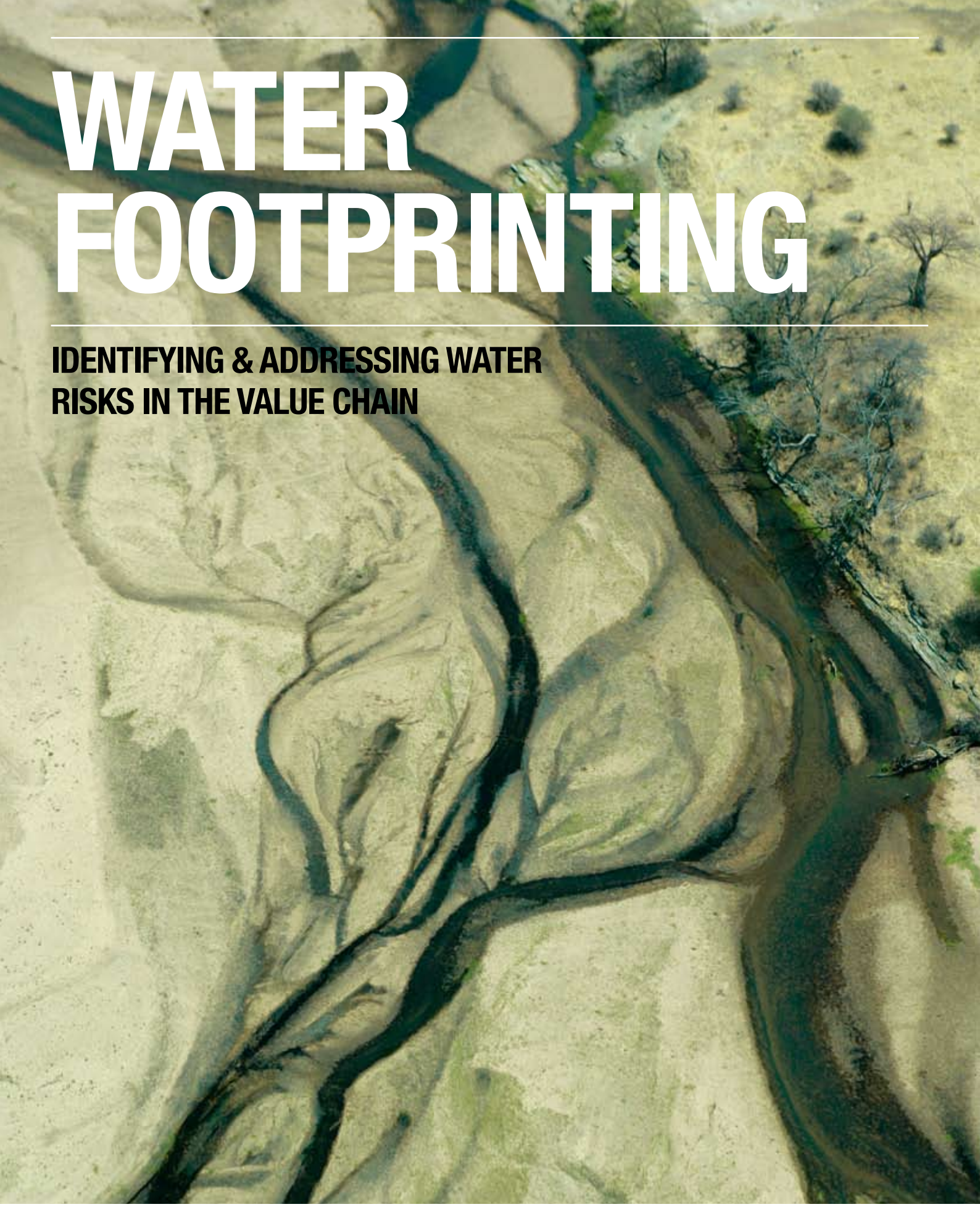
WATER FOOTPRINTING

IDENTIFYING & ADDRESSING WATER RISKS IN THE VALUE CHAIN



SAB MILLER

WWF

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About SABMiller: As one of the world's largest brewing companies, SABMiller has brewing interests and distribution agreements across six continents. Our wide portfolio of brands includes premium international beers such as Pilsner Urquell, Peroni Nastro Azzurro, Miller Genuine Draft and Grolsch along with leading local brands such as Aguila, Castle, Miller Lite, Snow and Tyskie. Six of our brands are among the top 50 in the world. In a number of our African markets we brew sorghum-based traditional beers. In 2009 our group revenue was US$25,302 million with earnings before interest, tax and amortisation of US$4,129 million and lager production of 210 million hectolitres. We are also one of the world's largest bottlers of Coca-Cola products. In addition to our Coca-Cola operations, we produce and bottle a range of soft drinks including Appletiser. In 2009 we produced 44.3 million hectolitres of soft drinks – sparkling drinks, water, fruit juices and malt beverages – making up 17% of total volumes. SABMiller is a partner of the Water Footprint Network (WFN).

About WWF-UK: WWF is the world's leading environmental organisation founded in 1961. WWF-UK is one of nearly 50 offices around the world. Using our unique combination of practical experience, knowledge and credibility, our 300-strong staff work with governments, businesses and communities both here in the UK and around the world so that people and nature thrive within their fair share of the planet's natural resources. In 2007/8 WWF-UK spent £42m on our work; most of our income comes from our dedicated members and supporters. WWF is a partner of the Water Footprint Network.

Executive summary

WATER FOOTPRINTING IS BECOMING A POPULAR WAY OF UNDERSTANDING THE TOTAL WATER INPUT TO CONSUMER PRODUCTS SUCH AS BEVERAGES, FOOD AND CLOTHES. JUST AS THE CARBON FOOTPRINT CONCEPT HAS ASSISTED BUSINESSES AND CONSUMERS IN UNDERSTANDING THE LEVEL OF GREENHOUSE GAS EMISSIONS CREATED BY THEIR ACTIVITIES, SO WATER FOOTPRINTING IS CREATING AWARENESS OF HOW AND WHERE THIS PRECIOUS RESOURCE IS USED.

WWF and SABMiller are both pioneers in the use of water footprints to understand ecological and business risks. Both are partners of the Water Footprint Network (WFN) and publish this report as a contribution to improve the use and utility of water footprints.

The report provides a detailed insight into the learning of WWF and SABMiller, who worked together with consultancy URS Corporation to undertake water footprints of the beer value chain in South Africa and the Czech Republic. It discusses what the water footprint results in both countries mean for SABMiller's businesses and their action plans in response to the findings. This study looks beyond the basic water footprint numbers and considers where the resource is used and the context of its use – in particular by considering water use for different agricultural crops in the context of specific water catchments.

The water footprints for two respective SABMiller operations in the Czech Republic and South Africa were very similar in terms of the percentage split between different users in the value chain, with crop production dominating water usage, averaging over 90% of the footprint. In terms of actual quantitative footprint, the South African footprint at 155 litres of water per litre of beer (l/l) was significantly higher than the Czech Republic footprint at 45l/l. The differing country temperature (evapo-transpiration) profiles, greater reliance on irrigated crops in South Africa and the larger proportion of imported agricultural raw materials flowing into SAB Ltd, SABMiller's South African business, from countries where crop water consumption is higher, were the main reasons for the volume differences.

Water footprinting is primarily focused on quantitative water supply issues. However, the example of the Czech Republic provided in this report also shows that quality issues can be identified and addressed using water footprinting.

As this report shows, water footprints can differ enormously between agricultural growth regions depending on the amount of rainfall that a region receives. There is also significant complexity in calculating the impact of one water footprint versus another on the environment and on communities. Therefore, whilst good for consumer awareness, water footprints are not yet effective tools for helping consumers choose between different products. Over time, and as methodologies mature and become more standardised, this may change. For now, the numbers are helping businesses and other water users to understand more fully how best to operate within the context of the water environment.

If water footprinting is applied well it can be very useful from a business perspective, helping identify the scale of water use in water-scarce areas and the potential business risks that arise. The key test of a water footprint is whether it helps a business to take better operational decisions concerning how it manages its plants, how it works with suppliers and how it engages with governments, to reduce business risk and improve environmental sustainability.

To this end, a water footprint must not only look at the total water use in litres of water per unit of product across the value chain, but must also consider where that water is used, what proportion that water use represents of the total resource in that area, and whether this proportion of water use presents risks to the environment, to communities, or to business, now or in the future. To undertake such a detailed approach adds complexity to the process, but adds immeasurably to the water footprint assessment.

Water footprinting methodologies are continually being refined. This report presents a number of innovations in the methodology which are recommended for consideration by the WFN and others keen to understand the total water impact of their products' value chains and the risks this may present to their business.

1.0
Introduction

VERY FEW ACTIVITIES OCCUR IN THE WORLD TODAY THAT DO NOT RELY ON FRESHWATER IN ONE WAY OR ANOTHER. WHETHER THIS IS PERSONAL SUSTENANCE, BASIC HYGIENE, GROWING CROPS, PRODUCING ENERGY, MANUFACTURING GOODS OR MAINTAINING ECOSYSTEMS TO KEEP THE EARTH IN BALANCE – HUMAN BEINGS ARE INEXTRICABLY LINKED TO FRESHWATER.

Unless water management improves significantly, we will face major challenges in securing enough water to support the growing world population, to underpin economic growth and to meet environmental needs. To date, the track record on managing water sustainably – almost anywhere in the world – is poor. For most governments water management is not, in practice, a priority, and societies largely fail to value and govern their freshwater resources adequately. Thus, despite significant strides in legislation and water-efficiency technology in recent years, water scarcity and water pollution continue to be all too common occurrences.

In parallel, as a result of a better awareness of the water challenge, there is a rapid increase in private sector recognition of the importance of water for the wellbeing of society, the growth of the economy and the protection of the environment. Numerous reports and activities around water have emerged, while business forums such as the UN Global Compact's CEO Water Mandate and the World Economic Forum (WEF) have helped to distil these important debates, and organisations such as the Water Footprint Network (WFN) and the Alliance for Water Stewardship (AWS) have been established to help measure and set standards around water use.

1.1 The Water Footprint Network

In 2008, WWF and SABMiller became partners of the WFN, a body established to promote the transition towards sustainable, fair and efficient use by freshwater resources worldwide by:

i. advancing the concept of the 'water footprint', a spatially and temporally explicit indicator of direct and indirect water use by consumers and producers;

ii. increasing the water footprint awareness of communities, government bodies and businesses and their understanding of how consumption of goods and services and production chains relate to water use and impacts on freshwater systems; and

iii. encouraging forms of water governance that reduce the negative ecological and social impacts of the water footprints of communities, countries and businesses.

Through this organisation numerous companies are testing the methods of the water footprint and applying them to their operations. Over time, these findings will improve the methods and build up water footprint impact assessments for more detailed analysis.

1.2 Objectives of this report

The report provides a detailed insight into the learning of two water footprint pioneers, WWF and SABMiller, who worked together with consultancy URS Corporation to undertake water footprints of the beer value chain in South Africa and the Czech Republic.

A water footprint is only useful when it informs better decision making. In the context of a business, this means enabling the business to take a better decision regarding how it manages it plants, how it works with suppliers, or how it engages with governments on policy issues.

The report discusses what the water footprint results in South Africa and the Czech Republic mean for SABMiller's businesses and their action plans in response to the findings. This study looks beyond the basic water footprint numbers and considers where the resource is used and the context of its use – in particular by considering water use for different agricultural crops in the context of specific water catchments.

Agriculture contributes a high proportion to the overall water footprint of products from the food and beverage industry

Unless water management improves significantly, we will face major challenges in securing enough water to support the growing world population, to underpin economic growth and to meet environmental needs.

These water footprints have been undertaken very recently and are published in a spirit of transparency. SABMiller is now in the process of engaging with agricultural suppliers on the insights provided by these water footprints and building partnerships, most notably with WWF, to address the issues discussed in this report. As a result this report should be considered as a work in progress.

Many WWF freshwater programmes around the world are focused on protecting basic ecosystem functioning through the maintenance of minimum environmental flows. These programmes are increasingly being implemented in partnership with governments, businesses and other stakeholders, and the assessment of water footprints is integral for the delivery of these goals.

WWF and SABMiller hope that this report will be a useful contribution to the growing debate around water footprinting.

2.0
Water challenges & opportunities

THE DISTRIBUTION OF FRESHWATER ACROSS THE GLOBE IS VERY UNEVEN IN TERMS OF BOTH SPACE AND TIME. JUST NINE COUNTRIES POSSESS 60% OF GLOBAL FRESHWATER SUPPLIES[1]. RAINFALL LEVELS DIFFER NOT ONLY BETWEEN COUNTRIES, BUT BETWEEN REGIONS OF COUNTRIES, FROM SEASON TO SEASON AND FROM YEAR TO YEAR. CLIMATE CHANGE IS EXPECTED TO EXACERBATE THIS VARIABILITY AND INCREASE UNPREDICTABILITY.

In agriculture the level of rainfall has a direct impact on the need for irrigation. In some developing countries for example, irrigation can account for over 90% of water taken from natural resources. Compare this to the United Kingdom, where until recently agriculture accounted for approximately 3% of total water usage[2]. As a global average however, approximately 8% of water is used domestically, 22% by industry and 70% by agriculture.

According to the World Resources Institute (WRI)[3], the term 'Water stress' is used when there is not enough water for agricultural, industrial or domestic needs all to be met. An area is said to experience water stress when annual per capita renewable freshwater availability is less than 1,700 cubic meters, on either an occasional or a persistent basis. 'Water scarcity' is used when availability falls below 1,000 cubic meters, which can usually seriously impact economic development and human health *(see Figure 1 on page 5)*. Current estimates indicate that by 2025 water stress will be a reality for half the world's population. This in turn will mean higher water prices reflecting scarcity, competition for water, and changing water allocations between the three categories of user group. It will also require that all companies measure, monitor and reduce their water use needs and impacts on society and the environment. Compounding the issue is the fact that most definitions fail to take adequate account of the environmental needs for water, in other words they do not factor in the need for minimum flows to maintain ecosystems and ecosystem services. This means that availability may in fact be over-estimated.

2.1 Why is water different?

Water is undoubtedly a complex resource for a number of reasons. Unlike carbon, another fundamental and interlinked global challenge to manage, the impacts and issues around water are very local, historically within the confines of the watersheds and river basins of specific geographical locations. However this is beginning to change through man-made interventions such as inter-basin transfers and, much more significantly, the movement of virtual (embedded) water between nations, causing a reliance on water management many miles away from where the virtual water is eventually consumed. →

1 These are Brazil, Russia, China, Canada, Indonesia, U.S, India, Colombia and the Democratic Republic of Congo

2 FAO, AQUASTAT: 2005

3 WRI, 'Will there be enough water?' Revenga, C., EarthTrends, October 2000, www.earthtrends.wri.org

FIGURE 1: **ANNUAL RENEWABLE WATER AVAILABILITY (WRI)**

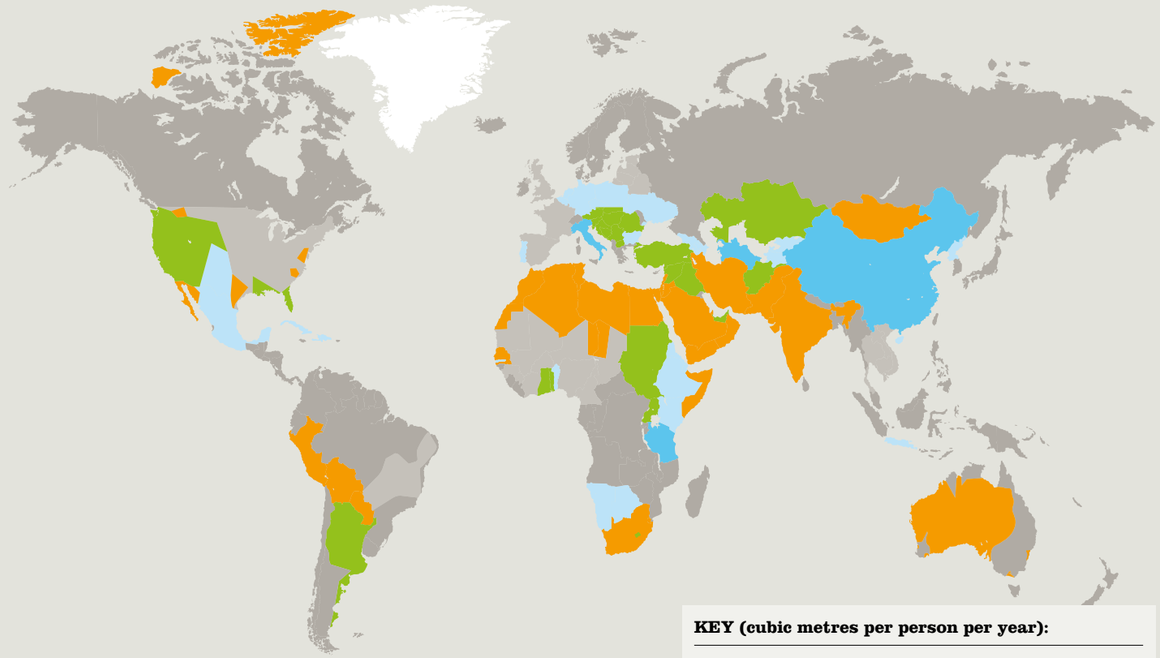
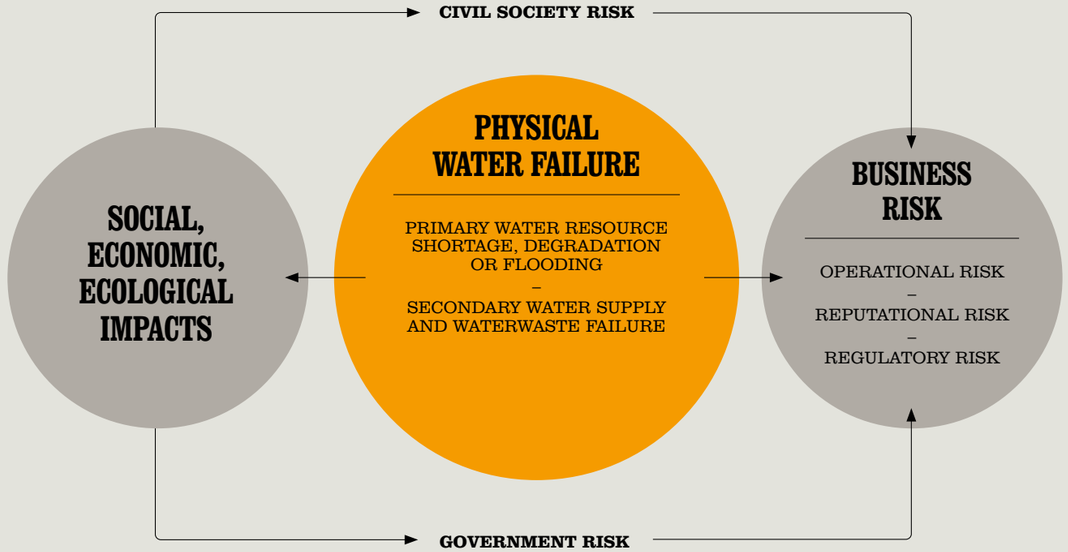


FIGURE 2: **WATER RISKS**



Business will be required to not only ensure that their facilities are being optimally run in terms of water usage but also ensure that their activities are transparent to the local community with open channels of communication.

Connected to this is the variability of water over time. For example, water availability varies year on year due to changing meteorological conditions and countries can vacillate between the extremes of drought and flood. This variability is likely to increase with the onset of climate change.

Importantly, water has not only an economic utility but also significant social and environmental utilities which separate it from a number of other resources we rely on. This social utility can include meeting basic human needs, recreational use and may stretch to significant spiritual connotations. Healthy water ecosystems underpin functioning economies, through 'provisioning services' such as aquifer recharge, fish supplies and transport routes, 'regulating services' or ecosystem services such as water purification, stream flow mediation and options for adaptation to climate change. As such, there are no straightforward or 'one size fits all' solutions to water problems and each issue has to be dealt with in the context of its local setting.

Finally the utility of water varies between users and between countries. Reflecting the point above, different users place a different economic and social value on water resources, often tied to the net availability and quality of the resources in a given location. Hence a cubic metre of water in South Africa may have a very different value to a cubic metre of water in the Czech Republic.

2.2 Water–related business risks

Water-related business risks emanate from changes to the resource in terms of quality or quantity. Risks then manifest themselves in reputations, costs, regulatory changes and ultimately the bottom line. Water is not only used at the primary manufacturing site but rather touches the entire value chain with varying degrees of intensity. Now more than ever, there is a convincing case to be made for a comprehensive approach to water management that not only looks at internal processes but also considers the supply chains that companies source from and the communities and ecosystems these activities interact with.

Being aware of and understanding the water challenges they face undoubtedly allows businesses to make better management decisions and provides the platform to engage with a broader set of stakeholders to address issues outside their direct sphere of influence. These challenges include:

Water scarcity
Current physical water scarcity is more often a factor of geographic location as opposed to a new global shortage of water. This is often exacerbated by poor water management and allocation which results in inefficient water use, and a lack of water allocated to vulnerable communities and environmental needs. Scarcity can also imply economic water scarcity, where water resources are available but accessing them is financially prohibitive. Looking forward, water shortages are likely to spread due to increasing demands from a growing global population, unsustainable withdrawal rates, difficulty in finding new supplies and changing climatic and precipitation patterns.

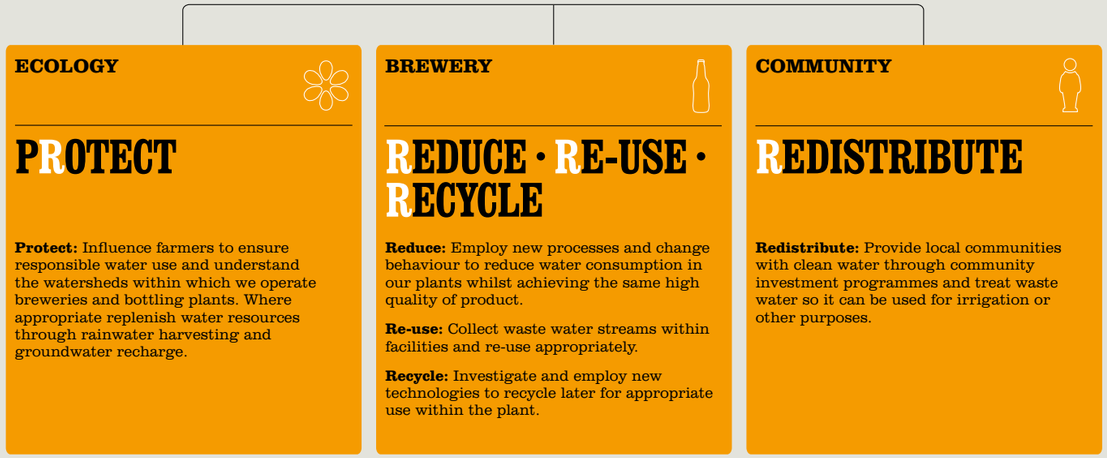
Competition for water resources
As water availability declines per capita and existing resources are required to satisfy a broader range of needs, competition for water rights can materialise. In such cases local authorities are required to balance the needs of domestic, industrial and agricultural consumption together with considering the requirements to maintain ecosystem services.

Declining water quality
In a number of regions of the world, the quality of freshwater resources is declining rapidly. There are numerous causes of this, such as discharge from industrial sites, agricultural run-off, sedimentation due to land clearance activities, saline intrusion of coastal aquifers and the reduced ability of watercourses to assimilate pollutants due to decreased stream flow. This can lead to greater water treatment costs to meet the quality requirements required for production of goods.

Social dimension of water and interaction with business
Community interaction with water will play an important role going forward, particularly in regions where water scarcity is already being felt. The ability of companies to work in isolation is no longer a valid proposition as community groups are increasingly exercising their rights to question water allocation and actual/perceived abuse of water resources by companies. Business will be required not only to ensure that their facilities are being optimally run in terms of water usage but also to ensure that their activities are transparent to the local community with open channels of communication. *Figure 2 (page 5)* highlights the relationship between businesses, government and society to explain where risks emanate.

FIGURE 3: SABMILLER 5R WATER MODEL

The '5 Rs' enable each of our operations around the world to focus on specific issues upstream, downstream and within our operations:



2.3 SABMiller's approach to water management

SABMiller recognises these risks and the importance of water in their production and supply chains, making water one of SABMiller's top sustainable development priorities. As a founding signatory of the United Nations CEO Water Mandate, SABMiller recognises that we have a responsibility to promote responsible water use throughout our operations, and to encourage our suppliers to do the same. We have invested significant management time at local and global level in understanding the challenges of water scarcity and quality and what they may mean for our business, but there is more to do.

SABMiller has set itself the demanding target of reducing its own operational water use per litre of beer by 25% by 2015. This initiative will reduce the company's consumption to an average of 3.5 litres of water to make a litre of beer. In 2008 this figure was 4.6 litres; the industry average is 5 litres.

SABMiller also recognises that water issues are by nature cross-community and cross boundary, and cannot therefore be managed simply within the fence lines of our own operations. Therefore we engage in local dialogues on water issues, we contribute to public policy discussions to ensure that governments manage water resources efficiently and sustainably and we aim to report our use and management of water issues transparently. Solutions to local water challenges are usually best provided through partnerships with NGOs, communities, local governments and other businesses, and we will strive to build long-term sustainable partnerships to tackle local water issues.

Most importantly, the water footprints detailed in this report reveal that the vast majority of water used in the value chain of a litre of beer is used in the agricultural cultivation phase. Whilst this is ultimately the responsibility of the farmers themselves, it is a priority to understand which agricultural areas face risks of water scarcity and to work with farmers to encourage them to use water more efficiently.

2.4 WWF's view of water footprinting

WWF first began research in water footprints back in 2006. At that time we were focused on linking production site impacts with consumer choice, but quickly became aware of how this could be used not just for advocacy but for business audiences. WWF-UK launched a UK Water Footprint report in 2008, and WWF network offices will launch other country studies in key areas around the world. This work has now led to innovative partnerships with government and business audiences to assess and track water use, environmental and social impacts and risks along supply chains. Ultimately many tools will be required, as a water footprint by itself does not provide all answers or solutions, but provides a better understanding of absolute volumetric needs, the opportunity costs of the water used, and the impacts to environments and people that could become material risks.

For WWF-UK, this work is not seen as the total picture, but rather as an extremely important first step in understanding the role that businesses can play to support better management of scarce water resources. For companies it begins to tell an important story of dependence and risk, and together we believe we can bring about the type of changes necessary for delivery of sustainable and equitable water management.

3.0
A background to water footprinting

The water footprint of an individual, community or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business. Water use is measured in terms of water volumes consumed (evaporated) and/or polluted per unit of time.

ENVIRONMENTAL FOOTPRINTING HAS BEEN GROWING FOR A NUMBER OF YEARS, IN PARTICULAR WITH THE DEVELOPMENT OF VALUE CHAIN CARBON FOOTPRINT TOOLS IN THE LAST THREE YEARS.

Many consumer goods businesses, including SABMiller, have undertaken detailed carbon footprints of specific products such as beer, carbonated soft drinks, fruit juices and potato chips. Given the growing awareness of water scarcity, water footprints have been considered as a natural next step, although there are important differences.

A water footprint has been defined as: 'An indicator of water use that looks at both the direct and indirect water use of a consumer or producer. The water footprint of an individual, community or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business. Water use is measured in terms of water volumes consumed (evaporated) and/or polluted per unit of time.'

'A water footprint can be calculated for any well-defined group of consumers (e.g. an individual, family, village, city, province, state or nation) or producers (e.g. a public organisation, private enterprise or economic sector). The water footprint is a geographically explicit indicator, not only showing volumes of water use and pollution, but also the locations.'[4]

4 www.waterfootprint.org

The water footprint concept, developed by Hoekstra and Chapagain (2002), was introduced as a consumption-based indicator of water use for products and services. This provided a better indication of water demand than suggested by national statistics on water use in different sectors (e.g. agricultural, industry, drinking water). The water footprint of a product or service has two components: use of water resources originating from within the country or organisation of production (internal) and the use of water related to imported goods and services (external).

The concept of a water footprint is closely linked to the virtual water concept, introduced by Allan (1996, 1998). Virtual water is defined as the volume of water required to produce a commodity or service. Allan developed this concept as a way to conceptualise water scarcity in the Middle-East region, where high imports of virtual water in food help to alleviate water scarce resources within these countries.

A water footprint can be applied at different scales. For example, Hoekstra and Chapagain (2002) developed a method for calculating the water footprint of a nation based on the consumption pattern of its people. Chapagain et al (2005) developed a global water footprint for cotton consumption from crop growth through garment production, import and export patterns and waste disposal. Many organisations have developed an estimate of the water footprint for individual items, including beer. The Water Footprint Network website contains a calculated footprint of 300 litres of water for one litre of beer, while Cranfield University (2008) calculated one litre of beer as requiring 200 litres of water. Given this variance and the degree of estimation used in these figures, SABMiller decided to undertake detailed water footprints for two of its operations to test the methodology.

This report raises a number of questions which are relevant to the debate on broader environmental footprint for consumer products. These questions include:

1. What can a footprint tell us about the impact on natural ecosystems of manufacturing and consuming a product?
2. What is the principal value of a footprint exercise? To understand value chains better, to reduce business risk, or to improve transparency?
3. If a footprint sends a clear message regarding environmental damage or risk, what can practically be done about it, and who is responsible? And how much influence do consumers, manufacturers or campaign groups have?
4. What are the key variables in a footprint figure and how often do they change? What does this mean for the provision of reliable data for different purposes?

Dry cracked earth near river level gauging station
© Brent Stirton/Getty Images/WWF-UK

Rice paddies © Simon de Trey-White/WWF-UK

4.0
Case study methodology

THE WATER FOOTPRINTS IN THE CASE STUDIES THAT FOLLOW ARE BASED ON THE BUSINESS WATER FOOTPRINT ACCOUNTING METHODOLOGY AS DEVELOPED BY GERBENS – LEENES AND HOEKSTRA (2008).

The key aspects of the calculations were:

- provision of data sets on each stage of the value chain from SABMiller and its business partners;
- infilling of data gaps through literature review and internet searches; and
- development of a method to calculate direct and indirect water use, using standard techniques such as the UN Food and Agricultural method to calculate crop water requirements and the use of lifecycle inventories.

The water footprint starts with the cultivation of the crops and follows all the processes through to bottle recycling. It does not, however, include water use by consumers (for example, washing out a beer glass) as this is considered to be relatively minimal in the context of the overall footprint and there is very little existing data to estimate water use in this regard. It is important to note that the water footprint covers only 'operational' water use. In other words it does not include the embedded water used in the creation of the infrastructure associated with each stage in the process, such as the manufacture of any machinery used. The key components are *(see Figure 4, page 11)*:

Crop Cultivation
The water footprint is calculated on the raw materials used, direct water use in growing crops, the water related to the energy use of farm machinery and irrigation systems and the transport of the crops to the crop processing facilities. The water footprint does not include the water used in the manufacture of the farm machinery, the irrigation equipment or the vehicles used to transport the crops.

Crop Processing
The water footprint covers the raw materials (including the importing of crops), the direct water use and the water related to the energy used in the processing of the crops as well as the transportation to the seven breweries. The water footprint does not include the water used in the manufacture of the equipment or vehicles used in the processing and transport of the processed crops.

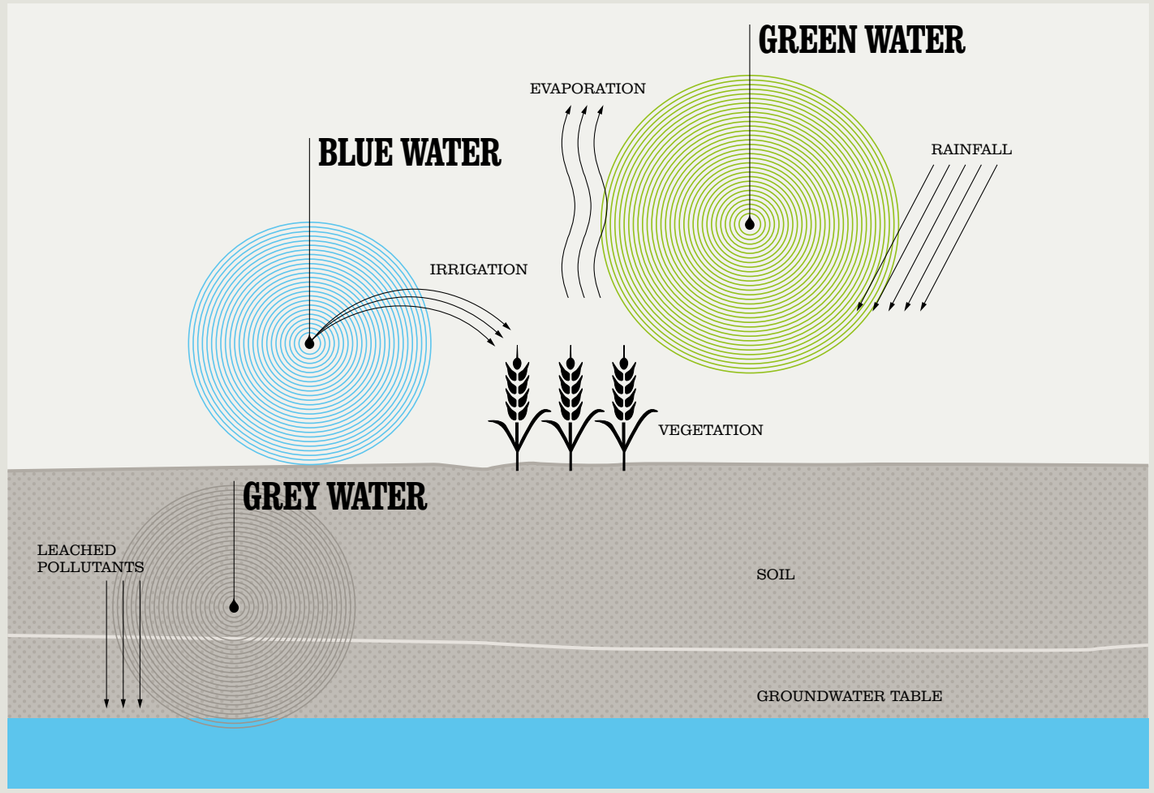
Brewing and Bottling
The water footprint covers the direct water use, water in the manufacture of the other raw materials, water in relation to the recycling of bottles and water related to packaging (including bottle labelling). The water footprint does not include water used in the manufacture of any of the equipment in the brewery.

Waste Disposal
The water footprint covers the recycling of cans, bottles and kegs but not the manufacture of the equipment used in this process. →

FIGURE 4: **VALUE CHAIN APPROACH TO WATER FOOTPRINTING**

CROP CULTIVATION	CROP PROCESSING	BREWING	DISTRIBUTION	CONSUMER
• ENERGY	• TRANSPORT	• ENERGY	• TRANSPORT	• DISPOSAL
• FERTILISER/ PESTICIDE	• ENERGY	• TRANSPORT		• RECYCLING
• CROP GROWTH (rainfed/irrigated)	• CROP IMPORTS	• PACKAGING		
	• DIRECT WATER USE	• RAW MATERIALS		
		• WASTE		
		• DIRECT WATER USE		

FIGURE 5: **TYPES OF WATER**



In the development of a water footprint three types of water are assessed: green water, blue water and grey water.

4.1 Definitions for water footprint terms

In the development of a water footprint three types of water are assessed: green water, blue water and grey water. The most up-to-date definitions have been provided by Gerbens-Leenes and Hoekstra (2008) as follows:

- The 'green' component refers to the water evaporated through crop growth that originates from soil moisture (from rainfall). This is relevant to agricultural products (barley, maize and hops for beer production). The evaporative loss is included as a component part of the water footprint because a significant proportion of the water would be available to other water users (e.g. groundwater reserves, ecological features) if the crops were not, in fact, grown. Although the evaporation may be a resource available to other users, it has been assumed that such a loss is not available to the area on immediately downstream of the area in which the crops are grown and it is, therefore, considered a water use. Throughout this report we refer to 'net' green, which is the difference between water taken up by the natural vegetation of a given area and the crop being grown (see page 23 for a detailed explanation).
- In crop production, the 'blue' component refers to the water evaporated through crop growth that originates from surface or groundwater. This is more easily thought of as the irrigation water that is not returned to either the surface or groundwater environment. For the production of a product (e.g. beer) this is defined as the amount of water withdrawn from groundwater and surface water that does not return to the system from which it came.
- The 'grey' component refers to the volume of polluted water associated with the production of goods and services, quantified as the volume of water that is required to dilute pollutants to such an extent that the quality of the ambient water remains above agreed water quality standards. For crop production this would be the volume of dilution to reduce to agreed standards nitrate and phosphate (fertiliser) levels and pesticide levels leaching from soils. For industrial production this is the dilution of effluent quality to agreed standards, although this is complicated by the use of downstream municipal treatment plants.
- The distinction between green and blue water is extremely important, particularly in crop production given the significant differences in the management of rain-fed agriculture and irrigated agriculture. It also highlights the various 'opportunity costs' of water use. Green water generally has a lower opportunity cost than river and lake water, which has numerous other utilities in society. Understanding this profile breakdown is important in areas where water competition is high, costs are increasing and rainfall is decreasing or where the suitability of crop growth is under question.

Green and blue water are considered direct consumptive use while grey water is an indirect consumption. Each stage of beer production could have two or three different components of green, blue or grey water. However, it would be infeasible to attempt to calculate all components for all activities. For some of the components in the production process (e.g. transportation, energy consumption, smaller quantities of raw materials), a virtual water footprint has been developed from literature and internet sources. This virtual (or 'embedded') water footprint is effectively the total of green and blue (generally blue). It does not include grey water.

4.2 Considering the different aspects of water footprint methodology

Whilst both case studies detailed below used a consistent methodology to ensure comparability, we also used each case to test other dimensions of the water footprint. The South African case study collected water cost information in addition to volumetric figures. This study sought to understand whether price had a particular influence on water use. The Czech Republic case study focused on volumetric water numbers, but drew on three years of data rather than just one year. In this case we were keen to understand how the product water footprint changed from year to year.

The distinction between green and blue water is extremely important, particularly in crop production given the significant differences in the management of rain-fed agriculture and irrigated agriculture.

5.0
Case studies

IN 2008, SABMILLER UNDERTOOK ITS FIRST WATER FOOTPRINT EXERCISE AT ITS SUBSIDIARY, SAB LTD, IN SOUTH AFRICA, THE BREWER OF CASTLE AND OTHER BRANDS OF BEER. SOUTH AFRICA WAS SELECTED BECAUSE THE COUNTRY FACES SUBSTANTIAL WATER-RELATED CHALLENGES. MANY REGIONS OF THE COUNTRY WILL BE DEFINED AS WATER SCARCE BY 2025.

5.1 SAB Ltd – South Africa

The diagram on page 18, developed using the World Business Council for Sustainable Development (WBCSD) water tool[5], shows the regional nature of the water scarcity challenge in South Africa. Some regions will become extremely water scarce by 2025, whilst a small number will remain abundant or sufficient.

In this context, SAB Ltd faces particular challenges given the widespread nature of its activities. Its operations in the country produce and distribute around 5.7 billion litres (2.6 billion in beer and 3.1 billion in soft drinks) of beverages annually from seven breweries, seven soft drinks bottling plants and 41 sales and distribution centres.

The total net water footprint for SAB Ltd's beer operations is 421 billion litres, excluding 'grey' water, equivalent to 155 litres of water for every 1 litre of beer (l/l). Due to uncertainties regarding the assumptions required to calculate a meaningful grey water aspect of the footprint, grey water has been left out of this calculation. However, if grey water were added, we estimate that water consumption would increase to 517 billion litres, or 191l/l.

The local cultivation of the crops is the dominant water consumer at 84.2%, whilst another 14.1% of the water footprint is derived from the cultivation of imported crops *(see Figure 6 on page 18)*. In effect, 98.3% of the water footprint is related to the growth of crops.

The green water component, as illustrated in *Figure 7 (page 18)*, is the largest proportion and relates to the use of soil moisture, derived from rainfall, which is evapo-transpired by the growth of crops such as barley, maize and hops for beer, plus to a lesser extent the trees used for paper-based packaging and bottle labels. The blue water component is water used for irrigation in agriculture and the brewing of beer at SAB's facilities, while the grey water component is an indirect water use to dilute pollutants from pesticide and fertiliser use. The grey water component has the greatest level of uncertainty.

Water use, as described previously, has very local connotations and impacts. As such, it was important that the effects of water consumption, particularly in the agricultural supply chain, be fully understood in each geographic region. In order to do this, each crop type was examined using data from both local and international sources[6], to understand which crops consumed the most water and why.

Our research has shown that there is great variability in the way our crops receive water. For example barley in the Northern Cape region and maize production in the North West province were the most reliant on irrigated (blue) water sources, more than 90% in both cases, since rainfall is insufficient to support barley and maize production. On the other hand, barley grown in the Southern Cape and maize grown in the Mpumalanga province were entirely reliant on rain (green) water.

The availability of this data was an integral part of the footprint analysis. However a more important aspect was understanding where water is used and what pressure this may put on local water resources. To reflect this each of the major crops was mapped against the 19 South African water management regions *(see Figure 5 on page 18)* and the water use of each crop was considered within the local resource constraints (all of the crop, not just the crop bought for SABMiller products). This provided valuable information in terms of the current and future sustainability of crop growth.

The importance of local context is illustrated by the fact that despite the high reliance on irrigated water for maize in the North West, the region has sufficient water resources to support this without detrimental impacts on local ecosystems or other users. However, barley grown in the Southern Cape, despite being rain-fed, is vunerable in the long term due to changing climatic conditions and population pressures predicted for the area.

5.2 Water pricing in South Africa

A further aspect of the South African analysis was to consider the cost of water to the value chain, and the water price differential between different parts of the beer value chain. The total cost of water to the value chain is equivalent to around 5.9 South African Rand per hectolitre of beer, i.e. a low proportion of the operating costs within the entire value chain. The majority of this cost is for municipal wastewater treatment of brewery effluent.

However it is the differential between water prices in the value chain that is most interesting. Whilst in 2007 SAB Ltd paid around 0.61 Rand for municipally supplied water per hundred litres of beer, farmers typically pay 0.014 Rand per hundred litres of beer for irrigation water for their crops. This is in part a result of the different costs of supply, but more importantly reflects the economic values of the different types of water, where there is a different 'willingness to pay' between the commercial farmers and industry. Over time, as climate change leads to greater use of irrigation in South Africa, it is important that water use in agriculture is priced to lead to a much more efficient use of a scarce resource. →

WATER FOOTPRINT RELATED TO CROP GROWTH IN SOUTH AFRICA

98.3%

Beer being loaded for market distribution in South Africa


Irrigating sugar cane fields © Martin Harvey/WWF-Canon

5 See www.wbcsd.org

6 Data was sourced from local farmers, local industry bodies and the UNFAO

Water treatment at a brewery

5.3 Plzensky Prazdroj – Czech Republic

In 2009 SABMiller conducted a second water footprint, examining the beer value chain in the Czech Republic, where SABMiller owns Plzensky Prazdroj, comprising three breweries, two maltings plants and 13 sales and distribution centres. The Czech Republic was selected because it contributes a significant volume to SABMiller's overall European beer volume (20%), its water resources are classified as being under stress, and it is home to the iconic international brand Pilsner Urquell.

A key difference between this and the South Africa study is that a longer time horizon was considered, using three years' data (2006, 2007 and 2008). This strengthened the methodology by allowing for variations in water use and efficiency within the breweries and the supply chain over a longer timeframe, as well as taking into consideration variable meteorological conditions over those years.

The net water footprint calculated for beer production, in 2008, in the Czech Republic is 38 billion litres (excluding grey water), equivalent to 45l of water for every 1l of beer. With the inclusion of grey water the water footprint increases to around 39 billion litres or 46l/l.

As in the South African example, the most significant component of the water footprint is the local crop cultivation which accounts for between 70.6% (2008) and 80% (2007) of the net water footprint. Imported crops account for 24% (2008) of the net water footprint. Therefore crop cultivation (either within the Czech Republic or outside the Czech Republic) accounts for in excess of 90% of the total water footprint.

The net green water component forms by far the largest element of the water footprint, contributing over 90% of the final figure *(see Figure 9 on page 19)*. This is due to the fact that the majority of crops grown are reliant on rainwater as opposed to irrigation. Blue water accounted for 6% of the footprint and is mostly related to water consumed during the brewing and bottling process while grey water only represents 2% of the total and is associated with the crop production phase.

Figure 10 (page 19) also shows that the water footprint for the processing, brewing and bottling and waste disposal elements of the footprint do not vary significantly across the three-year period. However, for the cultivation element of the water footprint the 2006 and 2007 water footprints are significantly greater when compared with 2008.

This is because the cultivation water footprint (in this case, all net green water) is very sensitive to variations in both rainfall and crops yields. The mean annual rainfall for the Czech Republic is 674mm/annum. In 2006 average rainfall was 651mm/annum (3% below average), and in 2007 the average rainfall was 698mm/annum (3.5% above average). However in 2008, the average rainfall was only 604mm (10% below average). While this was lower, the crop yields for both barley and hops increased gradually over the three-year period. For example, barley crop yields increased from 3.72 tonnes per hectare in 2006 to 4.67 tonnes per hectare in 2008, meaning that 2008 had below average rainfall but higher yields, resulting in a lower cultivation water footprint compared to other years. Therefore greater crop yields are considered the dominant factor in net green water footprint variability, as yield per hectare of land was some 30% greater in 2008 than in 2006, despite lower rainfall.

The blue water footprint is relatively constant and varies with the volume of beer produced, as in this case the blue water footprint is effectively the direct abstraction of water associated with beer production, energy for brewing and to distribute and package the beer. The blue water footprint per unit of beer was 2.14, 2.15 and 2.11 for 2006, 2007 and 2008 respectively.

The grey water footprint is more complex and is inversely related to rainfall. That is, the higher the rainfall the lower the footprint. This is because a higher rainfall across the cultivated area acts to dilute the nitrate, phosphorous and potassium from fertiliser applications that impact groundwater and surface water.

5.4 Comparison between the South African and Czech Republic water footprints

The results show that in terms of percentage split of the total water footprint across the four key elements of the beer value chain, the results for South Africa and the Czech Republic are comparable. Both studies show that the crop processing, brewing and bottling and waste elements of the footprint account for a small percentage of the total water footprint, while crop cultivation is in excess of 90% of the footprint.

In terms of absolute numbers, South Africa is more than three times the Czech Republic's footprint.

This is not as a result of any improved efficiencies in beer production in the Czech Republic over South Africa, but rather of the differences related to crop production including:

- The evaporative demand for crops in South Africa is greater than in the Czech Republic due to meteorological conditions.
- There is a considerable reliance on irrigated crops (i.e. a significant added blue water component to crop production).
- Water use per litre beer is much higher for imported crops, due to the countries of origin of these crops, for South Africa at 44l/l beer where as for Czech Republic is 11l/l beer. For the Czech Republic only 5% of total crops used are imported, comprising small quantities of hops and processed malt: with the exception of a small amount of hops imported from the USA, the majority of crops imported for the Czech Republic operations are from Europe. However, for South Africa 31% of total crops are imported with 30% of total barley used in the SAB Ltd maltings being imported from the USA, Argentina and Australia.
- The blue water component of the crop processing stage for the Czech Republic is anticipated to be underestimated due to the lack of 'real' data and the number of assumptions made. This has been identified as an area for follow-up and clarification as part of the project action plans.
- The water footprint/litre beer for packaging is 2l/l for South Africa compared to <1l/l for the Czech Republic operations. For South Africa 91% of all finished product is packed in bottles, however for the Czech Republic only 47% of finished product is packed in bottles. Of all packaging materials used by SABMiller, paper has the highest water footprint at 10 litres per A4 sheet (WFN) and an assumption has been made that each bottle has an associated paper label. Therefore, due to the high 'virtual' water of paper the water footprint of a glass bottle (and associated paper label) is higher compared to other packaging types.

SAB LTD: CALCULATED WATER FOOTPRINT FOR ONE LITRE OF BEER

155 litres

CZECH REPUBLIC: CALCULATED WATER FOOTPRINT FOR ONE LITRE OF BEER

45 litres

South Africa

CASTLE LAGER: South Africa's iconic beer brand.

FIGURE 5: CROP GROWING REGIONS ACROSS SOUTH AFRICA
INSET MAP: ANNUAL RENEWABLE WATER SUPPLY PER PERSON (PROJECTION FOR 2025)

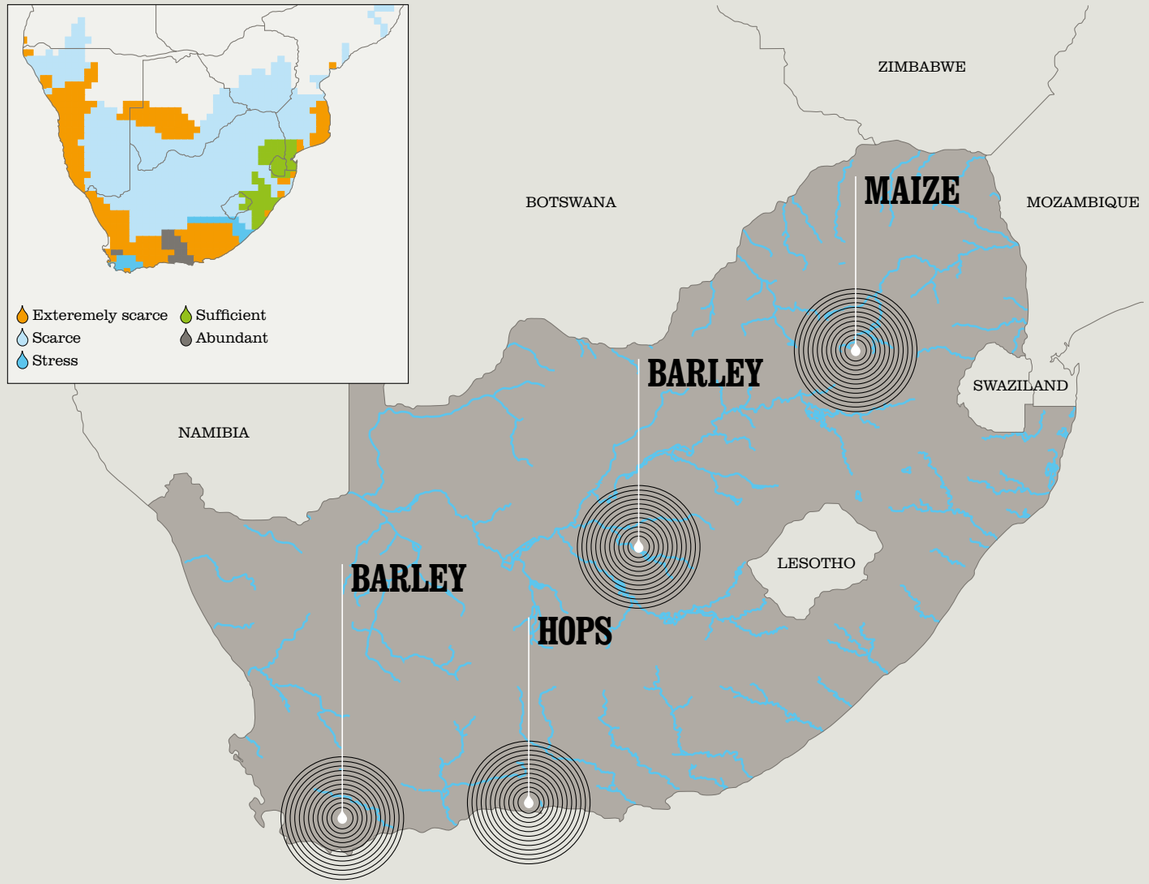


FIGURE 6: WATER USAGE ACROSS THE VALUE CHAIN

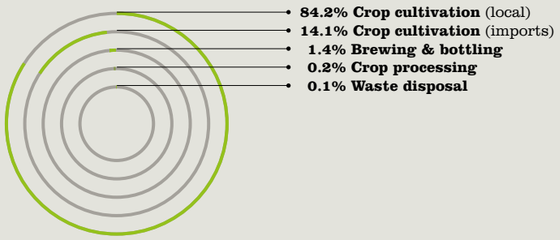
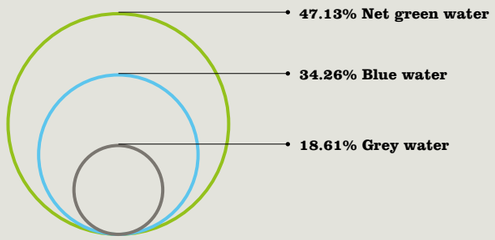


FIGURE 7: SPLIT BETWEEN NET GREEN, BLUE AND GREY WATER FOR SAB LTD



Czech Republic

PILSNER URQUELL: One of SABMiller's four international beer brands.

FIGURE 8: CROP GROWING REGIONS ACROSS THE CZECH REPUBLIC
INSET MAP: ANNUAL RENEWABLE WATER SUPPLY PER PERSON (PROJECTION FOR 2025)

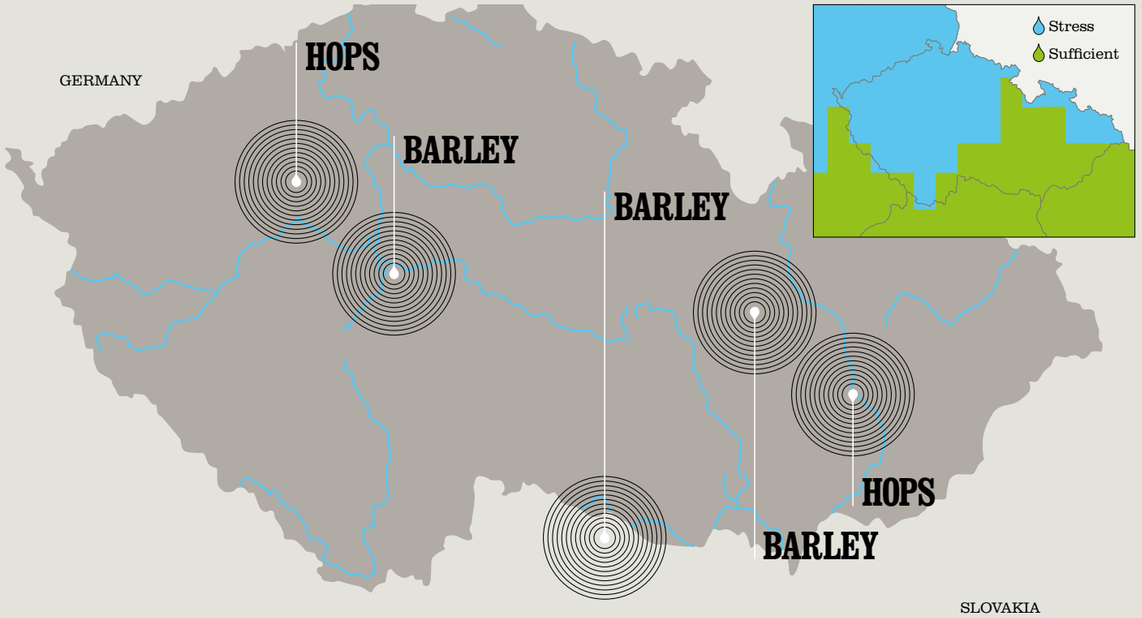


FIGURE 9: SPLIT BETWEEN NET GREEN, BLUE AND GREY WATER, CZECH REPUBLIC 2008

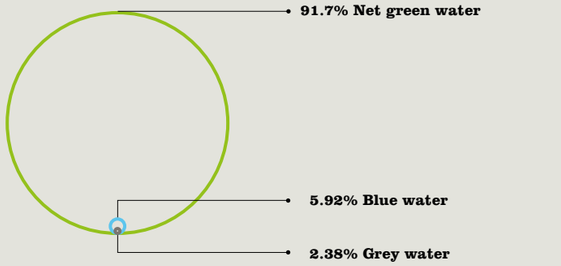
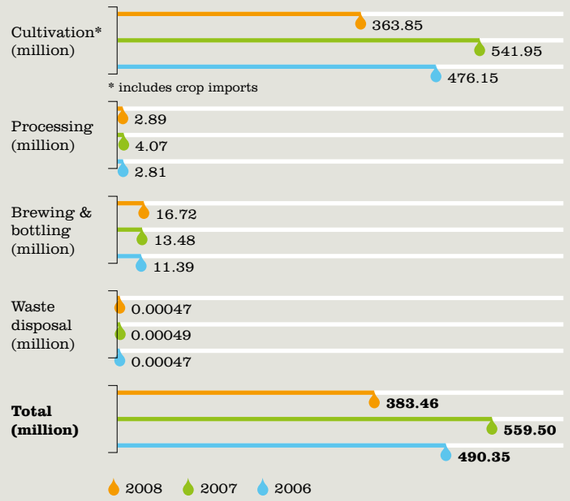
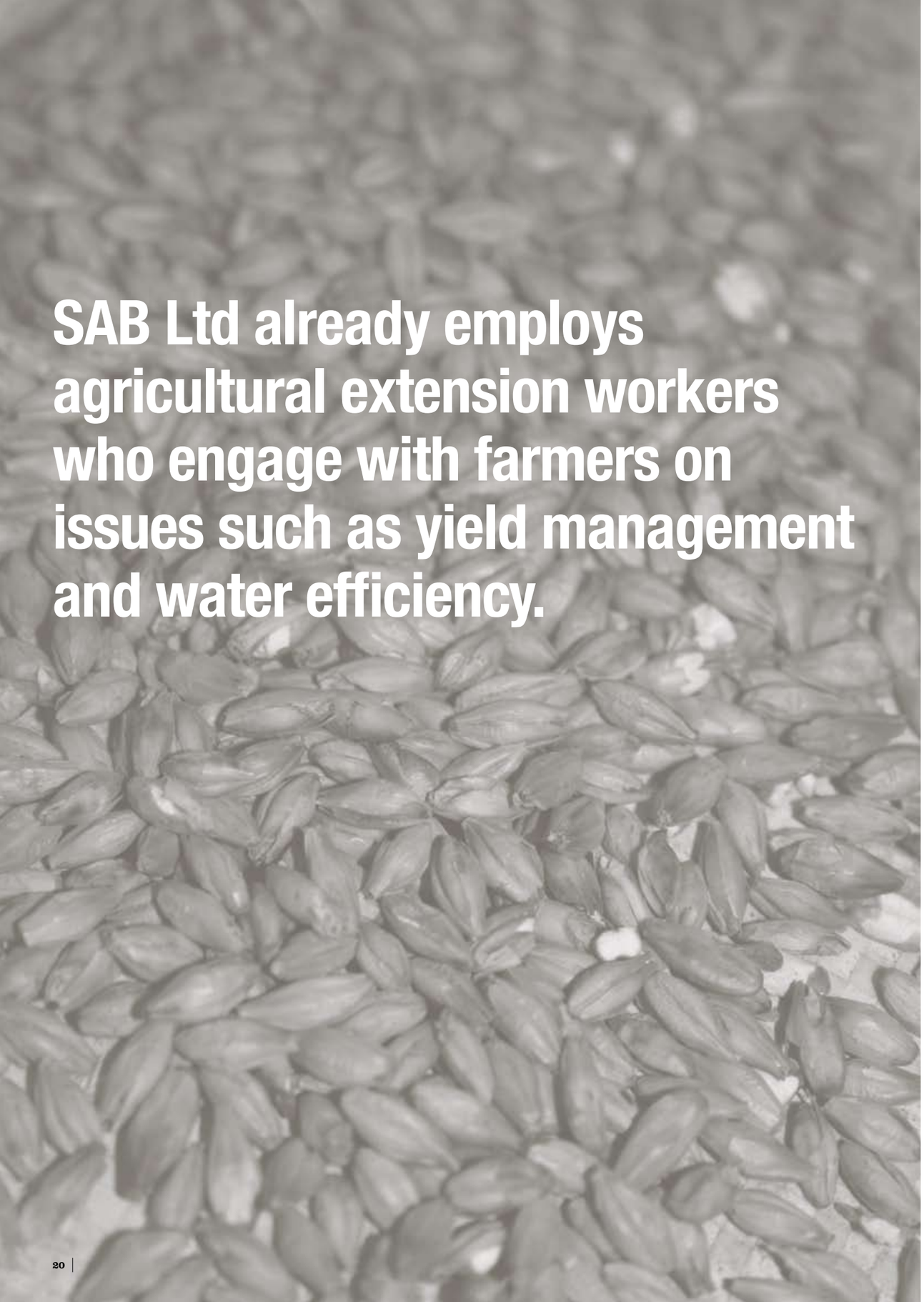


FIGURE 10: NET WATER FOOTPRINTS (HECTOLITRES), CZECH REPUBLIC 2006-2008





6.0 Considering the business implications

TO HELP INTERPRET THE RESULTS OF THE WATER FOOTPRINTS FOR SOUTH AFRICA AND THE CZECH REPUBLIC, FULL-DAY WORKSHOPS WERE HELD IN EACH COUNTRY. THE WORKSHOPS INCLUDED SENIOR MANAGERS FROM THE PROCUREMENT, OPERATIONS AND CORPORATE AFFAIRS FUNCTIONS OF THE LOCAL SUBSIDIARIES, AS WELL AS SENIOR MANAGERS AT THE GLOBAL LEVEL.

Local and global WWF staff also attended, as did other local water policy experts to bring a specific policy context to the conversations and results. The full dataset was shared with all participants to provide a fully transparent process and to ensure that the benefit of the expert views from WWF and others was maximised.

6.1 Local Action Plans

The workshops considered the results of the water footprints in the context of ecological risks and needs, business risks and needs and the broader water policy context. The footprints were used to develop a matrix of water risk for each business covering blue water, green water and grey water, and in response to develop local action plans to mitigate these risks.

SAB Ltd in South Africa is already working with WWF and the South African government's Working for Water Programme to pilot the 'water neutral' concept in two water-scarce regions where it has breweries. The initiative, launched in 2008, is believed to be the world's first fully quantitative water neutral scheme.

The scheme allows SAB Ltd to voluntarily monitor and reduce its operational water consumption and then offset the residual by investing in projects that clear alien vegetation. This in turn releases equivalent volumes of water back into natural aquatic ecosystems.

In terms of agricultural water use, highlighted as the biggest risk area in the South African water footprint, WWF South Africa has an existing project focused on a toolkit for sustainable agriculture practices for sugar cane growth. SAB Ltd is considering whether this toolkit can be tailored to barley farming and what value it would add to pilot this approach with barley farmers. SAB Ltd already employs agricultural extension workers who engage with farmers on issues such as yield management and water efficiency.

In the Czech Republic, SABMiller is considering projects to initiate in order to understand the risk of climate change on water availability and how this may impact crop growth in the future. In addition it is reviewing how legislative risks may impact its crop growing areas, with particular reference to groundwater, nitrate limits, and engaging with suppliers in the process.

The aggregate volumes provided an overall picture of green and blue water used in our value chains and presented a picture of risk and opportunity costs. The South African water footprint in particular highlighted that the crop water use within the context of available resources was the most important element. However, even this number needs to be treated with care, because there is no simple answer to what is an acceptable, →

fair or efficient use of water for a particular purpose. These questions always need to be answered in the context of local economic, social and environmental needs, government priorities, available technologies and the structure of the agriculture industry.

6.2 Water policy

The policy overlay in South Africa was the most telling, and provides a clear example of the benefits of obtaining a clear understanding of the likely risks and opportunities around water use both at facility level and in the broader value chain. Four key policy issues were identified during the course of the South African study and these include:

Water allocation and resource protection
The South African Water Act is perhaps one of the most progressive of its kind, providing specific allocations to protect the ecological integrity of water bodies and ensuring sufficient availability for domestic consumption before industrial water users are allocated water rights.

To manage this process a comprehensive catchment management strategy has been established in the country which governs licensing, water use efficiency and determination of illegal water use.

Water use efficiency
Of particular relevance to the drive for efficiency is the government's drive for geographic-specific, water conservation/demand management. The result of this is that there is a high likelihood of licensing and allocation being based on water use efficiency and a more focused look at water reuse and recycling.

Water use licensing and enforcement
This relates to where water rights/licenses are withheld for certain types of activity considered to have a detrimental impact on water resources and the monitoring and enforcement of these directives. An important impact of this is the move towards reducing the amount of water available to agriculture for example, in favour of other water users.

Economic instruments and pricing
Finally the use of economic instruments to manage water will become more apparent in the future. This will include full cost pricing in relation to water infrastructure development, water charges related to efficiency of use of the resource and reviewing the structure of the polluter pays principle insofar as waste discharges are concerned.

These elements of water policy can potentially significantly impact on the management and utilisation of water resources. By having a firm grasp on the relevant policy frameworks, local managers are able to make informed investment decisions.

Malted barley, a key ingredient in the brewing process

6.3 Business value of water footprinting

For SABMiller, water footprinting informs three important areas relating to business planning and decision making. First, it provides a good overview of the water use in the value chain. It answers the important question of how much water is being used and the physical locality of the water use.

Second, it provides the strategic information required to assess the risk associated with the water use. Risk in this context refers not only to physical availability but also, importantly, to regulatory risk such as future allocation and pricing. This information allows SABMiller not only to inform own operations' business models but predict its likely its impacts on its supply chain.

Finally it equips senior managers with a knowledge set that enables them to access the broader issues around water management. This equips them to engage proactively with stakeholders and establish partnerships, where necessary, to address problems outside of SABMiller's breweries that are likely ultimately to provide benefits for its operations.

7.0 The future for water footprints

WATER FOOTPRINT METHODS ARE EVOLVING RAPIDLY, AND NUMEROUS COUNTRY, PRODUCT AND BUSINESS STUDIES ARE PUSHING THE METHODS TOWARDS AGREED AND HARMONISED ACCOUNTING. THE WATER FOOTPRINT NETWORK IS STEERING THESE ACTIVITIES AND HAS STRONG PARTNER AND EXTERNAL SUPPORT FOR ITS WORK.

7.1 Methodology improvement

The two studies highlighted a number of areas where the water footprinting methodology needs to be improved.

Grey water
Both studies highlighted the weak point of how the grey water footprint is translated into clear business risk. Its inclusion in the footprint is important in accounting for the impact of pollution on freshwater resources – with the water footprint methodology defining it as 'the volume of polluted water associated with the production of goods and services, quantified as the volume of water that is required to dilute pollutants to such an extent that the quality of the ambient water remains above agreed water quality standards.'

There are two main issues relating to the inclusion of grey water:

- the current methodology does not fully account for the environment's ability to assimilate a certain quantity of pollution and
- there are certain areas of the value chain, e.g. crop production, where it is extremely difficult to obtain actual quantitative data on wastewater. This is due to the fact that there is a wide range of variability that can occur at field level which, depending on environmental and soil factors, can yield significantly different results even within the same field.

As such WWF and SABMiller are committed to working within the WFN to help share experiences and learning, in order to help define the scope of the grey water element. This will help to make it both meaningful and accurate to a degree that action plans can be put in place, where necessary, to address the issue.

Green vs. net green water
In this study, green water has been disaggregated to 'net' green water. The green water component is effectively the evaporative loss of rainwater taken into crop roots through soil moisture. Although the growth of crops increases evaporation, there would remain a substantial evaporative demand from the land were the crops not cultivated, for example through naturally occurring vegetation. A 'net' green water footprint is defined as the difference between the crop evaporation and the natural evaporation, providing a more meaningful result for companies such as SABMiller. However, it does pose new questions which this study was unable to answer. For example, if the naturally occurring vegetation has a higher evaporative demand than the crops planted, does this in effect provide a water negative input into the overall water footprint? Again, these are issues to be decided within technical discussions with partners and the WFN.

7.2 Impact analysis

While a great deal of work is currently underway to incorporate impact categories and mapping into the water footprint analysis, the existing methodology gives little provision for guidance on analysing the impacts of water usage in the value chain. Unlike carbon footprinting, where the size of the carbon footprint is a critical element in determining impact, the critical element of a water footprint is in the detail of where water is used in relation to local →

In terms of water footprinting and the consumer interface, water footprinting is a useful tool to build awareness around the water used in the value chain to produce the products we consume.

pressures and scarcity. As we have discussed before, water presents some unique challenges in this regard, and the complexity of attributing impact to individual users is not straight forward. The local nature of water also places the water footprint in extremely diverse contexts, making impact assessments difficult. For now, it is useful for companies to use risk maps for the value chain to assess where the footprint 'lands' in relation to scarcity issues on the ground. Other maps could also be overlaid with the analysis depending on the local water-related issues and potential risks to the user.

Through both case studies, SABMiller was able to gain important insights into the long-term sustainability of water supply at facility level but also of potential impacts along its agricultural supply chain. The latter provided the details for the company to establish detailed, prioritised action plans going forward as opposed to the stand-alone footprint number.

7.3 Looking to the future

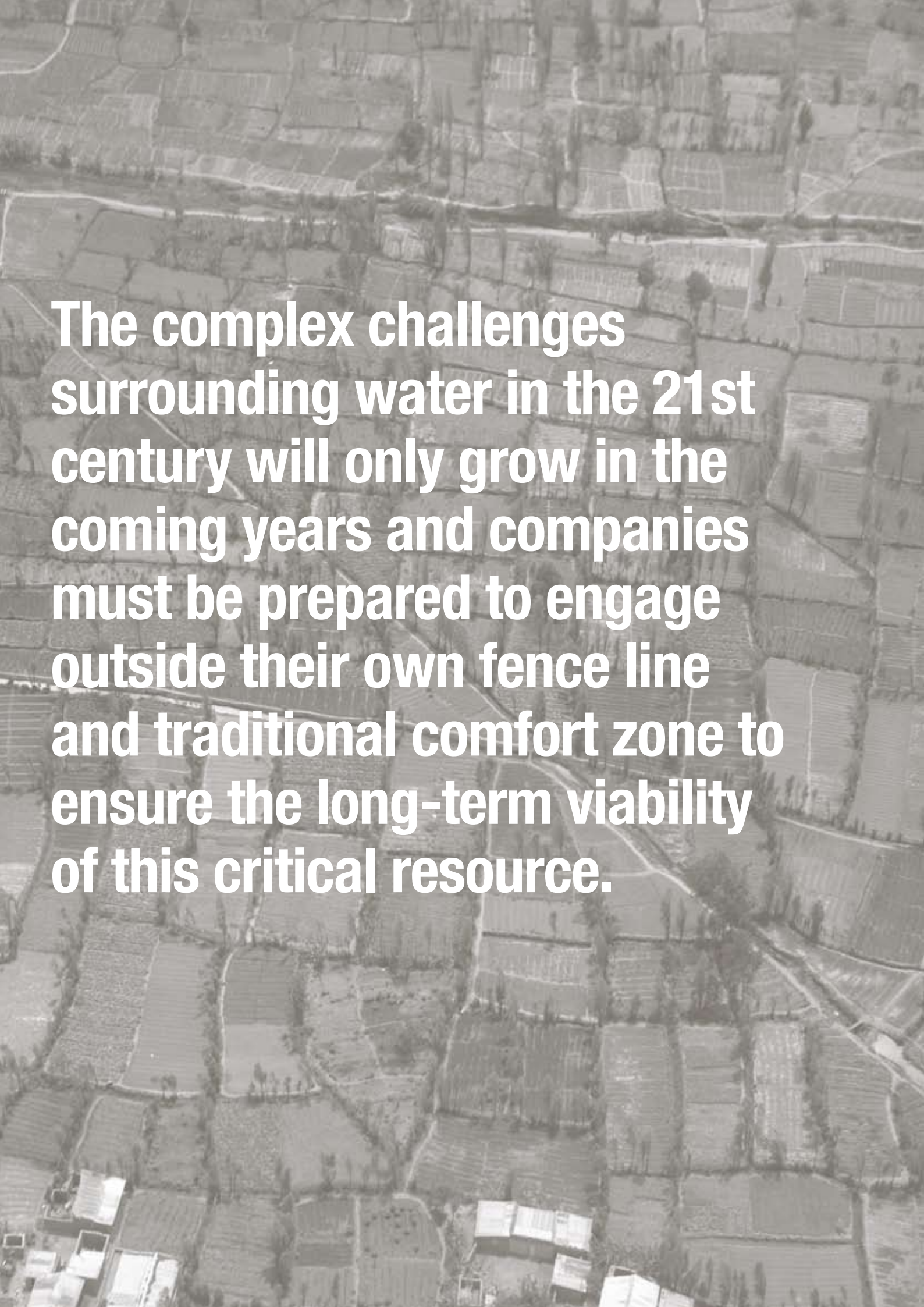
Advocacy for water footprints will continue, and more people will be made aware of the complex and significant role of water in our lives and economies. For WWF and SABMiller, this work is the bedrock on which meaningful actions are taken. 'Measure to manage' is a phrase that businesses know well, and with agreed and tested methods there is a chance to build strong standards for water users, to define meaningful interventions to address water footprints and risk, and to do so in a coordinated fashion.

Indeed there are already robust discussions about what water disclosure for companies will look like, and there is broad agreement that water footprint assessment, the volumes of direct water use and most importantly the impacts of water use will play a large role in this. New tools for assessing water footprints are being developed within the WFN, giving any water user a chance to estimate supply chain and operational volumes, impacts and risks. Further research is underway within academic institutions and businesses to advance the water footprint methods. If the confusion that gripped the carbon footprint debate with numerous accounting methods and unilateral activities is to be avoided, future work must be shared and debated under the umbrella of the WFN.

Barley crops nearing the point of harvest

In terms of water footprinting and the consumer interface, water footprinting is a useful tool to build awareness around the water used in the value chain to produce the products we consume. However, the use of consumer labelling at this point of the methodology's evolution will be at best counterproductive and at worst misleading. This is due to the underlying complexity of determining a company's water footprint and the level of detail that lies behind the number, in terms of local environmental, economic and social impacts.

The business future around water hinges on an ability to understand, measure and engage. The complex challenges surrounding water in the 21st century will only grow in the coming years and companies must be prepared to engage outside their own fence line and traditional comfort zone to ensure the long-term viability of this critical resource.



The complex challenges surrounding water in the 21st century will only grow in the coming years and companies must be prepared to engage outside their own fence line and traditional comfort zone to ensure the long-term viability of this critical resource.

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