool** is an online tool that helps organizations create a water strategy. It assesses a company's relationship to water, identifies associated risks and describes the business case for action, and helps address companies' specific needs and circumstances. It features five modules:

- Water Use, Impact, and Source Assessment
- Business Risk Assessment
- Business Opportunity Assessment
- Strategic Direction and Goal Setting
- Strategy Development and Implementation

The Tool does not provide a method or calculator to measure or quantify water use, impacts, and risks, but rather introduces a number of questions on these topics to facilitate companies' understanding of various water sustainability issues. These questions act as the basis for guidance on goal setting and the development of strategic plans.

The GEMI Water Sustainability Planner***—an online tool released in 2007—focuses on the needs of a facility-level user rather than the company as a whole. It helps facility personnel to better understand the facility's dependence on water and the status of the local watershed (including local social and environmental considerations) and to identify its specific challenges and opportunities. The Planner is divided into three modules:

- Facility Water Use and Impact Assessment Program

** To access the GEMI Water Sustainability Tool, go to: www.gemi.org/water/

*** To access the GEMI Water Sustainability Planner, go to: www.gemi.org/waterplanner/

- Water Management Risk Questionnaire
- Case Examples and Reference Links

It uses input from the facility to give a broad assessment of risks regarding the local watershed, supply reliability, efficiency, compliance with regulations, supply economics, and social context. As with GEMI's Water Sustainability Tool, the Planner does not provide quantitative data but rather qualitative guidance on risks and identification of some of the most pressing issues.

From the perspective of the researchers, both GEMI tools are perhaps best oriented to companies and facilities that are just beginning to understand how water issues affect nearby ecosystems and communities, as well as their own business risks. They can be used to get a broad assessment of some pertinent questions, but provide no quantitative information with which to compare different water uses, products, or facilities. As such, they are perhaps less useful for companies that are seeking a comprehensive assessment of different water uses and impacts in order to assess hotspots, drive product development, or identify specific long-term water strategies.

Financial and personnel requirements for water accounting methods and tools

Corporate water accounting assessments typically require notable amounts of company time and money to provide meaningful results. The resources needed vary significantly depending on the scope of study, the type of data used, the size of the company, and the type of analysis conducted (e.g. water footprint or LCA). Acknowledging this large variability, below we provide general estimates of the company resources needed for each of the main methods and tools discussed in this report. This information is based on input provided by developers of these methods and tools and companies who have used them.

WATER FOOTPRINTING

The time and financial requirements for water footprint assessments vary depending on whether companies' water use is measured using company data or databases (e.g. FAOSTAT or CROPWAT) for their inputs and whether the assessment is company-wide or for a specific product. If the necessary data are readily available, one qualified person can complete a product water footprint in a matter of weeks. It may take roughly five months for a product assessment and over a year for a company-wide assessment if a company must collect its production data. This process becomes progressively shorter as the amount of pre-existing database input used increases. It can take only one-to-two weeks when databases comprise a large portion of input data (Zarate, 2010) (Grant, 2010).

A full product-level WF assessment could cost roughly around 40,000-50,000USD. A company-wide assessment may cost anywhere from 50,000-200,000USD. The WFN Secretariat provides technical support at a rate of roughly 20,000USD for a product assessment and perhaps twice that for a company-wide assessment. Corporate personnel typically spend five person days per month to collect and analyze data, typically at a cost of 1,000USD/person day. The amount of time required of operations managers varies depending on the availability of data (Zarate, 2010) (Grant, 2010).

LIFE CYCLE ASSESSMENT

LCAs vary in time and cost depending on whether the assessment uses more database data (i.e., a screening LCA) or more actual production data (i.e., full LCA), as well as whether the study looks at a wide range of indicators (e.g., GHG emissions, human health, ecosystem health, energy use) in addition to water use, or whether it is water-specific. A screening LCA typically takes roughly ten person days spread across one month to fully complete, while a full LCA takes 35 person days over 3-4 months. A LCA study considering only a company's water use and its impacts across its product portfolio takes roughly 260 person days over the span of a year consisting of ad hoc support from 5-8 employees (Milà i Canals, 2010).

Like WFN water footprints, companies usually conduct LCAs with assistance from an external organization with expertise in the field. Unlike water footprints, there is an extensive community of practitioners that provide such assistance. These external organizations typically charge 10,000-30,000USD for screening LCAs and 50,000-100,000USD for full LCAs when looking at a comprehensive set of indicators. These costs are typically cut in half (i.e., 5,000-15,000USD for a screening LCA and 25,000-50,000USD) when only considering water use and its associated impacts (Humbert, 2010).

ONLINE TOOLS

As a free online offering, the WBCSD Global Water Tool is much less expensive than either WFs or LCAs to implement, and requires less time as well. However, like those methods, the amount of time and money required to use the WBCSD Tool depends on the size of the company, coupled with what it is attempting to accomplish. As mentioned, the WBCSD Tool can be used for a number of applications, although for the Tool's most common application—mapping a companies' and its supplier's facilities against water stress maps (i.e., hotspotting)—a company typically needs between a half-day-to-two-full-person days to assess its direct operations and more days in cases where companies have extensive supply chains. Conducting this exercise requires no special expertise; thus the only costs are those needed to cover the employee's time (Boffi, 2010).

Like the WBCSD Tool, both of the GEMI offerings are much less expensive and time-intensive than undertaking water footprints and LCAs. That said, quantifying the time and money needed for these GEMI tools is more difficult due to their focus on building corporate understanding of water issues rather than providing specific quantified answers. As such, reading the relevant guidance in these tools could take less than a day. Completing the Planner's risk assessment questionnaire is more demanding, but could still be completed in 1-2 person days if the company already has the necessary data relating to their operations and nearby watersheds (Van De Wijs, 2010).

Summary of Scope and Structure for Major Corporate Water Accounting Methods and Tools

Criteria	Water Footprint	Life Cycle Assessment	WBCSD Global Water Tool	GEMI Water Sustainability Tools
Definition	• WFN's water footprint measures the total volume of freshwater used to produce the goods and services consumed by any well-defined group of consumers, including a family, municipality, province, state, nation, or business/organization.	• A Life Cycle Assessment (LCA) is the quantification of the environmental impacts of a given product or service caused or necessitated by its existence. LCA identifies the environmental impacts incurred at different stages in the value chain.	• WBCSD's online tool couples corporate water use, discharge, and facility information with watershed and country-level data. This allows companies to assess and communicate their water risks relative to water availability and access in their operations and supply chains.	• GEMI's online tools help organizations build a water strategy. They assess a company's and its facilities' relationships to water, identify risks, and describe the business case for action that addresses companies' specific needs and circumstances.
Scope / Boundaries	• Water-specific – comprehensive measurement of corporate water use/discharge only • Emphasizes "evaporated water" (i.e. consumptive uses)	• Assesses many environmental resources uses and emissions, including but not limited to water • Comprehensive measurement of water use and assessment of impacts • Measures consumptive and non-consumptive uses	• Water-specific • Rough measurement of water use and efficiency • Determines relative water-related business risks • Provides information on countries and watersheds	• Water-specific • Rough measurement of water use and assessment of key water impacts • Assess water-related business risks
Structure and Output	• Divided into blue, green, and gray footprints • Corporate footprints divided into operational and supply-chain footprints • Results provided in actual volumes	• Inventory results • Impact divided into several different types of quantified impact categories • Impacts by life cycle phase • Results can be expressed in weighted impacts across different impact categories	• Provides many disparate components, including key water GRI Indicators, inventories, risk and performance metrics, and geographic mapping	• Tool divided into 5 modules: water uses, prioritized risks, risk mitigation, goals, water strategy • Planner divided into 3 modules: water use, risk assessment, case examples
Origins and Level of Maturity	• Fairly well-established with water resource management community • Relatively new to private sector • Corporate water accounting calculations and impact assessment methods and related support tools still nascent and under development	• Very well-established general method for environmental assessments of products, companies, and regional systems (e.g. water supply or wastewater management systems) • Water has only recently been considered as an area of focus • Methods for measuring water use and assessing related impacts are nascent and still evolving	• Introduced in 2007 and has since become commonly used in private sector • Version 2.0—featuring updated data and new types of date—released in 2009 • Currently in scoping phase to include energy component.	• The Tool was released in 2002; the Planner was released in 2007. • No publicly announced plans to further develop or expand

IV. Identifying Water-Related Business Risks

As one of the key drivers for water accounting, we will look closely at the types of water-related risks that businesses are exposed to, as well as the ways in which water accounting methods/tools are working to (and intended to) identify and mitigate them. Our headline conclusion is that all water accounting methods/tools reviewed for this study are generally good for risk identification purposes, particularly in terms of providing a "broad brush" understanding of relative water risk. However, each approach provides unique information, helping companies understand the nature of the risk in different ways.

The interplay between water-related impacts and business risks

Water-related business risks are closely related to water-related impacts. In most cases, companies with significant water impacts will be subject to corollary business risks. However, the inverse is not necessarily true: even companies with relatively insignificant water impacts may face major water-related risks. This is typically due to physical and/or socio-political factors that may change outside the company's fenceline. For instance, economic development or population growth in a region may increase pressure on water resources and thus jeopardize a company's continued access to water. New source water pollution may require (through regulation or otherwise) a company to install expensive on-site pretreatment technology so that the water is of suitable quality for production processes. In this respect, water-related impacts are just one (albeit a large) subset of issues that create water risk for a company. While it may be true that not all social and environmental impacts eventually manifest themselves as business risks, companies often find addressing major water impacts (both the company's impacts on others and vice versa) a prudent risk management strategy.

Impact assessments—discussed in detail in the following two sections—attempt to explore the implications of water use and discharge on "external" factors such as human health, community access to water, ecosystem health, etc. In contrast, assessments of business risks tend to focus more on exploring the implications of this water use and changing external circumstances on "internal" factors such as the company's legal access to water supplies and services, operational efficiencies, investor confidence, consumer perceptions, etc. Both types of assessments (risk and impact) require companies to consider how their own water use fits within the broader local water resource context. As such, the process for assessing impacts on watersheds, ecosystems, and communities is often linked to (or at times integrated with) the process for assessing business risks. For this reason, it is useful to consider water impacts and risks together; however, it is also important to note that the various water accounting methods/tools may have an emphasis on one or the other.

While some water accounting methods (e.g., LCA) are geared toward addressing the environmental and social (e.g., human health) impacts a company might have as a result of its water use and discharge, others focus instead on allowing companies to broadly understand their water risk, for example, by using place-based water indicators that contextualize the company's water use (e.g., WBCSD Global Water Tool). Others (e.g., water footprinting) aspire to shed light on both a company's business risks and impacts.

The range of water risks

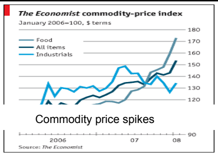
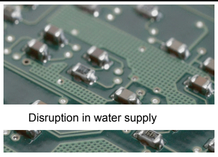
Companies' growing interest in water is driven by a number of factors, including pure operational efficiency, brand management, and corporate ethics/philanthropy. However, they are all ultimately driven by the desire to reduce related business risks whether that is to maintain social license to operate, build competitive advantage, encourage investment, or ensure long-term water supplies. The severity and type of these risks (as well as the appropriate mitigation strategies for them) depend on geographic location and type of industry sector and water use. That said, water-related business risks are often divided into three general and inherently inter-related categories:

- **Physical:** Physical risks pertain to the inability to access adequate water supplies or services to effectively manage a company's operations. This can be caused by drought or long-term water scarcity (i.e. insufficient and/or unreliable access to water); flooding (causing damage to infrastructure and/or disruptions in supply); or pollution, to the extent that such water is rendered unfit for operational use. This is most often a problem for companies with water-intensive operations in water-scarce regions. In many of those regions, climate change is exacerbating the problems of water scarcity.

- **Regulatory:** Regulatory risks manifest themselves when policymakers and/or water managers change laws or regulations or management practices in ways that alter companies' access to water supplies/services, increase the costs of operation, or otherwise make corporate water use and management more challenging. Stricter regulatory requirements often result from water scarcity and/or ensuing conflict among various needs (e.g. ecological, urban, agricultural, industrial) or because of public perception of a company's water uses and discharges as wasteful, disproportionately harmful, or inequitable. Regulatory risk can also stem from poor management—and therefore an inconsistently applied regulatory framework—among a region's water managers.
- **Reputational:** Reputational risks stem from diminished stakeholder perceptions (i.e., consumers, investors, local communities, etc.) due to inefficient or harmful production activities (or products) that have (or are perceived to have) negative water-related impacts on watersheds, ecosystems, and/or communities. Reputational concerns can lead to decreased brand value or consumer loyalty or changes in regulatory posture, and can ultimately threaten a company's legal and social license to operate.

All of the abovementioned risks lead to financial risks, which are created by increased costs or lost revenue due to the diminished status of the local watershed (i.e. scarcity or pollution) or the mismanagement of water resources. For instance, water scarcity or excessive pollution can lead to higher water prices, disruptions in production due to unreliable water supply, higher energy prices, higher insurance and credit costs, or damaged investor confidence, and therefore significantly affect the profitability of certain operations.

EXAMPLES OF WATER-RELATED RISK THROUGHOUT THE VALUE CHAIN

Point of impact: / Type of risk:	Supply chain	Production process	Product use
Physical	 Commodity price spikes	 Disruption in water supply	 Scarcity limiting sales
Regulatory (+ litigation)	 Water quality standards constraining power generation	 Court settlement to scale back operations	 Insecure water rights
Reputation	 Multinationals' suppliers singled out for violations	 Competition with social uses	 Profligate water use

Source: Treating water – Sector report for engagement: Water exposure of food & beverage companies. Robeco Asset Management in collaboration with the World Resources Institute. April 2009

New stakeholder expectations regarding corporate responsibility now expose companies to financial risks based on the perception of inefficient or inequitable corporate management of water resources.

Water Footprinting

Our research suggests that businesses consider water footprinting (WF) a useful framework for understanding and contextualizing their water use, and in turn, for identifying related water risk "hotspots" in their products, facilities, and/or supply chain. In this regard, WF can be considered quite effective for "big picture" strategic planning purposes and for helping companies prioritize actions and set long-term objectives and targets. The strengths and weaknesses of WF as a risk assessment tool are explored below.

GREEN-BLUE DISTINCTION

For companies that have undertaken WF, the distinction between blue and green WFs appears to be quite helpful. This is particularly (and perhaps mostly) the case for companies in agriculture-based industry sectors (such as food and beverage, textiles, etc.) due to their greater reliance on green water supplies. This may also prove true for companies with large land-use impacts such as those in the petroleum, mining, and forestry industry sectors, among others. With regard to agricultural production, blue water essentially is comprised of irrigated water (whether groundwater or surface water), while green water is comprised of the evapotranspiration of water naturally occurring in the soil from precipitation. Though evapotranspiration occurs in the absence of human intervention, it varies greatly depending on the type of land use (e.g., fields, orchards, pasture, forest) which humans frequently modify for agricultural purposes.

The green-blue distinction is helpful because these two types of water use create substantially different potential risks and have different impacts on the surrounding hydrologic region. Blue water use directly depletes aquifers and surface waters, thereby potentially contributing to water scarcity, destruction of ecosystems, and/or reduced access among human communities, among other things. There is often competition for blue water among users, sometimes leading to business risks when corporate water use hinders, or is perceived to hinder, other uses. In contrast, green water use does not deplete aquifers or surface waters, but rather uses water trapped in the soil. This typically does not create risks in and of itself, but can pose risks when it relates to changes in land use, for instance converting forest to agricultural land. Such land-use changes can impact biota and ecosystem functions.

The distinction between green and blue water is also perceived as useful in its capacity to assess long-term risks related to climate change. Climate change is predicted to have significant impacts on regional hydrologic cycles and the availability of water for human uses. Precipitation patterns will change on a regional basis, with rainfall often becoming less or more frequent and more concentrated depending on the location. This has many implications for blue water resources (e.g. infrastructure's ability to cope with longer droughts), but it particularly presents risks for operations in those regions heavily reliant on green water. Less frequent rainfall will ultimately mean less water stored in the soil. Because of this, those relying solely on green water use (namely agricultural growers in the Global South who do not have access to irrigation infrastructure) will simply not be able to sustain crop production through long droughts. This of course poses business risks for companies that rely on those growers as suppliers or that use large amounts of blue water in those same regions. For this reason, the green-blue water distinction in conjunction with climate change models can help companies better assess which of their water uses may be most susceptible to climate disruptions.

Life Cycle Assessment

LCA is not typically characterized by companies and/or LCA practitioners as a water risk assessment tool, but rather a management decision support tool. Here, a distinction can be made between the different ways in which water accounting methods and tools define and address "risk." In some instances (i.e., WBCSD Global Water Tool), the focus is solely on business risks—how local water conditions might potentially damage a company's short-term or long-term viability, reputation, or profitability. However, a company's water use/discharge may pose risks in a number of ways: it can lead to an inefficient use of resources and therefore money and it can negatively impact the ecosystems and communities in which it or its suppliers operate, thereby creating potential regulatory and reputational risks.

A key characteristic of LCA is its emphasis on science-based environmental or human health impact assessment, which in turn can serve as an entry point for companies seeking to identify and understand water-related business risk. Such LCA assessments are typically carried out using complex fate-transport modeling and other relatively sophisticated modeling techniques. While distinct from direct business risks, these potential impacts to ecosystems and communities may ultimately have severe implications for business viability. In this sense, to the degree to which companies with significant water impacts will be subject to corollary business risks, LCA can help identify operational "hotspots" whereby product design and technical improvements can be seen as risk mitigation efforts.

WBCSD Global Water Tool

As with water footprinting, the WBCSD Global Water Tool appears effective at identifying water risk "hotspots." However, where WF delves into the nature of company water use to help identify and characterize risks, the WBCSD Tool emphasizes geographic location as the primary basis for a qualitative assessment of relative water risks. The Tool is typically used by companies seeking to identify "hotspots" across global operations by comparing sites' relative water stress. This allows companies to prioritize their mitigation activities on facilities in water-stressed watersheds which are presumably more likely to pose water-related risks. It does not provide an in-depth system for companies to account for water use or impacts.

The Tool provides companies with a series of data and maps that reflect country-level and watershed-level data and help identify risk. Metrics used to shed light on the nature and degree of risk based on the local water context include:

- Mean annual relative water stress index
- Access to improved water
- Access to improved sanitation
- Annual renewable water supply per person (1995 and projections for 2025)
- Ratio of industrial to total water use

The Tool allows companies to evaluate each of their facilities based on these "contextualizing" metrics. For instance, a company can use the Tool to determine what percent of its operations or suppliers are in regions considered to be under water stress or the percent of its employees who live in countries where populations have low/high levels of access to improved water and sanitation. By providing these indicators for each of a company's operations or key suppliers, the Tool helps to identify and characterize the risks that are prevalent on a site-specific basis.

GEMI Water Sustainability Tools

Both GEMI's Sustainability Water Planner and Tool can be used to assess water-related business risk. Like the WBCSD Tool, the GEMI Tools focus primarily on identifying and mitigating risks that occur because of issues external to the company operations (e.g., infrastructure, pricing, scarcity, etc.).

The Planner assesses the likelihood that these external factors might have negative effects on specific facilities. It is built around a web-based questionnaire that features seven components: General Information, Watershed, Supply Reliability, Efficiency, Supply Economics, Compliance, and Social Context. The Planner uses questionnaire input data to provide quantified "Average Risk Ranking" scores (0-5) for each of these components and provides links to variables, documents, and articles that may be relevant to the company based on their survey input. This helps companies identify specific issues that may pose the most significant risks in a particular area, and provides some preliminary information on how the company may mitigate those risks.

The Tool is focused on business-wide water-related risks. It is divided into three steps: 1) Water Use Risk Assessment; 2) Water Impact Risk Assessment; and 3) Prioritize Water-Related Risks. In the first step, companies answer a series of questions to determine the business importance of each water use; how sensitive the company is to changes in issues such as water pricing, availability, quality, or the loss of a specific water source; and the probability that these changes will occur. The second phase is a very similar analysis to step one but is focused on risks due to discharge and pollution.* Once these steps are complete, companies plot their water uses on a matrix that features business importance and chance of change on its axes in order to easily prioritize different actions.

* GEMI's references to "impacts" refers specifically to water discharge and pollution caused by the company, rather than the broader definition inclusive of water-use impacts used throughout the majority of this report.

V. Understanding and Responding to Impacts on Watersheds, Ecosystems, and Communities

The actual social and environmental impacts associated with corporate water use/discharge can differ drastically depending on the local water resource context (i.e., physical availability of water, in-stream flows, community access to water, etc.). A company using a certain amount of water per day in a large, water-abundant system will typically have less severe (if any) impacts on issues such as community access to water or ecosystem function than a company using the same amount of water in an arid region, or one where water is not equitably allocated to meet basic human and environmental needs. Impact assessments ultimately aim to understand and quantify the ways in which business activities may affect issues such as community access to water, human health, or the in-stream flows required for healthy ecosystems. A successful impact assessment provides companies with a factual basis for prioritizing management practices and tailoring mitigation/stewardship strategies to address the impacts deemed most important.

Limitations with water-related impact assessments

The process of understanding and quantifying a company's water-related impacts is quite complex, primarily due to the many criteria that can comprise the local water resource context and the difficulty in quantifying some of them, particularly the social aspects. Corporate impact assessments might be thought of as having two main components: 1) measuring and assessing the local water resource context, 2) overlaying and normalizing corporate water use/discharge within that local context. Both are wrought with challenges.

MEASURING AND ASSESSING THE LOCAL WATER CONTEXT

Determining the local water resource context can be complicated and in many instances is reliant on subjective evaluations/or priority setting. For instance, determining "water scarcity" requires accounting for not only the physical abundance of water in a watershed, but also the quality of that water, the environmental flow requirements of the system, and the ability of people to access and/or afford adequate water services, among other things. The phrase "social and economic water scarcity" has been coined in order to express the idea that water systems can be considered "scarce" even in the presence of abundant physical supplies due to inadequate potable water and/or wastewater infrastructure.

Examples of criteria used to assess local water resource context include:

- Total amount of water physically available for use in that system;
- Total proportion of that physically available water currently being used;
- Allocation of water being used and its ability to meet demands (i.e., basic human needs, the environmental flows);
- Quality and safety of that water;
- Ability of local communities to afford adequate water services.

Because of the range of criteria a company could use to assess local water context, the resulting impact assessments are highly variable. As such, developing a comprehensive, yet efficient, system for measuring the local water resource context (i.e. physical, social, and economic scarcity) is critical to assessing impacts; however, a harmonized and objective approach to doing so does not currently exist.

OVERLAYING CORPORATE WATER USE WITH LOCAL WATER CONTEXT

Once criteria for assessing local water context are established and measured, companies must compare these data with their corporate water use/discharge in order to gauge associated impacts. In the process of quantifying impacts, corporate water use and discharge data are adjusted or "weighted" to reflect local physical, social, or even economic water conditions. These scores allow companies to compare the impacts of various water uses in different watersheds and thus prioritize which business activities, facilities, and production stages are addressed. For instance, such characterization allows 20,000 gallons of water from a water-scarce region to be quantitatively shown as having greater relevance than 20,000 gallons of water from a water-rich region.

This process of quantifying impacts inherently requires a high degree of subjectivity in determining what constitutes a negative impact. For instance, a methodology must determine what constitutes sufficient in-stream flows, what constitutes basic human water needs, or at what point water is polluted to the extent that it is not available for use. Further, companies sometimes wish to compare different types of impact categories (i.e. impacts to in-stream flows, basic human needs, water quality, etc.), which adds an additional layer of complexity and subjective determination. While such comparison can be quite useful in prioritizing management responses, they are not scientifically valid: comparing impact categories requires a subjective assessment of what types of environmental and social activities provide the most value.

Water Footprinting

As discussed, the WFN's corporate water footprint (WF) calculation itself does not attempt to account for the context of a watershed (e.g., water availability, allocation among users, etc.) or quantify or otherwise assess a company's water-related impacts. That said, the green-blue distinction within the WF itself does provide important information on the context in which a certain volume of water is used and that can help inform a cursory understanding of impacts. However, without broader watershed context data, a company is unable to assess key issues such as where and how its WF may infringe on other uses.

The WF calculation has been intentionally developed to provide a volumetric, "real" WF number that avoids any impact characterization as an inherent component. However, acknowledging the usefulness of understanding how water use volumes affect the condition of a watershed and its users, the WFN includes a "water footprint sustainability assessment (WFSA)" as part of a broader WF assessment. Once practice matures, WFSAs will overlay water use data with indexes that reflect the local water resource context in order to assess the WF in terms of its environmental, social, and economic sustainability. WFSAs will consider not only the location of water use, but also the timing. Few WFSAs have been conducted in practice, however many companies have expressed the need for such a method to be further developed.

The WFN is currently in the early stages of developing the Water Footprint Decision Support System (WFDSS), which will be the primary tool through which companies can conduct WFSAs. The WFDSS will be an interactive, open-source-software-based system designed to help decision makers compile a range of raw data to identify and solve water-related problems. The WFDSS will allow entities conducting WFs to assess: 1) the condition of the watershed in question (i.e., local water resource context); 2) the impacts of the entity's water use on that watershed; and 3) the appropriate response strategies to mitigate those impacts. WFN hopes such assessments will soon become a critical component of water footprint assessments worldwide.

Emerging company practice can already shed light on how companies are using WF to identify and manage water impacts. For example, some food and beverage companies have adopted the concept of "net green"* water—the difference between water evaporated from crops and the water that would have evaporated from naturally occurring vegetation. This allows companies to better understand their contribution to water stress in a particular area and how much water would be in the system if the company were not there. In particular, it highlights the opportunity costs associated with the company's green and blue WFs as compared to other possible uses in the watershed.

The blue and green dimensions of a company's WF also provide direction on how impacts can be managed. To mitigate blue water impacts and associated risks, companies might improve their water use efficiency or engage with affected parties to improve their access to water services. In contrast, the impacts and mitigation strategies for green water use are typically related to land use change rather than infringement upon other water uses. These land use changes—for instance the conversion of forests to arable lands—clearly affect ecosystem function (e.g., habitat and biodiversity), as well as communities' access to resources (e.g., timber). As such, companies may consider the distinction between green and blue water useful in helping them understand the types of impacts their

* Though the Water Footprint Network acknowledges the importance of this concept for businesses, it believe the term "net green" is unhelpful in respect to WF's broader purposes. It advocates use of the term "changed runoff as a result of the green WF". However, the term "net green" has been adopted by many in the business community.

production system might have on surrounding ecosystems and communities. However, at present, the WF community offers no guidance on how to interpret or value the different impacts of green and blue water use.

The handful of companies interviewed for this analysis indicated that while the individual WF components (especially the blue and green WF) were quite useful for informing management decisions, the total WF—the blue, green, and gray components aggregated into one number—is not as meaningful a number in terms of understanding a company's impact on water resources. This is based on the notion that there are substantially different types and severity of impacts associated with the blue and green WF and the fact that the gray WF, which is a theoretical rather than actual measured volume, should not be aggregated with the other two.

Life Cycle Assessment

Several LCA studies have been published that use inventory data as the basis for evaluating the impact of water usage. These impact assessments are calculated by overlaying corporate water use and discharge data with characterization factors that reflect the local context (e.g., the respective water availability/scarcity and degree of human capacity to access water for each watershed).

There is currently a flowering of techniques for water-related impact assessment within the LCA community. The Swiss Ecological Scarcity Method 2006 developed by Frischknecht et al. was among the first to use regional conditions (i.e., relative water stress) as a characterization factor, thus allowing for water use to be assessed within a local context. The relative water stress levels—as determined by the percentage of the total renewable water resources consumed—were each given a weighting factor that could be used to characterize water use volumes, thereby serving as a rough proxy for relative impact.

Mila I Canals et al. (2009) identified two primary pathways through which freshwater use can impact available supply: 1) freshwater ecosystem impact and 2) freshwater depletion, in order to determine which water uses need quantification. They suggest surface and groundwater evaporative uses, land use changes, and fossil water as the critical water flows to be measured within the inventory phase.

Pfister et al. (2009) further developed methods for assessing the impacts caused by freshwater consumption. This study assessed impacts to: 1) human health (i.e., lack of water for drinking, hygiene, and irrigation); 2) ecosystem quality (i.e., damages to ecosystem functioning and biodiversity); and 3) resource availability (i.e., depleting water stocks) using a further-developed water stress index similar to that used by Frischknecht et al.

Most recent studies have been facilitated by the work of Pfister, who has produced global maps of water scarcity at the 0.5 minute scale (approximately the 1 km scale). The scale runs from 0 to 1 and includes both the effects of precipitation/evapotranspiration (the equivalent of WFN's "green" water footprint) and the effect of human withdrawals (approximating the "blue" water component).

Ridoutt and Pfister (2010) have introduced the concept of "liters H^{2}0-equivalent" which can be likened to the CO^2-equivalents seen in carbon footprinting. This enables a consumer to quantitatively compare the pressure exerted on freshwater systems through consumption of a product depending on local water context.

On top of this analysis, different authors have added:

- Human health impacts due to drought/malnutrition, in units of DALYs per liter of water;
- Socio-economic impacts due to the local ability to pay for water quality improvement;
- Biodiversity loss at dams and due to groundwater extraction.

A summary of the different methods can be seen at Kounina et al. (2009). In addition, a handful of LCA studies have now been published that attempt to use the volumetric measurements provided by water footprinting (i.e., blue-green WF) as the basis for an impact assessment. In doing so, a number of LCA authors have suggested redefining/augmenting the WF from a purely volumetric measure to a weighted index that results from multiplying volumes by impact characterization factors (Pfister et al. 2009; Ridoutt et al. 2009). While such a result allows for regionalized assessments and company evaluation of issues that may inform product design, WFN argues that such weighted and aggregated single numbers are not useful from a WRM perspective, as they can obscure temporally and spatially explicit data and also because the functional unit-relative results no longer provide data in real volumes. WFN believes it is useful to keep the volumetric measurement and characterization steps separate so as to accommodate the different (i.e., non-corporate-focused) applications of the WF methodology.

One limit to the utility-of-impact assessment within LCA lies in the lack of harmonization regarding models with which to evaluate available data, though better consensus is expected as the science of LCA continues to advance.

WBCSD Global Water Tool

The WBCSD Tool in no way attempts to assess how corporate water use in a particular watershed or country may lead to social or environment impacts, thus it not considered an impact assessment tool. To the degree to which the Tool helps companies identify water-stressed regions, it can serve as a rough proxy pointing companies toward regions where they are likely having their most significant impacts.

GEMI Water Sustainability Tools

Both GEMI Water Sustainability Tool and Planner provide a set of qualitative questions and information that is meant to help companies identify, characterize, and prioritize potential water-related impacts, particularly those caused by wastewater discharge/pollution. They do not provide a methodology through which companies can quantify impacts, but rather a compilation of information that can help them better understand what those impacts may be and how they might eliminate them. The Planner does so by directing companies to assess the degree to which changes to external supply and management could affect their access to this water and the impacts of their uses. The Tool focuses primarily on building corporate understanding of their sources of water (e.g. their relative water stress) and the ways the company impacts those sources.

Summary of Accounting Approaches to Water Use-Related Impacts

Criteria	Water Footprint	Life Cycle Assessment	WBCSD Global Water Tool	GEMI Water Sustainability Tools
Assesses water-related impacts?	• As of yet, no. WFs do not attempt to assess impacts. Methods to quantify impacts though WF Sustainability Assessments are under development.	• Yes. However, water-use-specific methods are nascent and need further development and harmonization.	• No, but local context data highlighting water stressed areas can serve as a general proxy for relative impact.	• Yes, but not comprehensively or quantitatively.
Types of impacts assessed	• NA	• Water use (proposed): • Ecosystem quality • Resource depletion • Human health	• NA	• Focuses on building understanding of the local water context and factors that could limit companies' access to water sources

VI. Accounting for Industrial Effluent and Water Quality

Though water quantity receives much of the focus in the context of corporate water management practices and accounting, water quality is equally important to businesses both in terms of risk and impacts. Untreated or insufficiently treated water can lead to increased incidence of disease, damaged ecosystems, and the inability of the company and other users to use such water. Thus, companies have just as great a stake in accounting for—and addressing —their risk and impacts associated with water quality as they do for water quantity issues.

As discussed, accounting for water use/quantity can be quite complex and requires meshing a number of different factors in order to be credible and meaningful. That said, accounting for industrial effluent and related impacts on water resources is arguably even more complex and problematic. This complexity is due to many factors, including the various different types of pollutants coming from industrial facilities and agriculture (e.g., phosphates, nitrates, mercury, lead, oils, sulfur, petrochemicals, undiluted corrosives, and hard metals, just to name a few); the interactions among pollutants; the variety of ways water quality can be compromised (i.e., contaminant loads, temperature, odor, turbidity), and the various approaches to accounting for the resulting impacts to ecosystems and communities.

Measurable water quality characteristics can be grouped into three broad categories:

- Physical characteristics (e.g., temperature, turbidity/light penetration, and flow velocity),
- Chemical characteristics (e.g., pH, salinity, dissolved oxygen, nitrate, phosphate, biological oxygen demand [BOD], toxics, chemical oxygen demand [COD]); and
- Biological characteristics (e.g. abundance of coliform bacteria, zooplankton, and other organisms that serve as an indicator of ecosystem health).

Companies aiming to account for their water pollution and its effects on water quality must determine a range of factors including the volume of wastewater they discharge, the types and loads of pollutants within that wastewater, the short- and long-term effects of those pollutants on receiving waterways, and the impacts of those changes on human health, human access to safe water, and ecosystem function.

Dilution Water and the Gray Water Footprint

DEFINITION AND OBJECTIVES

Water footprints deal with industrial effluents and water quality exclusively within the “gray water” component. The gray WF is calculated as the volume of water that is required to dilute pollutants to such an extent that the quality of the water remains above agreed water quality standards. Whether this water is discharged back to surface or groundwater, it is considered “used” because it is unavailable for human use due to the fact that it is functioning in-stream as a dilution medium. For this reason, the gray WF is a theoretical volume, rather than a real volume as compared to the blue and green WF.

The methodology for determining the gray WF is perhaps the least developed of the three WF components. In fact, many corporate WF studies to date do not include a gray water component. Those that do include gray water have done so in different ways. However, they all utilize some permutation of the same basic equation that uses one water quality regulatory standard to calculate how much water is needed to dilute pollution to acceptable levels. Because companies almost always release more than one pollutant (and typically dozens) to waterways, the methodology requires the company to select the pollutant with the highest required dilution volume. In theory, this dilution volume will then be sufficient for all other pollutants discharged. This method also requires the company to identify the most appropriate regulatory standard for the relevant pollutant and location of the discharge.

At the time of this writing, the authors were unaware of if and how the WF Decision Support System would address the gray WF on a watershed basis.

LIMITATIONS

While the concept of accounting for industrial effluents and water quality was unanimously considered important, companies familiar with the WF methodology have significant concerns (both conceptual and practical) with the gray water component its current form. Many felt that approaching water quality accounting through the assessment of dilution water volume has some fundamental disadvantages/limitations. The most notable of these limitations are the obscuring of contaminant load data and the base referencing of local water quality standards.

Specifically, focusing on the contaminant with the highest dilution water requirement is deemed a questionable approach, because in reality, industrial effluent typically contains a number of different types of contaminants, all of which have different implications, time constants and impacts for the surrounding environment. Further, a dilution approach cannot account for potential additive, synergistic, and long-term effects of the various types of persistent, bio-accumulating pollutants that may be discharged by a company.

Linking dilution water requirements to water quality standards is also problematic because these standards vary from watershed to watershed and in many localities do not exist (or are not available) at all. Not only does this mean that the required dilution volumes are dependent on political factors rather than scientific determinations, but this requirement adds additional complexity to the system, prompting questions such as:

- Which standard does a company use (e.g., national regulations, recommendations from intergovernmental organizations)?
- What do companies do in the absence of national standards or if national standards do not mitigate pollution to a level that protects communities and ecosystems?
- Does such an approach lead to an accounting bias in favor of countries with less stringent water quality standards, and/or incentivize companies to favor/give preference to operations in such countries?

Lastly, the dilution approach is deemed a circuitous route to addressing industrial effluents. Rather than directly accounting for the initial corporate water use/discharge, the gray WF focuses on a theoretical corporate response, which may or may not occur. In doing so, dilution—rather than prevention—is implicitly promoted as the desired solution to industrial effluent. Many consider pollution prevention to be highly preferable to dilution due to the fact that many pollutants persist and bioaccumulate and impacts occur even when dilution volume is considered adequate to meet regulatory standards. Furthermore, this approach obscures and de-emphasizes important information about the type and amount of pollutants released to waterways, as well as potential ways to reduce these pollutants. Finally, the WF gray water accounting method does not address water pollution transported to waterways through air pollution, the predominant source of water pollution in many industrialized nations.

In the gray water approach, the WF's typical inclination toward real numbers that require little human subjective assessment is replaced by a methodology that requires highly variable and subjective standards. Because of these fundamental differences between the gray water component (a theoretical volume characterized based on water quality standards) and the green and blue water footprints (real volumetric measures), the handful of companies surveyed for this analysis indicated that aggregating the gray component along with the green and blue components is misleading and of little use.

Direct Assessment of Contaminant Load into Waterways / LCA Approach to Water Quality

In the context of water pollution, LCA methods are already well-developed and widely accepted. They are aimed at a number of different environmental impact categories independent of whether the emissions occur to water or to some other medium. The most common impacts associated with water quality in LCA are:

- Eutrophication (overgrowth of algae due to excess nutrient addition)
- Acidification due to emissions of acidifying substances (mostly into the air)
- Ecotoxicity (potential for biological, chemical or physical stressors to affect ecosystems)
- Human toxicity

These impact categories are measured in terms of equivalents of eutrophication potential (phosphorus or nitrogen units); acidification potential (hydrogen ion or sulfur dioxide units); and ecotoxicity potential (cubic meter-years). Because these units are not the same, these impacts cannot be added up without a value judgment for normalization and weighting of the impacts, for example as is done for eco-indicator points or end-point indicators.

There is research going back to the 1990s that evaluates ecotoxicity potential with impact units of cubic meter years, adding up the impacts of the many different toxic substances. These analyses are based on a so-called "unit earth" or fugacity standardized fate and transport model for toxic pollutants (regardless of their medium). Information on the ecotoxicity of the individual pollutants and their persistence in different environmental compartments must be known or estimated. This kind of model is the most closely related to the Water Footprint Network's gray water.

It is possible to report loads of pollutants to waterways through the simple addition of the mass of emissions to water, but this is not practiced within the LCA field because there is no way to describe the environmental mechanism to support the calculation. In effect, such a calculation would be saying that there is no science behind the analysis.

The use of these life cycle impact models and reporting on the product basis supports all the basic purposes of LCA (decisions for engineering, policy, and purchase and sales) as described above. It helps businesses understand the risks of different environmental effects for processes within the control of the business and also for those outside the direct control of a business. Of particular interest are the impacts of a product downstream (the use and recycle/disposal phases). Although manufacturers do not control the actions of their customers, in the case where a manufacturer designs a product with the use and disposal phases in mind, these phases can be shown to have fewer polluting impacts.

LIMITATIONS

LCA is limited to the impacts for which there is good enough science to perform impact assessment. LCA is a relative method, normalized to the functional unit defined in the study. It is not typically applied to a whole ecosystem or whole watershed analysis, and therefore is seldom used by water resource managers. On the other hand, the broad application to the entire life cycle of the product allows managers to understand where it is possible to manage or influence the product's overall outcome.

WBCSD Global Water Tool

The WBCSD Global Water Tool does not measure or otherwise assess water quality or industrial effluent.

GEMI Water Sustainability Tools

The GEMI Water Sustainability Tool encourages companies to analyze their pollution to water bodies (which they perhaps confusingly refer to as "water impacts"). It does not provide any method or guidance for the measurement of industrial effluents or quantification of impacts to water quality. It looks at both pollution caused by a company's direct discharges to the environment as well as more indirect avenues of pollution such as air deposition and the leaching of chemicals. It provides a series of questions (categorized by value chain stage) that help companies better understand their effects on the pollution of water bodies.

Summary of Accounting Approaches for Water Quality and Industrial Effluent-Related Impacts

Criteria	Water Footprint	Life Cycle Assessment	WBCSD Global Water Tool	GEMI Water Sustainability Tools
Assesses water quality?	• Yes	• Yes	• No	• Yes, but not comprehensively or quantitatively.
Basic approach	• Dilution volume	• Direct measurement of mass or volume of contaminants	• N/A	• Qualitative review
Types of criteria assessed	• Most harmful contaminant (often nitrogen) based on discharge quantities and local regulatory standard	Impact categories: • Eutrophication • Acidification • Ecotoxicity • Climate change • Human health	• N/A	• Queries company on types of pollution in various value chain stages
Potential limitations	• Only accounts for primary pollutant (i.e., disregards additive and synergistic effects). Uses local regulatory standards rather than direct measurement and scientific assessment	• Does not typically quantify impact to specific local receiving bodies; results are relative to functional unit which seldom is scoped at the watershed level.	• N/A	• No measurement or quantification

VII. Conveying Water Information to Stakeholders

Historically, companies have typically used internal proprietary software and/or undisclosed metrics when carrying out water accounting for internal management purposes. In recent years, companies have been increasingly expected to disclose the results of their water accounting to key stakeholders and the general public. These expectations have led to the development of harmonized measures, metrics, and indicators on corporate water use by third party interests, most notably the Global Reporting Initiative (GRI), and, most recently, the Carbon Disclosure Project (CDP), in order to support consistent and meaningful corporate disclosure of water information. Emerging corporate water accounting methods, such as water footprinting and LCA, are also increasingly being used to inform water-related disclosure by companies. This section will discuss how water accounting methods and tools can be used to support corporate disclosure efforts and provide an overview of other third-party initiatives that have developed reporting metrics and protocols.

A significant portion of corporate water-related reporting is qualitative, with companies providing descriptions of various water stewardship initiatives, principles, policies, programs, and goals. However, companies are perhaps more intently evaluated based on their reporting of quantitative information. Theoretically, such quantitative reporting could be about any of the findings from corporate water accounting efforts, including the local water context of their operations and the quantified impacts to watersheds, communities, and ecosystems. In practice, however, companies almost always report a much more limited and context-neutral set of information, such as their total water use, total wastewater discharge, water use efficiency, or total amount of recycled water. Such metrics usually serve as the basis for most companies' social responsibility reporting regarding water, though the meaningfulness and legitimacy of such generic and aggregated data are widely disputed (JPMorgan 2008, Pacific Institute 2008).

Third-Party Water Disclosure Metrics and Protocols

The use of harmonized metrics or indicators on corporate water use developed by third-party interests is often seen as one factor in credible corporate sustainability reporting. The most widely used and accepted metrics for sustainability reporting are developed by the Global Reporting Initiative (GRI). GRI's most recent reporting framework, known as the G3 Guidelines, contains indicators for the economic, environmental, and social performance of companies, including five core indicators specifically focusing on water-related issues:

- Total water withdrawal by source
- Water sources significantly affected by withdrawal of water
- Percentage and total volume of water recycled and reused
- Total water discharge by quality and destination
- Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the organization's discharge of water and runoff

While certainly useful, these indicators are limited in the nature and scope of information they provide. First, as discussed throughout this paper, strict volume measurements of water use/discharge alone do not capture the risks and impacts that vary depending on the relative local water conditions. Furthermore, aggregated company total water use data without regionally specific volumes obscures important relative water scarcity contextual information.

The Carbon Disclosure Project (CDP)—an organization that collects information from companies worldwide regarding their greenhouse gas emissions and climate change strategies—is currently developing a similar framework through which to collect companies' water-related information and policies. The first iteration of the annual CDP Water Disclosure Information Request will be sent to companies to disclose against in April 2010 (with results reported in Q4 2010). It demonstrates an increased sophistication in what is asked of companies in respect to their understanding of their interaction with water resources. For this analysis, perhaps the most relevant of CDP Water Disclosure's requests are: 1) an in-depth examination of water-related business risks and 2) an assessment of the local context in which companies operate (e.g. the proportion of facilities located in water-stressed regions). The CDP Water Disclosure Information Request asks that companies disclose this data for their own facilities, as well as their suppliers. CDP Water Disclosure's new framework underlines the fact that not only do these types of analysis help drive down water-related impacts and risks, but they are also becoming expected of companies by investors, consumers, and other key stakeholders.

Water Footprinting

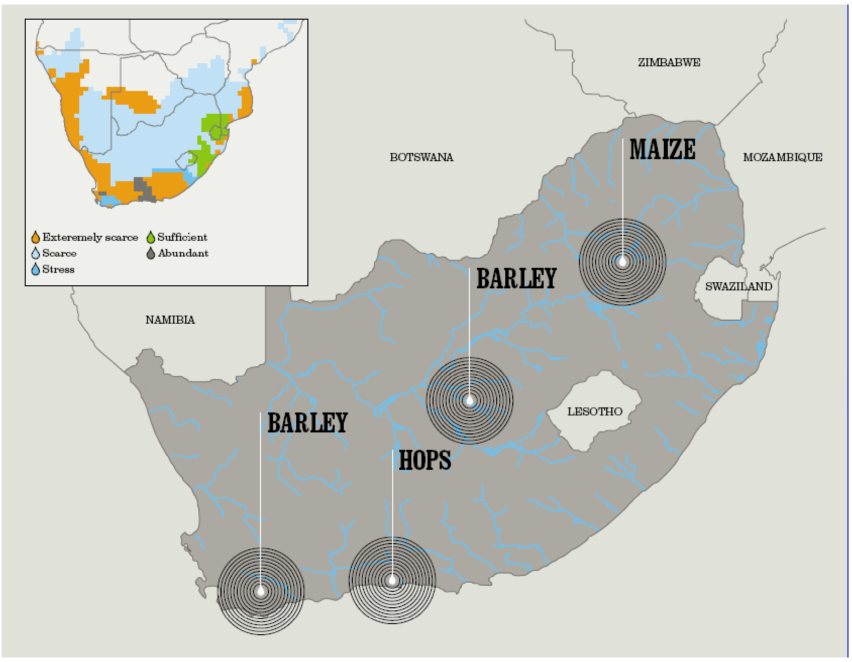
WFs are beginning to be used as a reporting/communication tool, though the appropriateness of this use is questioned by some. These concerns are based on the notion that generic and aggregated claims (such as 2,500 liters of water to produce one cotton shirt or 960 liters of water to produce a liter of wine) are inherently misleading and/or meaningless because they obscure essential information regarding the local context and nature of the water use, and therefore do not reflect impacts or risks. For this reason, total water footprint calculations can be very easily misused and misconstrued. For instance, Raisio, a Finnish food company, has produced a water "ecolabel" for its products that essentially uses a product's total water consumption as the basis for its scores. Such scores do not speak to the source of that water (i.e. blue or green) or the conditions of the watershed from which it was taken and thus have little value in terms of assessing the sustainability of a product's water use. That said, more detailed reporting of WF studies has served to help companies be accountable to (and receive feedback from) key stakeholders, as well as help build a good reputation relating to water transparency and responsible water practices. More generally, proponents have also identified WF as an effective awareness-raising tool for business, consumers, and policy makers on water issues worldwide.

WF studies typically use maps and other visualizations to express data and results. Though such visualizations are not provided for or required by the WF methodology, they have become common practice for WF studies. These maps can illustrate internal data such as facility locations and water use, as well as external data that contextualize the WF data, such as different water users within a system and the relative water scarcity of different regions. This not only allows companies to visually locate (i.e., "hotspot") potential impacts and risks (e.g., linking facility sites with water scarce regions or where their water uses may potentially infringe upon other uses), but is also emerging as a particularly powerful communication tool. Corporate sustainability managers have found these maps very effective in communicating with non-technical audiences, both internal (e.g., upper management) and external (e.g., investors, consumers, local communities).

WATER POLICY AND MANAGEMENT INTERFACE

Water footprinting has also proven to be useful for companies who look to engage with stakeholders (particularly water policy makers and managers) to manage impacts and advance sustainable water management beyond their fenceline. Companies can use WF to highlight where major water uses are

AN EXAMPLE OF WATER FOOTPRINTING STUDY VISUALIZATION



Source: Water Footprinting: Identifying and Addressing Water Risks in the Value Chain. SABMiller and WWF-UK. August 2009.

in the value chain to prioritize where they might focus their external engagement. For instance, if a company determines that the majority of their water use occurs in agricultural production, they could work with local growers (and suppliers) to implement efficiency improvements. Companies could also work with academia to further develop technologies that support these efficiency improvements. Similarly, companies could work with water managers to conserve water (e.g., through funding the repair of pipes), which is often cheaper and saves more water than internal efficiency improvements. If companies determine that their water use is hindering environmental flows or community access to water, they could partner with local NGOs to find effective solutions. Water footprinting is particularly well suited to help inform corporate engagement with water policy and management because it was originally designed as method for assessing WRM (and therefore many managers and policymakers are familiar with it). Its effectiveness as a communication tool for non-technical audiences also makes it particularly useful to this end.

Life Cycle Assessment

For some time, LCA outputs have been used to inform environmental purchase and sales decisions. This occurs either as a support for environmental claims or as the supporting information for LCA-based (i.e., Type I and Type III) ecolabels. In this context, LCA is useful to program operators of ecolabel programs, whether they are governmental or private sector programs. Type I labels are provided for products whose life cycle performance exceeds set standards. In contrast, Type III environmental product declarations (EPDs) merely disclose performance in a pre-set fashion by product category rules and make no claim of environmental superiority. EPD programs require LCA studies to be performed for all products seeking the label. EPDs are becoming a requirement under law in some countries, such as in Northern Europe. Almost all EPDs are aimed at the business or institutional customer. If and when the labels become available in a consumer setting, they will have to be accompanied by a substantial educational effort. Studies on nutrition labels, for example, show that even decades on, the consumer is confused about the meaning of the information, and environmental information is even more obscure to the average consumer.

The general framework for and validation of LCA studies is governed by the relevant ISO* standards:

- ISO 14040 and 14044 (the life cycle standards)
- ISO 14025 and 21930 (the EPD standards)

In general, these standards require higher levels of verification as the use of the data becomes more public and more widespread. The required/recommended validations are:

- For internal use only, verification by a co-worker who was not involved in the original study.
- For external use (what is called a third-party report), verification by a panel of at least three, including LCA experts and interested parties.
- For EPDs, there are two levels of verification: the first for development of the product category rules, which requires a panel of experts and interested parties, and the second for EPD product-specific LCA study, which requires only an independent individual. The standards call out the requirements for LCA experts, including that they be independent (with no conflicts of interest) and be technically competent in LCA matters and in the specific elements of the EPD program and the relevant standards. The review team must also have expertise in the products and processes under consideration.

WBCSD Global Water Tool

Though limited in the scope of data it addresses, the WBCSD Global Water Tool can serve as an effective communications tool due to the fact that it is easily understood by non-technical audiences. Companies are increasingly starting to include brief summaries of the proportion of their operations in water-stressed and water-abundant regions in their CSR reports and often use the WBCSD Global Water Tool as the basis for this

* ISO is also currently developing a standard specifically for water accounting, discussed further in Appendix B

assessment. Furthermore, the Tool converts the water use and discharge input data into GRI G3 indicators for total water withdrawals (GRI EN8); total recycled water use (GRI EN10); and total water discharge (GRI EN21). This allows companies to easily quantify and report their water use in a manner that is harmonized and comparable across many businesses and industry sectors.

GEMI Water Sustainability Tools

The GEMI tools are geared toward internal assessments at the facility- and company-wide level and are not designed or generally used as communication tools.

VIII: Data Limitations

Water accounting methodologies use data as inputs that serve as the basis of their analyses. Input data can describe corporate water use and discharge or the local water resource context (e.g., local water availability, access to water, etc.). Which types of data are used, and at what resolution, are key components in determining for what applications each methodology is most useful. Further, the data generated by the databases imbedded with these various corporate water accounting methodologies are of key importance to their overall effectiveness. However, data can be, and often are, quite lacking in many different regards. Indeed, at present, insufficient data is one of the biggest limitations to meaningful water accounting, and therefore companies' understanding of their water-related risks and impacts. This section will explore three different types of data-limitations issues in water accounting, as well as the implications of these limitations on a company's ability to derive meaningful results. These three types of limitations are:

- Inadequate databases
- Lack of access to data
- Insufficient granularity of data

INADEQUATE DATABASES

Water footprinting and LCA often use pre-existing databases in order to inform or supplement their analyses. Both methods depend on databases of average water uses when direct data are unavailable. For instance, companies often use databases that include the average amount of water needed to grow a certain type of crop (and often specified by irrigation type), and to a lesser extent the average amount used for a particular manufacturing process, if they do not have the money or time to measure such water use directly. The most common databases for evapotranspiration and crop growth are the EPIC model and the FAO's CROPWAT model. LCA also uses databases as a way to understand the local water resource context. Perhaps most commonly, LCA uses global water stress indexes that include the approximate amount of water available in many different locations around the world.

However, as of now, these databases are in almost all cases insufficient or could use improvement. Databases used to estimate averages are typically simply not available. When they are available, they are often not specific enough (e.g., average crop water use but not specified by irrigation type or climate type). Furthermore, the use of such databases would not reveal if a company or facility was particularly efficient or wasteful in any particular area (compared to averages) and therefore would not be useful in identifying areas for improvement that could be addressed relatively easily and result in high water savings. Databases used to understand the local water resource context are more commonly available, yet are often available only at the national level and often use methodologies that can be misleading. National-level data on water stress is often not useful because many nations have watersheds with drastically different water availability (e.g., the American Southwest and Pacific Northwest regions of the United States). The most common indicator for water stress is simply the volume of physically available water per capita. However, this measure obscures the potential for limited access to water due to economic problems, a governance deficit, or inadequate infrastructure.

LACK OF ACCESS TO DATA AND DATABASES

Companies often do not have access to the data necessary to conduct meaningful analyses of their water use and discharge. This can be due to inadequate internal and supplier measurement practices, insufficient data collection of external conditions by the appropriate parties, or databases of external conditions that are not publicly available due to political reasons.

Companies, particularly SMEs, do not have the infrastructure, employees, or systems in place to regularly and comprehensively collect their water use and discharge data. This can be due to financial limitations, lack of technical expertise, or the fact that until recently accounting for water use has been relatively low on companies' list of strategic concerns and therefore companies have not implemented effective data collection systems. In order to understand their water-related risks, companies must invest in their capacity to conduct assessments of their water use and discharge, as well as the status of the watersheds in which they and their suppliers operate. In many cases, companies buy their goods as commodities, and are not aware of the upstream impacts of their purchasing choices. In the same way, the global market means that goods are shipped worldwide through the efforts of purchase and sales agents who know (or disclose) little about either the upstream or downstream water situations relevant to the goods they handle.

Even when databases of external conditions do exist, governments or private interests that manage them may be unwilling to share them with companies or the public. For governments, this may be due to a fear that data revealing that the country is under high water stress might deter companies (or their investors) from their jurisdiction. For private sector actors, this may be driven by profit motives. In these situations, companies often have to collect their own data regarding the local water context to the best of their ability or try to encourage governments and private practitioners to become more transparent with their water data.

INSUFFICIENT PRECISION OF DATA

Another way in which the data underpinning water accounting methods can be limiting is in their granularity/resolution. Using data that shows the watershed (and perhaps the location within the watershed) from which water was taken or wastewater was discharged can be incredibly valuable in helping determine how that use might impact others in the watershed. For example, a company that knows where its facilities are using water in a system compared to where other users are withdrawing that water can let them know to what extent they are affecting others' access to water. Similarly, adequate temporal resolution of water use data can allow companies to assess water-related impacts and risks during different seasons and at different points in the hydrologic cycle. However, as of now, water use data is typically presented as an annual total.

Finally, in addition to the problems posed by insufficient data, it is also important to note the limitations of quantitative assessments of water use, discharge, and impacts in general. Though certainly effective at hotspotting certain water-related risks and identifying physical water stress, quantitative analysis is not able to show less concrete issues, such as mismanagement of water services, governance deficits, the attitude of nearby communities' toward the company, and a number of other societal and political factors that cannot be measured. These factors can create risks for companies just as easily as wasteful water use or physical water scarcity. For instance, a company can use water quite efficiently and operate in a relatively water-rich area, but if the government that manages water resources in that watershed does not have the capacity or desire to manage water sustainably and equitably, the company will be exposed to risk. For this reason, in addition to quantitative corporate water accounting, companies should invest time and money in better understanding the systems that manage water for their facilities and the communities and various other water users that are served by those systems.

IX. Water Accounting and Other Sustainability Accounting Methods

Water use and pollution is by no means the only aspect of sustainability that poses risks for companies and must be measured and assessed. Companies must also understand the contribution of their greenhouse gas (GHG) emissions to climate change; the impacts of their energy use on business costs, the environment, and human health; and a number of other resource uses and emissions. As such, several accounting methodologies akin to those analyzed in this report have been developed for other sustainability issues, such as GHG emissions or natural resource depletion.

The interactions and linkages between many of these sustainability issues are becoming more and more clear, particularly among water, carbon, and energy. Climate change—heightened by corporate GHG emissions—drastically changes the hydrologic cycle, leading to more frequent and severe drought and flood events and contributing to water scarcity. Transporting or pumping water for irrigation or desalinating it for other uses is often incredibly energy intensive. Likewise, creating energy often (as in the case with hydroelectric dams) severely damages aquatic systems, displaces communities, and creates human health concerns. These inextricable links between these three sustainability issues have become known as the "Water-Energy-Carbon Nexus". Companies are now increasingly concerned with understanding the ways in which these resource uses and emissions interact with and affect one another and how these linkages might inform a company' assessment of impacts and risks.

This section will provide a synopsis of accounting methods for other sustainability issues as a basis from which to explore how public perception and understanding of those methods might confuse water accounting, as well as how different sustainability accounting methods interact with one another and are compatible. It will focus on carbon accounting and ecological footprinting, as they are perhaps the most established and widely recognized of these methods.

Carbon Accounting

Carbon accounting (commonly referred to as "carbon footprinting") measures the total amount of GHG emissions caused directly and indirectly by an individual, organization, event, or product. This measurement is divided by the various types of GHG emissions (e.g., carbon dioxide, methane, ozone, nitrous oxide) and can be assessed for any type of carbon emitting entity (e.g., individual, city, nation, product, company, etc.). A carbon footprint of a company or product ideally includes emissions from all stages in the value chain. A specific methodology for corporate carbon footprinting has been developed in the WRI-WBCSD GHG Protocol (and subsequently adopted as the basis for an ISO standard). Several methodologies exist for product carbon footprinting.

Three different scopes have been described for carbon footprinting. Scope 1 is the direct GHG emissions of an organization. Scope 2 is Scope 1 plus upstream GHG emissions associated with the production of energy used by the organization. Scope 3 is Scope 2 plus the life cycle GHG emissions of all the products purchased by an organization. The Scope 3 carbon footprints are simply the climate change results of all LCAs.

Carbon accounting is fundamentally an assessment of impacts, rather than a strict measurement. After measuring the amount of emissions for each type in real masses, each mass is multiplied by a characterization factor that "weights" that mass based on the type of gas emitted, using factors developed by the Intergovernmental Panel on Climate Change (IPCC). The characterization factors are based on the relative global warming potential—their contribution to climate change per unit—of each greenhouse gas. Once this weighting occurs, all the masses are expressed in terms of carbon dioxide equivalents which allows for comparison and aggregation of different types of emissions across different products, facilities, and companies. Companies use this to assess the impacts of different types of emissions and evaluate the extent to which their entire business, their products, or their facilities contribute to climate change in order to prioritize areas for improvement and to assess business risks.

Carbon footprinting has led to the concept of carbon offsets: the idea that one can pay others to reduce their pollution for less money than required to reduce their own pollution. Offset schemes have been criticized on a number of fronts. Of particular concern are issues related to "additionality" (i.e., would the carbon reduction project have occurred without the offset?) and whether they lead to actual improvements in the atmosphere. There are also questions about the actual methods of accounting for carbon emissions, especially as they relate to land use changes and biofuels. Despite these concerns, the potential to offset water use is even more questionable than the potential to offset carbon emissions due to the extent to which impacts differ depending on the location and timing of use.

Due to the presence of characterization factors, carbon footprinting is often an integral part of an LCA. However, the carbon footprinting approach is fundamentally different from water footprinting (as defined by the WFN) which only provides volumetric measures of different types of water from different locations. The WFN's water footprinting includes no characterization factors that allow different types and sources of water to be compared based on their impacts. That said, a number of LCA practitioners, applying the characterization methods of Frischknecht or Pfister, are including water resource results (which they are dubbing "water footprints") as part of broader LCAs showing the trade-offs among different impacts (e.g., water use and land-use related impacts). Due to the present confusion around terminology, any conclusions made about "water footprinting" based on one's understanding of carbon footprinting should be scrutinized carefully.

Ecological Footprinting

The Ecological Footprint (EF) is a resource accounting tool used widely by governments, businesses, educational institutions, and NGOs to measure the biological capacity of the planet that their activities or products require (Global Footprint Network 2009). Biological capacity is defined as the area of productive land and sea required to produce the resources consumed by humans and to neutralize the subsequent waste. An understanding of biological capacity can help these entities better manage their operations and communicate with stakeholders. An EF compares human demand on nature to the availability of nature. It therefore can be considered an impact assessment (though quite different in appearance than impacts assessments for water use), rather than a straight measurement like that seen in water footprinting. The methodology of the water footprint has been inspired by that of the EF, but was adapted by Prof. Hoekstra to water-specific circumstances. The current EF method also reflects the reality of data limitations for describing biocapacity demand of water.

An EF is categorized into a number of different individual footprints (i.e., Food, Mobility, Housing, and Goods and Services). The Footprints can also be divided into the various land types that are needed (i.e., forest, grazing area, fisheries, etc.). The common measurement unit of both Ecological Footprint and its counterpart, biocapacity, is global hectares. These hectares correspond to biologically productive hectares with world average productivity. Ecological Footprinting is most often used in educational or communication settings to help quantify ideas like "sustainable development." The tool is also increasingly being applied in policy settings.

Ecological footprinting does not include water footprinting or any other form of water accounting; current assessments only capture freshwater impacts indirectly. While the carbon footprint is a direct subcomponent of the EF, despite the similarities in terminology, EF and water footprinting are not directly linked methodologically. The main reason is that each unit of water use has a distinct demand on biocapacity depending on the local context. Such calculations have not been possible due to the aforementioned data limitations.

Compatibility of sustainability accounting methodologies

Neither carbon accounting nor ecological footprinting assess water use or pollution. Similarly, water footprinting and other water accounting methods do not account for carbon or other sustainability issues such as energy use. However, as mentioned earlier, the links between these different sustainability issues in terms of impacts to watersheds, ecosystems, and communities, as well as in terms of business risks, are undeniable.

Insofar as companies and products are concerned, LCA is the most well-established and well-suited system through which to assess different sustainability issues and their common and different impacts. Done properly, carbon accounting is streamlined as part of an LCA such that GHG emissions and their contribution to climate change can be integrated into broader product assessments. Because of this, LCA is well-positioned to allow carbon-related impacts to be compared with other types of environmental impacts (including those related to water use and pollution) incurred in a product's life cycle.

X. Advancing Corporate Water Accounting Practices

While the methods and tools explored in this analysis are all effective for certain purposes, there remain a number of factors that hamper companies' ability to effectively measure, assess, and report their water use and impacts. These limitations are due to a range of issues including relatively nascent methods/tools, lack of capacity among company personnel, insufficient water management and governance infrastructure, lack of cooperation and harmonization among key actors, and inadequate communication and engagement with relevant stakeholders.

As mentioned in the Preface, this report is part of the broader UNEP Water Footprint, Neutrality, and Efficiency (WaFNE) Umbrella Project, which strives to enhance water efficiency and water quality management through the refinement and pilot testing of emerging water accounting methods and supporting management tools. Among other things, this WaFNE project aims to encourage convergence of practice and compatibility among these methods. One of the key components of this project is a country-level pilot testing of methods that will further explore the practical application and advancement of the methods/tools discussed in this report. These pilots will aim to test:

- Implementation of water use/discharge self-assessment tools at the company/factory level;
- Appropriate stewardship responses based on corporate water accounting outcomes;
- Use of indicators and management guidance to report the water accounting findings to stakeholders and the broader public.

One of the objectives of this analysis is to shed light on the areas of corporate water accounting that can be improved via this upcoming on-the-ground pilot testing. Based on our findings, below is a series of recommendations regarding how UNEP-led pilot testing might advance corporate water accounting and stewardship practices in general.

1. ASSESSMENT OF LOCAL WATER RESOURCE CONTEXT

Historically, corporate water accounting has focused on the amount of water used within a company's direct operations, focusing on ways to reduce use and drive down corollary costs and risks. However, this report, among others, highlights that companies are often exposed to risks associated with external factors such as water scarcity, pollution, or inadequate infrastructure or public water management, even if their internal operations are quite efficient and responsible. For this reason, corporate water accounting is increasingly looking to better measure and assess the external economic, social, and environmental contexts of the watersheds in which companies operate. While practice in this area is certainly improving, much still needs to be done in terms of consistent approaches to assessing external conditions (e.g., partnering with water managers and NGOs who collect such data); identifying effective metrics (e.g., determining appropriate measures of water stress); and harmonizing such approaches. This is particularly true for social criteria, such as access to water, affordability of water, and human health.

Pilot testing can help advance these local assessments by exploring different types of criteria that can be used to quantify environmental and social conditions; innovative practices for data collection; and effective ways of communicating with water managers, governments, communities, and local NGOs. Ideally, this will lead to a convergence of practice with respect to understanding, quantifying, and reporting physical, economic, and political water scarcity, and will contribute to an effective method of assessing how companies perpetuate or mitigate that scarcity over time.

2. ASSESSMENT OF SUPPLY CHAIN

While many companies recognize that much of their water use and impacts (and in many cases the majority) occurs in their supply chain, current corporate water accounting practice does not adequately emphasize suppliers' water use and discharge. This is largely due to the difficulty in obtaining reliable data from a vast network of suppliers worldwide, as well as the fact that many companies buy their supplies on global commodity markets that obscure the source and production history of those goods.

Pilot testing can help develop more robust and systematic ways to address suppliers' water issues, by improving efficient data collection systems in complex supply chains and promoting innovative ways to communicate and incentivize this responsible practice to suppliers. In particular, pilot testers can help suppliers implement management systems that help collect this data, educate suppliers on the rationale and process for improved water stewardship, and/or establish supplier guidelines that require this information.

3. IMPROVED DATA COLLECTION

Our report found that one of the key limiting factors for nearly all accounting exercises is the lack of reliable data at a sufficient level of detail/granularity. While supplier data, discussed above, is a large component of this, companies are also lacking with respect to their own production data and external watershed data. Many companies rely on generic databases that report regional averages rather than their own production data. While this can be useful in quickly identifying material issues, it is not sufficient for a comprehensive assessment of a company's water use.

In addition to improving the ability of suppliers to collect and report such data, pilot testing can also build the capacity of their operations managers so that they understand corporate needs and implement appropriate practices. This could be achieved through management systems, corporate mandates, and training programs. Further, pilot testing can explore avenues through which companies work with governments, civil society groups, and local water managers to access watershed-level data regarding environmental flows, access to water, water quality, etc. that will support their impact and risk assessments.

4. ASSESSMENT OF WATER QUALITY

Previous corporate water accounting efforts have focused on the impacts and risks associated with water use (i.e. concerns related to water quantity). However, water pollution and other water quality concerns are equally important in companies' assessment of impacts and risks. Pollution can lead to increased incidence of disease; damaged ecosystems; and the inability of people, agriculture, and industry to use that water at all. Future water accounting must give higher priority to measuring corporate wastewater discharge, assessing its impact on ecosystems and communities, and understanding ambient water quality in the watersheds in which they or their supplier's operates. Outside of LCA which has well-developed methodologies for assessing water quality impacts, the methods reviewed in this analysis do not sufficiently assess water quality. That said, many companies likely have internal proprietary systems that assess water discharge and local water quality.

Pilot testing can advance this practice by exploring LCA as a water quality assessment tool — especially its ability to point companies toward meaningful changes in their water polluting practices and measure improvement - and identifying internal systems that companies can share with others.

5. HARMONIZED REPORTING CRITERIA

In addition to improved understanding of water-related impacts and business risks, the ability to effectively report to and communicate with key stakeholders is a key goal for water accounting. Stakeholders' ability to assess this information and guide future corporate water-related practices can be supported through a more consistent approach to reporting, both in terms of one company from location to location and year to year, but also across different companies and industry sectors.

Pilot testing can help this convergence of water reporting practices by identifying water use and impacts metrics that are relatively easy to assess for companies and meaningful for key stakeholders, including consumers, investors, environmental representatives, and affected communities. This process will likely require companies to communicate with one another regarding effective metrics to engage with stakeholders in order to better understand their perspectives and needs.

6. COOPERATION AMONG COMPANIES

Acknowledging that many companies contribute to water scarcity and pollution and are exposed to many of the same types of water-related risks, there is a great opportunity for companies to share innovative practices, policies, and technologies that can assist in measuring and analyzing their relation to water resources, as well as contributing to sustainable water management in general. For instance, companies can share supplier/facility sustainability guidelines, supplier and watershed data, effective reporting criteria, and accounting approaches.

Pilot testing can provide a chance for companies to cooperate in this manner as it will focus on companies in close geographic proximity, who might be likely to have similar suppliers (in the case they are in the same industry sector) and be located in the same watersheds. For example, pilot testers with shared suppliers can work together to encourage more responsible practice and implement education programs. Pilot testers working in the same watershed can pool resources to collect data regarding the local water context and engage with neighboring communities.

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Appendix A: List of Research Advisory Committee Members

Name	Organization
Representatives from companies	
Emmanuelle Aoustin	Veolia Environnement
Denise Knight	Coca-Cola
Henrik Lampa	H&M
Llorenc Mila-i-Canals	Unilever
Andy Wales	SABMiller
Representatives from international NGOs, institutes, and initiatives	
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Jim Fava	UNEP-SETAC Life Cycle Initiative
Sébastien Humbert	Quantis / ISO Working Group on Water Footprinting
Derk Kuiper	Water Footprint Network
Stuart Orr	WWF International
Frederik Pischke	UN-Water
Brian Richter	The Nature Conservancy
Brad Ridoutt	CSIRO
Other experts	
Kim Christiansen	Danish Standards
Luiz Fernando Cybis	Universidade Federal Do Rio Grande Do Sul
Wang Hongtao	Sichuan University
Atsushi Inaba	AIST-Japan
Annette Koehler	UNEP-SETAC Life Cycle Initiative / ETH Zurich
Claudia Peña	Centro de Investigación Minera y Metalúrgica
Vinod Sharma	Indira Ghandi Institute of Development Research
Ex officio members	
Jason Morrison	Pacific Institute
Gavin Power	UN Global Compact
Guido Sonnemann	UN Environment Programme
Rita Schenck	Institute for Environmental Research & Education
Peter Schulte	Pacific Institute

Appendix B: Key Players in Corporate Water Accounting

Various organizations and initiatives have attempted to help companies responsibly and comprehensively account for their water use and discharges and to achieve sustainable water management in general. Often these attempts are in the form of developing methodologies that act as a framework for accounting. However, these attempts can also be in the form of online tools, standards, guidance, software, or certification schemes. This section will provide brief descriptions of the organizations and initiatives attempting to advance responsible corporate water accounting through such methodologies and other tools.

Water Footprint Network

The Water Footprint Network (WFN) was launched in order to coordinate efforts between academia, civil society, governments, the private sector, and intergovernmental organizations to further develop and disseminate knowledge on water footprint concepts, methods, and tools. To these ends, WFN engages in the following activities:

- Developing standards (methods, guidelines, criteria) for water footprint accounting, impact assessment, and the reduction/offsetting of related impacts;
- Developing practical tools to support people and organizations interested in water footprint accounting, impact assessment and water footprint reduction and offsetting;
- Providing for, or arranging for third parties to provide for, meetings, publications, education, research and development with regard to the water footprint concept;
- Promoting the communication and dissemination of knowledge about water footprinting;
- Supporting government bodies, international institutions, non-governmental organizations, businesses and other organizations in implementing water footprint accounting and developing a sustainable and fair water policy; and
- Providing advice on the application of the water footprint and by checking and certifying the use of the water footprint.

Global Environmental Management Initiative (GEMI)

The Global Environmental Management Initiative (GEMI) is an organization of companies promoting global environmental and social sustainability through the development and sharing of tools and information. In 2002, GEMI released “Connecting the Drops Toward Creative Water Strategies: a Water Sustainability Tool” that looks at water issues at the company-wide level. In 2007, it released “Collecting the Drops: A Water Sustainability Planner” which provides tools and detailed guidance on water issues at the facility level.

World Business Council for Sustainable Development (WBCSD)

The WBCSD — a business association of roughly 200 global companies with efforts to promote sustainable development - launched its Global Water Tool in 2007. This tool — developed in collaboration with CH2M HILL - allows companies to:

- Compare their water uses (direct operations and supply chain) with water and sanitation availability information on a country and watershed basis,
- Calculate water consumption and efficiency,
- Determine relative water risks in order to prioritize action,
- Create key water GRI Indicators, inventories, risk and performance metrics and geographic mapping.
- Perhaps the most important aspect of this tool is that it — unlike water footprint and LCA methodologies —explicitly assesses the business risks associated with water use and discharge.

Overview of LCA entities (particularly in respect to water accounting)

Whereas the water footprint concept and methodology are housed solely within the WFN and developed by a small number of coordinated players, LCA methods have no single base organization and are developed by a number of entities.

UNEP/ SETAC Life Cycle Initiative

The UN Environment Programme (UNEP) and The Society of Environmental Toxicology and Chemistry (SETAC) - a global non-profit professional society aiming to develop principles and practices for sustainable environmental management — have worked together since 2000 on a partnership known as the Life Cycle Initiative. This initiative aims to:

- Collect and disseminate information on successful applications of life cycle thinking;
- Share knowledge about the interface between Life Cycle Assessment and other tools;
- Identify best practice indicators and communication strategies for life cycle management;
- Provide a basis for capacity building;
- Expand the availability of sound LCA data and methods;
- Facilitate the use of life cycle based information and methods.

In respect to water-related LCA efforts, the UNEP/SETAC Life Cycle Initiative launched a working group on the assessment of water use and consumption within LCA. This group was established to provide companies with a framework with which to develop an LCA indicator for water quantity and quality, integrating this indicator within the ISO 14040, and developing an assessment scheme for water within the LCA framework. It is also working to use this scheme to harmonize how water is addressed within the LCA community.

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Australia's CSIRO has taken an active role in advancing the LCA methodology — specifically on water issues and on other environmental issues. In regard to general LCA work, CSIRO has developed and maintained a database of LCA information, published manuals on the principles and practice of LCA. CSIRO Minerals has recently facilitated the implementation of LCA analyses by mining companies in Australia, which helped these companies assess the implications of different metal production and processing routes on water use and the components of their value chain which have the greatest water-related impacts.

PE International

PE International — the world' largest working group in LCA — develops the world's leading LCA analysis software, GaBi. GaBi provides a universal software tool for quantifying the environmental performance at the organization, facility, process, and product levels. This includes LCA, but also a number of different environmental accounting and analysis systems (e.g. GHG accounting, life cycle engineering, environmental reporting, strategic risk management, etc.). In addition to the GaBi software tool, PE International provides consulting services based on LCA analyses and water footprinting assessments.

Quantis

Quantis (www.quantis-intl.com) is a consulting company providing expertise in life cycle assessment (LCA) and offering solutions for organizations worldwide that are engaged in sustainable development. Quantis is also one of the leaders in the development of water assessment indicators within LCA, being actively involved in the UNEP-SETAC Life Cycle Initiative's project as well as convening the new ISO standard on water. Quantis has offices in Lausanne (Switzerland), Paris (France), Boston (United States) and Montreal (Canada).

International Organization for Standardization (ISO)

ISO, the world's most recognized standards-making body (including the ISO 14000 Environmental Management series) is the developer of the most widely used standards for the implementation of LCA (i.e. the ISO 14040 series). These ISO standards on LCA describes the principles and framework for LCA including the definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements. This standard provides a framework for a general LCA analysis and does not include water-specific elements.

ISO is currently developing a standard for the principles, requirements, and guidelines for the measurement and communication of the water footprint of products, processes, and organizations. While this standard refers to itself a standard for "water footprints", it is important to note that "water footprints" in this context refers to the broader range of water accounting tools and not specifically water footprints as developed by WFN. This standard intended to establish a framework and set of principles that enable existing water accounting methods to be consistent with one another and with other standards. This will consider regional concerns (e.g. relative scarcity, extent of economic development, etc.). ISO has explicitly stated that it does not intended to establish its own methodology, but rather provide guidelines for the important elements that water accounting methods should address.

Other corporate water accounting initiatives

Australian Bureau of Meteorology's Water Accounting Standards Board
As part of the Australian Government's Raising National Water Standard Program, the Water Accounting Standards Board (WASB) is responsible for the oversight and coordination of the development of all the nation's standards on water accounting. It is housed with the Bureau of Meteorology, but serves as an independent expert advisory board. WASB recently published the Water Accounting Conceptual Framework (WACF), which provides guidance for the preparation and presentations of general purpose water accounts, as well as a preliminary Australian water accounting standard that is meant to harmonize the methods and indicators that are used to measure water use and discharge. These documents are applicable to many different sectors, including the private sector.

Beverage Industry Environmental Roundtable (BIER) Water Footprint Working Group
BIER — a coalition of global beverage companies working to advance environmental stewardship — has formed the BIER Water Footprint Working Group to develop sector-specific guidelines for assessing the water use and impacts of a company or product. These guidelines will attempt to establish common water accounting boundaries, definitions, and calculation methods for the beverage industry. They will provide detailed instructions for specific inputs and operations that are unique to the sector. These guidelines will be developed with assistance from ISO, WFN, WWF, and UNEP/SETAC and will be published in late 2010.

Corporate Water Gauge
The Corporate Water Gauge™ is a context-based measurement tool/method that measures the sustainability of a facility's and/or enterprise's water use in light of locally relevant watershed and precipitation conditions, while taking into account the volumes, sources and sinks of water inflows and outflows, and the populations with whom such resources must be shared. The Gauge produces quantitative scores that reflect the sustainability of a facility's/organization's water use relative to locally renewable supplies. Sustainability performance is determined by comparing rates of water use against rates of water regeneration, after allocating shares of available resources to specific facilities and/or organizations. It uses GIS technology to profile, analyze and report local hydrological, demographic and economic information at a watershed level of analysis in combination with site-specific datasets. It was developed by the Center for Sustainable Innovation, a non-profit corporation dedicated to the advancement of sustainability measurement, management and reporting in organizational settings.

Minerals Council of Australia
The Minerals Council of Australia (MCA) is an organization - composed of over 60 member companies and associate members — that represents Australian mining and mineral processing industries in their efforts to reach sustainable development. It works to promote policy and practice that is safe, profitable, environmentally sustainable, and socially responsible. Since 2005, MCA has been developing a water accounting framework meant specifically for the mineral industry. This framework aims to provide a way to quantify water flows into and out of facilities, metrics for reporting about water use and discharge, an approach to account for recycled water, and a model for detailed operational water balances. A preliminary framework was released in July 2008 and results from a pilot test of the framework were released in November 2009.

Other supporting organizations and initiatives

Alliance for Water Stewardship
The AWS is an initiative developing a global freshwater stewardship certification program. This certification program will provide a voluntary "eco-label" that rewards responsible water use management with

competitive advantage. Such a certification system will require quantification of water use, discharge, and impacts, however the Alliance intends to build on existing methodologies (namely the water footprint as developed by WFN) as a key component of its measurement, and will attempt to minimize duplication of efforts and confusion in this space. The Alliance intends for this certification scheme to be applicable both to water "users" (businesses) and water "providers" (utilities). The initiative is currently in the standards development phase in which they are defining what constitutes water stewardship.

Global Footprint Network

The Global Footprint Network (GFN) - established in 2003 - encourages and facilitates the use of the Ecological Footprint (EF) in order to promote global dialogue and action on ecological limits and sustainability. It is comprised of individuals, cities, nations, companies, scientists, NGOs, and academia from all over the world. The Network's work involves continuously improving the EF methodology, engaging with national governments to establish the EF as a globally-accepted metric, developing footprint standards, and encouraging cooperation among sectors to advance these concepts.

Global Reporting Initiative

The Global Reporting Initiative (GRI) is a network-based organization that has developed the world's most widely-used corporate sustainability reporting framework. The most recent version of this framework (known as the G3 Guidelines) includes five water-related criteria among a list of environmental, social, and economic criteria. These guidelines do not call for the reporting of quantified impacts. They also do not provide a comprehensive methodology for accounting for their criteria, but rather establish a harmonized framework through which companies communicate to stakeholders.

The Greenhouse Gas Protocol Initiative

The GHG Protocol — a partnership between the World Resources Institute and the WBCSD - is perhaps the most popular accounting tool for GHG emissions worldwide. It works with the public, private, and civil society sectors to advance credible and effective programs for mitigating climate change. The GHG Protocol developed the only widely-accepted methodology for corporate carbon footprinting and is one of the many methodologies for product carbon footprinting. It provides the standard for corporate carbon accounting as well as calculation tools for carrying this out. ISO has adopted the Protocol's Corporate Standard as the basis for its standard on corporate carbon accounting.

Appendix C: Acronyms

CDP — Carbon Disclosure Project
CSIRO — Commonwealth Scientific and Industrial Research Organization
CSR — Corporate Social Responsibility
DALY — Disability Adjusted Life Year
EF — Ecological Footprinting
FAO — Food and Agriculture Organization
EPD — Environmental Product Declarations
GEMI — Global Environmental Management Initiative
GHG — Greenhouse Gas
GRI — Global Reporting Initiative
IPCC — Intergovernmental Panel on Climate Change
ISO — International Organization for Standardization
LCA — Life Cycle Assessment
LCI — Life Cycle Inventory
LCIA — Life Cycle Impact Assessment
RAC — UNEP-CEO Water Mandate Corporate Water Accounting Research Advisory Committee
SETAC - The Society of Environmental Toxicology and Chemistry
SME — Small and Medium Enterprises
UNEP — United Nations Environment Programme
UNGC — United Nations Global Compact
WBCSD — World Business Council on Sustainable Development
WaFNE — UNEP Water Footprint, Neutrality, and Efficiency Umbrella Project
WF — Water Footprinting
WFN — Water Footprint Network
WFDSS — Water Footprint Decision Support System
WFSA — Water Footprint Sustainability Assessment
WRI — World Resources Institute
WRM — Water Resources Management
WTO — World Trade Organization

1. Water footprints are divided into three separate components—the blue, green, and gray WFs—which differentiate water use by source/type (surface/groundwater, evaporative flows, dilution water respectively) and are meant to be considered both separately and together as a total WF.

The Ten Principles of the United Nations Global Compact

HUMAN RIGHTS

Principle 1	Businesses should support and respect the protection of internationally proclaimed human rights; and
Principle 2	make sure that they are not complicit in human rights abuses.

LABOUR

Principle 3	Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
Principle 4	the elimination of all forms of forced and compulsory labour;
Principle 5	the effective abolition of child labour; and
Principle 6	the elimination of discrimination in respect of employment and occupation.

ENVIRONMENT

Principle 7	Businesses are asked to support a precautionary approach to environmental challenges;
Principle 8	undertake initiatives to promote greater environmental responsibility; and
Principle 9	encourage the development and diffusion of environmentally friendly technologies.

ANTI-CORRUPTION

Principle 10	Businesses should work against corruption in all its forms, including extortion and bribery.

THE GLOBAL COMPACT

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