WATER FOOTPRINTS FOR INDUSTRY IN SOUTH AFRICA

Volume II
Policy and Regulations

Traci Reddy, Mao Amis, Hannah Baleta & Guy Pegram

WATER RESEARCH COMMISSION
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Water Footprints for Industry in South Africa

Volume II
Policy and Regulations

Report to the
Water Research Commission

by

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This report forms part of a series of three reports. The other reports are:

Water Footprints for Industry in South Africa. Volume I: Literature Review: Applicability of Water Footprints in South Africa. (WRC Report No. TT 616/14);
Water Footprints for Industry in South Africa. Volume III: Lessons from Industry Case Studies. (WRC Report No. TT 618/14).

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EXECUTIVE SUMMARY

In South Africa and other water-scarce countries, tools which can inform efficiency and raise awareness and create dialogue with people not previously involved in water debates are potentially very useful. Water footprints have the potential to contribute in this way, bringing new and important decision-makers into the water debate in a way that is intuitive and cuts across sectors. Additionally, water footprints create an opportunity for companies to join a global process of disclosure, understand risk and integrate an understanding of water into planning decisions. With this potential, the concept of water footprint has gained significant traction in the past 10 years in the private and public spheres across a variety of sectors. However, water footprint as a tool is still developing and many conceptual and methodological questions remain.

To explore the applicability of water footprints in South Africa, the Water Research Commission has commissioned this project (number K5/2099). The purpose of the project is to understand how water footprints may contribute to sustainable management of water in South Africa primarily in the industrial sector, and to explore linkages between water and energy and the concept of water offsetting.

Several reports have been submitted as part of the study. This final deliverable summarises the work carried out to date and highlights the key learning points to be taken away. The final deliverable has been split into three focussed volumes:

- ***Volume I:*** Literature Review
  This volume explores the international experience with water footprints and linkages to carbon footprints and offsetting has been completed as the first deliverable and helped in scoping the project and highlighting key issues which should be addressed.

- ***Volume II:*** Policy and Regulation
  This volume places the water footprinting tool in context with various other water resource management strategies, policies and tools.

- ***Volume III***: Key insights from South African Case Studies
  This volume summarises the key learnings from the South African case studies and makes recommendations for the applicability of water footprinting for the corporate sector.

Presented below is a summary of the findings of each volume:

VOLUME I: LITERATURE REVIEW

The literature review documents the international experience and methods for water footprint, and explores linkages with carbon, energy and offsetting. It also summarises the purposes for which

water footprints are being explored in the industrial sector, and highlights questions that must be addressed to use water footprint as a reliable and meaningful indicator.

Water Footprint Methodology and Case Studies

A water footprint is an indicator of freshwater use that considers the direct and indirect water required to produce a product, measured over the full supply chain. A water footprint also considers the origin of the water used, and considers both water quantity and water quality impacts by differentiating between blue-, green- and greywater. The Water Footprint Assessment Manual provides the basic and commonly used water footprint methodology. However, alternative methodologies, such as the life cycle assessment approach which would assign a weighting factor based on water scarcity, are being explored.

Water footprint studies have been completed for a variety of entities, including countries, products, commodities and river basins. The country and river basin footprints focus on informing policy, whereas the product and commodity water footprints focus on understanding supply chain risks. Different potential uses and challenges exist for each type of study.

- ***Country*** – The first water footprint studies focussed on illustrating water flows between countries through trade of industrial and agricultural products. These studies are useful in illustrating virtual water flows into and out of countries. However, the local context of water use must be included to understand the impacts, and challenges arise in framing the water footprint as only one of many environmental, social and economic indicators that must be considered in the context of trade.

- ***Basin*** – Basin-level water footprints have gained focus in recent years, and have been completed for basins including the Nile Basin, the Breede-Overberg River Basin, and several river basins in Spain. Basin water footprints are largely directed to the public sector, with the intent to foster strategic dialogue, inform sector policy and development planning, or inform water allocation. It has, however, proven difficult to sufficiently contextualise the water footprint and to integrate a water footprint with the wide spectrum of public interests or the complex political decision-making processes. Basin-level water footprints have been a useful communication tool for fostering dialogue between diverse sectors.

- ***Product*** – Following country-level water footprints, companies began using water footprints to help understand the footprint of products such as a bottle of Coca-Cola or a cosmetics product. The international review shows that water footprint has different levels of traction for different industries. The food and beverage and textiles sectors are most active with water footprint, as the tool helps to understand significant upstream supply chain risks. Consumer products and the cosmetics, which have significant downstream water implications, are increasingly becoming interested. The chemicals and mining industries have been least active with water footprints. In the studies completed, water footprint is perceived as being useful for understanding supply chain water risk, and for benchmarking and communication. However, there is concern as to whether the greywater footprint is an appropriate representation of water quality. Additionally, understanding the local context

of water use, as well as the social, economic and environmental considerations, is critical and difficult task.

- ***Commodity*** – Water footprints have also been studied for global commodities and markets, such as wheat, cotton or biofuels. Commodity water footprints are useful for illustrating virtual water flows through trade between countries, and can help companies understand supply chain risks and make informed decisions. Additionally, commodity water footprints can create transparency and provide information which allows the public to hold companies accountable for supply chain decisions. Again, understanding the local context, including economic and social factors, is critical to understand impacts.

Key Uses and Challenges in the Private Sector

As this project is focussed on the applicability of water footprint to the industrial sector, it is important to understand the key potential uses of water footprint in the private sector and how they may apply in South Africa. Three broad purposes emerge, each having a different level of complexity:

- ***Disclosure and Reporting*** – Using a water footprint as a disclosure and reporting tool, similar to a carbon footprint, is the simplest use of a water footprint because it does not require a full understanding of impacts. The volume of water use is sufficient, without the context of that water use. Water footprint as a disclosure and reporting mechanism is valuable because it presents a more complete picture by considering water use in the supply chain, in addition to direct water use. Reporting can also be used in benchmarking and measuring progress.

- ***Risk Filter*** – Water footprints may be used as a risk filter by understanding supply chain dependencies, and the origin of water used in the supply chain. Using a water footprint as a risk filter is more complex because the impact of water use and the local context of water use must be better understood.

- ***Planning and Decision-Making*** – Water footprints may be able to inform planning, such as decisions regarding where to source supplies or where to build a new manufacturing facility. This is the most complex potential use of water footprints as it requires a full understanding of the environmental, economic and social impacts of a water footprint, and an understanding of opportunity costs and trade-offs.

While water footprints have significant potential to contribute to corporate water management and to integrate water into decision-making, significant questions must still be addressed in order for water footprints to be a reliable and meaningful indicator. Key questions include:

- ***Understanding Impact*** – A water footprint must be rooted in a local context and its local impact understood in order for the water footprint to inform decisions. A meaningful approach to understand impact has not yet been developed, and is a key challenge for the applicability of water footprint.

- ***Water Quality*** – Significant question exists regarding whether representing water quality as a volume of water is meaningful or appropriate. The nature of the water quality impact is lost, as is information which could inform potential responses. Based on the experiences of companies which have explored the use of the greywater component of the footprint, it must be further developed or reconsidered to be useful.

- ***Integrating Complexity and Nuance*** – A water footprint is a number which represents a single consideration. However, the decisions a water footprint is meant to inform are extremely complex and must consider a range of economic, social and environmental considerations. In order for a water footprint to play a role in complex decisions, it must be integrated with the broader context and linked with other considerations.

Offsetting, Carbon and Energy

The differing nature of carbon and water introduces complexities when exploring the potential of water offsetting. Most importantly, it is assumed that carbon emissions have a global impact and may be offset at a global level. Conversely, water is a local resource and must be offset at the local level. Thus, any offsetting effort must track the geographical location of water use through the supply chain and to a point of sale, and must offset in the same geographical location as water use.

While a few water offsetting projects have been initiated, they are still in exploratory stages and many questions arise in these projects. For example, how can geographically-specific offsetting be facilitated, what measures or technologies will be used for offsetting, and what will be the benefit of offsetting? On this last question, a company may offset for good corporate stewardship, or may seek a regulatory benefit such as higher-priority access to water in times of drought.

Finally, water and energy are linked as each is required to provide the other. Additionally, there are often trade-offs between water and energy, where becoming more efficient with one leads to less efficient use of the other. As carbon footprints can represent implications of energy use, carbon footprints and water footprints may be helpful in illustrating and clarifying the connection between water and energy, and understanding trade-offs.

The key potential uses and questions regarding water footprints and offsetting as they apply to the South African industrial sector are framed in this review. A series of case studies on South African companies will be completed to understand the potential of water footprint to contribute to sustainable water resources management and to explore the challenges and questions that must be addressed for water footprints to be a meaningful tool in South Africa. This is further elaborated in Volume II and Volume III.

VOLUME II: POLICY AND REGULATION

Water accounting is a field which has grown considerably in the past few years. Water accounting is carried out by corporates to identify and reduce water-related business risk (and therefore seize opportunities), whether through building competitive advantage, ensuring long-term operational viability, or maintaining and/or improving social license to operate. Water footprinting has been

used as one tool through which corporates are able to understand where the majority of their water use (including embedded water use) is situated. Since the development of water footprinting as a water accounting tool, a number of additional tools have been developed which further contribute to a wider understanding of water risks within the context of a particular catchment for example. Water risk tools may have a number of functions which include assessment, disclosure or response to particular water risk concerns. Risk tools may also be focussed internally on corporate concerns, or may have a 'government view' to support regulation. Tools may also play a self-regulatory role when the information is disclosed to competitive for example. This study investigated the applicability of using water footprinting as an accounting method through which water offsetting and neutrality could be achieved.

In response to water-related risks, companies may carry out water offsetting, to negate the impacts of damages done through production. In the case of water, this is further complicated by the spatial and temporal nature of water, which is localised. Offsetting may be required through regulation, or it may be carried out through a form of self-regulation whereby companies try to distinguish themselves from their competitors. Although water offsetting is particularly complex, there are a number of regulatory, social, environmental and business benefits which accrue from carrying out water offsetting. Water offsetting is extensively used to meet a level of water neutrality. Water accounting is required to ensure that the offsetting of water use has been carried out as claimed. Water footprint, as a form of water accounting however, is not the most relevant tool to use. In agriculture for example, the variable water footprints of crops across seasons and regions is too variable to be of use as an exact accounting method.

Water neutrality may be carried out through the use of market mechanisms to offset water use in one region through the investment in water saving or quality improvement in another (nearby) region. This becomes complex however through the recognition of water as a public good, and therefore the commodification of the resource needs to be managed in order to ensure social and environmental requirements are still met. A number of trading mechanisms including payment for ecosystem services, cap and trade and water banking exist through case studies globally. The water offsetting which needs to take place or order to meet neutrality needs to be accounted for. As mentioned previously, water footprint alone cannot be used to determine the volumes of water saved through offsetting measures. Although water footprinting can be used, the footprint needs to be repeated at a number of intervals to gauge the change spatially and temporally.

Therefore, the application of water footprinting to the regulation of water accounting and neutrality is not suggested. Water footprinting is seen as one of many potential alternatives through which water accounting may take place. The decision regarding which tool to use is dependent on the context of the water offset. The National Water Resources Strategy (NWRS, 2013) makes mention of the potential for water offsetting to meet neutrality within stressed catchments. However, further investigation is required regarding which accounting mechanisms are best suited to ensure water offsetting is correctly measured.

VOLUME III: KEY INSIGHTS FROM SOUTH AFRICAN CASE STUDIES

The water risks facing private business are growing as the resource becomes increasingly stressed worldwide. Risks include changing water rights, "increasingly stringent water quality regulations, growing community interest and public scrutiny of water-related activities". Business operations are reliant on "healthy water management systems, coherent policies that govern water use, and functioning ecosystems to access water and avoid risk". Internal measures to manage water risks alone (i.e. efforts to reduce water footprints within a company's direct operation and supply chain) cannot eliminate exposure to water risk and uncertainty about water supply. In response to these increasing risks, some businesses have begun to take more "proactive and comprehensive strategic water management actions" and in some cases, reporting these actions to stakeholders and the public.

A range of case studies were conducted to understand the applicability of water footprinting to different sectors using different lenses. The sectors most important to address in case studies include those which are significant water users, have significant water quality implications, and are important to the South African economy. These sectors include:

- ***Agriculture*** – The agricultural sector is the most intensive water user in South Africa in terms of water abstraction and its water footprint. The agricultural sector also plays an important role in the economy by providing rural employment and underpinning much of the economy. The footprint, and the economic and social implications will be important to understand.

- ***Manufacturing*** – The manufacturing sector is the second largest economic sector and has important blue and greywater implications.

- ***Electricity, gas and water*** – Electricity, gas and water underpin the rest of the economy, and have important blue and greywater implications. Additionally, the electricity sector offers an opportunity to consider trade-offs between water and energy.

- ***Mining*** – The mining sector is an important economic contributor and has significant water quality implications, for example in the Vaal River system. The greywater footprint with mining will thus be particularly important, and offers an opportunity to consider whether a greywater footprint is an appropriate representation of water quality.

- ***Wholesale and retail*** – Wholesale and retail plays an important role in the economy, including its role in imports and exports. This sector has little direct water use, but is heavily connected to its upstream water footprint for the production of goods and its downstream water footprint from the use of its products. Understanding water risks or opportunities in the supply chain can potentially offer important insights.

Steps to Designing Case Studies

According to the Water Footprint Assessment Manual, a water footprint has the 4 steps shown in the figure below. While these steps provide good guidance for a typical water footprint study, the design of case studies here will diverge slightly from these steps to reflect the project's primary objectives and to stay within the scope of the project.

Purpose

The first step is to identify the purpose or the goal of the water footprint study, as the purpose will determine the scope and methodology of the footprint study.

The 3 potential uses of water footprint which have been discussed are: (1) Reporting and disclosure or internal benchmarking, (2) Understanding supply chain risks or marketing, and (3) Planning and decision-making. Most uses will fall into one of these broad categories. For example, determining the water footprint of upstream supply versus operational processes speaks to understanding supply chain risks, and can be used to determine where to focus water-related efforts to reduce risks.

Identifying the purpose will guide how broad or narrow to make the study, whether to focus on the company or a specific product, and whether to focus on upstream, operational or the downstream footprint.

Scope

Scoping is important to determine the bounds of the study, and to create a study which leads to the intended outcome within the available timeframe and using available resources. The scoping steps should address the following:

- Whether the study will focus on a ***facility, product or company.***
- Whether the ***upstream, operational or downstream*** water footprint will be the area of focus, or whether all three will be analysed.
- Where to ***truncate the supply chain***, such as whether to consider the footprint of transportation and distribution, or downstream use and disposal of a product.
- Whether the study will look only at goods made with ***local*** raw materials, or whether ***imports*** will also be considered. This is important when considering availability and reliability of data.
- Whether the study will include a ***blue-, green- and grey*****water** footprint, or whether it will focus on one or two types.

The scoping step would normally include whether the study will look at the footprint from a consumption or production perspective. However, the industry focus of this project naturally lends

itself toward a production-based approach. A consumption-based approach would be more relevant when determining the footprint of a group of consumers, such as people within a nation.

Methodology for accounting

The starting point for methodology will in most cases be that described in detail in the Water Footprint Assessment Manual. The Manual describes an approach to calculating a blue- , green- and greywater footprint for the following:

- Crop
- Animal product
- Manufactured product
- Commodity
- Consumer or group of consumers
- Nation.

For the purposes of the case studies below, the methodologies for crops, animal products, manufactured products and commodities were most relevant.

Questions or Issues to Explore

Questions or issues to explore refers to the methodological and contextual questions which have arisen from the Literature Review and discussion above, such as whether the grey footprint is a good representation of water quality.

In a normal water footprint study, these kinds of questions do not need to be addressed and this step can be left out, unless it is the purpose of the study to do so. These kinds of questions are included in the case study descriptions below because this WRC project is intended to explore water footprint questions through the process of completing case studies.

Sustainability Assessment and Response

The Water Footprint Assessment Manual approach to a water footprint includes a sustainability assessment to understand the environmental, social and economic sustainability of a water footprint. It also includes formulation of a response strategy, which indicates the action that should be taken if a footprint is not deemed sustainable.

These steps will not be comprehensively addressed in the case studies below, as they are in the early stages of development, and are outside the scope of this project. The case studies will, however, summarise the list of responses which have been proposed and may be applicable to the product or industry of analysis.

Using the above design process, the water footprinting tool was applied to the following case studies:

- ☑ Irrigated carrots from the Ceres area, to represent a local irrigated crop
- ☑ Imported beans from Kenya, to represent an imported crop

- ☑ Cheese production in the Western Cape, to represent a livestock-based product with an operational water footprint component
- ☑ Dishwashing detergent produced in Johannesburg, to represent a consumer good with an operational and a downstream water footprint component
- ☑ Manufactured fruit concentrate, to compare the water footprint associated with the growth and processing of different fruits. A comparison was also made between fruits sourced locally and those that are imported.
- ☑ Extraction of coal from a mine, to represent the extractives industry and explore the greywater footprint
- ☑ Combustion of coal to represent the power generation industry
- ☑ Manufacture of products from a chemical facility in the Vaal to highlight the complexities of a large scale chemical plant

Key insights from case studies

Whilst the case studies go into detail about the study itself, the overall learnings are captured below:

Water footprint assessments have rapidly evolved, with several companies and countries having undertaken water footprint assessment. In South Africa, it's mostly large companies with global links that have undertaken water footprint assessment. This could be attributed to the fact that there are still many issues that act as a barrier to the effective uptake of water footprint in South Africa. Some the challenges are related to the following issues broadly:

Institutional, regulatory and policy implications

- The South African water policy does not include the water footprint assessment and its potential for use by large water users. This lack of clarity in the policy framework has created uncertainties in how business should interpret the results of water footprint assessments and its implications on their water use.
- Water footprint assessment methodology places a lot of emphasis on the hydrological aspect, which is a hindrance to effective integration into policy. This is because water footprint assessments are very complex and they are more effective in being used as a metaphor than a metric. There is a need to incorporate economic and ecological aspects of water footprint, to move into a more holistic goal of sustainable development.
- There are different players in the water footprint field, which complicates the issues because of differences in methodological approach (ISO vs WFN). There is need to develop closer alignment of the different initiatives being implemented and align with global processes.
- In many cases there are no clear regulatory framework for disclosure and the reporting of water footprint assessment outcomes, In addition there is no clarity on the application of water footprint tools, for example a company that has undertaken an operational water

footprint might report this as their sole water footprint, even though it does not include their supply chains. Due to the disparity in the application of the water footprint concept, there is a need to agree on an industry wide approach on the application of water footprint approaches. This is partly linked to the fact that some elements of the water footprint such as greenwater are not applicable to some sectors, especially those with no links to agricultural supply chains. For example, for the industrial sector, grey- and bluewater footprints are more pertinent than bluewater footprints.

- Water footprint is a very attractive concept, but it needs to be understood within a specific context. For example labelling of goods and services based on their water footprint can be misleading, because it does not give the full picture.
- Related to water use, companies need to specifically relate their water use efficiency in their annual report. The argument here is that water is at the core of the economy and sustainability, and the private sector particularly large water users have a massive impact on this precise resource. By pushing large water users to be transparent, a culture of responsible water use will be fostered.
- There is a need to mainstream water footprint assessments as water resource management tool to enable ease of their application. This is specifically related to the ease of accessing data that is required for water footprint sustainability assessment, which is mostly held by the biodiversity conservation sector. However due to the fact that water footprint has still not been mainstreamed effectively as a management tool, this information is not readily available for application in water footprint assessments.
- Water footprint tools are more suitable as a metaphor than a metric.
- There is a need to push for voluntary disclosure by companies on their water use to aid uptake of water footprint as a management tool.

Methodology

- The natural assimilative capacity of the environment is not accounted for in greywater footprint assessments, as result estimates of the greywater footprint are not very accurate in many cases.
- Difficult of greywater assessment is partly attributed to the variation in water quality standards and therefore there is a need to standardize accounting framework for greywater. Furthermore, greywater footprint for extractives is not well developed and needs further investigation.
- It is important to note that the greywater footprint is different to that of the blue- and green-, both in calculation and cannot simply be equated. The blue-and greenwater footprints represent volume, whereas the greywater footprint represents impact.

Data and assessment

- Successful application of water footprint tools requires that key decision makers related to water use in the company are involved from the onset. This helps to clarify the purpose of the assessment and to get a high level buy-in from key stakeholders in the company, because outcomes of a water footprint assessment might require a fundamental change in water use by the company.
- Data usage for all stages of the water footprint assessments need to be standardized, to ensure that the same national datasets are used when carrying out water footprint assessment. However, business should not hesitate to undertake a high level assessment if the very fine scale data is not readily availability. The insights gained from such high level assessments are still quite invaluable.
- Water footprint assessments can be very complicated, it is therefore advisable for a company seeking to undertake an assessment to involve expert practitioners to help guide the process to avoid any potential pitfalls.
- Consideration of the contextual issues such as the social, environmental and political dynamics at the point of water use is critical for understanding impact. This is especially pertinent for South Africa, where issues of readdress to water access need to be considered, and the fact that water resources are unevenly distributed, as a result the impact of water abstraction is dependent on when and where the water was abstracted.

Greenwater: gross versus net

- The issue here is the difference between natural evaporative demand and evaporative demand of a specific crop. For example if the natural evaporation of natural vegetation exceeds that of a crop, does it imply that the crop has a negative evaporative demand (water saver) compared to the natural vegetation? This poses a major challenge in the interpretation of water footprint assessment.

Impact analysis

- Current methodology for water footprint assessment does not consider the impact of water use in the value chain.
- The local nature of water makes it difficult to effectively understand the impact of water use on local water resources at the watershed level. The use of risk maps so far is the most effective way for assessing where the impact of water use lay in the value chain.
- To effectively understand impact requires the disaggregation of water footprint components. This implies that the interpretation of water footprint is more complex than carbon footprint.

Weighted water footprint

Weighted water footprint assessments have been proposed to reduce the complexity associated with water footprint assessment, but they have major shortfalls as outlined below:

- The use of weighted water footprint was an attempt to reduce and understand this complexity to ensure harmonization across geographic and sectoral boundaries, for effective communication.
- Even though WF assessment approach ensures that the key elements can be disaggregated (e.g. blue, grey, green, direct & indirect), using a weighting approach that produces a single volumetric figure to assess impact on water resources can be misleading.
- Weighted indicators are difficult to predict for non-physical parameters such as socio-economic and political issues, and opportunity cost of water use. As a result weighting can only be undertaken in a qualitative manner, which is subjective.

Overall, it can be concluded that water footprinting is indeed a useful tool that companies can use as a first estimation of their water use and impact. The major pitfall is the lack of consensus on the use and reporting of the water footprint studies. Companies need to be careful on the reporting of water footprints based just on the numbers, especially for areas that are not well understood and even more critical, on misrepresenting the numbers to suit their outcomes.

Furthermore, the study showed the water footprint data and knowledge base for industries is not well developed, and more work is required to gain confidence in the tool. Going forward, a standardised guide on the use of the water footprint and its application needs to be developed. A starting point would be the updated report that will be released later this year by the Water Footprint Network.

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LIST OF ABBREVIATIONS

CMA	Catchment Management Agencies
CMS	Catchment Management Strategies
CSR	Corporate Social Responsibility
ESG	environmental, and social and governance
GE	General Electric
GS	Goldman Sachs
JSE	Johannesburg Stock Exchange
LCA	Lifecycle Assessment
NWA	National Water Act
NWRS	National Water Resources Strategy
PES	Payment for ecosystem services
RDM	Resource Directed Measures
SDM	Source Directed Measures
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
WDCS	Waste Discharge Charge Systemwap
WAP	Water Allocation Plan
WF	Water Footprint
WFN	Water Footprint Network
WRC	Water Research Commission
WSA	Water Services Act.
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

1. INTRODUCTION

Water risks pose a major threat to the economy of South Africa, potentially affecting all sectors, ranging from the industrial, domestic and ecosystem water users. As a result there is a concerted effort to mitigate these risks, with numerous tools and approaches having been developed. Water footprint assessment tools are one of these approaches that have become increasingly popular in helping to understand the impact of water use and how sustainability considerations can be taken into account.

In South Africa several large water users have voluntarily assessed their water footprint and are exploring measures to mitigate their negative water footprint on the shared water resources. Most of the water footprint assessment has however been limited to specific sectors such as beverage companies, manufacturing and retail. The uptake of water footprint in the industrial sector in South Africa is still very limited, partly because of the nature of water use in this sector, which differs from other sectors that have a strong link to agricultural supply chains, where water footprint tools have been pioneered. It was for this reason that the Water Research Commission (WRC) initiated this project to explore the potential of adapting water footprint assessment for the industrial sector in South Africa.

Companies may undertake water footprint assessment for three main reasons namely, i) the recognition that water poses a major business risk, and therefore a need to develop appropriate corporate strategy (corporate view), ii) due to external drivers such as investors and consumers asking questions, companies have been forced to disclose information on their water related risks and the mitigation measures being implemented (self-regulation), and iii) companies are required to comply with water management regulations, which may include the implementation of specific water efficiency measures across their value chains (government view).

Following the conceptualisation of the different functions of a water footprint analysis, the applicability of water footprinting in offsetting or water neutrality is explored. The purpose of the water footprint study is to scope the key industrial sectors where water accounting, water footprints and water neutrality would make the largest impact as a management support tool for government and the private sector.

In the following chapter, additional water risk assessment, disclosure and response tools are identified in order to highlight the variety of water risk tools available. Water footprinting is one such tool within a suite of options, and therefore, depending on the context of the risk, may or may not be the most suited for risk mitigation or management.

Finally, the policies, legal and institutional arrangements of water footprinting in South Africa are explored. The institutional analysis report motivation for the institutional analysis was based on the premise that one of the largest barriers to the uptake of water footprint tools in the industrial sector. In South Africa in general is the lack of understanding of the institutional landscape for their implementation and the motivation for the water footprint assessment. This report explores the policy, legal and institutional landscape for the application and uptake of water footprint tools in South Africa, with a specific focus on the industrial sector. The review is based on the premise that water footprint as a tool for effective water management by companies is gaining wide acceptance, however the institutional and policy landscape within which these approaches could be applied is still not clear. The report uses the above framework to explore into more detail, the suitability of the current institutional, legal and policy frameworks for the uptake of water footprint tools for the industrial sector in South Africa.

1.1. Project Objectives

Several reports have been submitted as part of the study. This final deliverable summarises the work carried out to date and highlights the key leaning points to be taken away. The final deliverable has been split into three focussed volumes:

- ***Volume I:*** Literature Review
  This volume explores the international experience with water footprints and linkages to carbon footprints and offsetting has been completed as the first deliverable and helped in scoping the project and highlighting key issues which should be addressed.

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- ***Volume III***: Key insights from South African Case Studies
  This volume summarises the key learnings from the South African case studies and makes recommendations for the applicability of water footprinting for the corporate sector.

This report deals with Volume II of the final deliverable.

2. LITERATURE REVIEW ON CORPORATE WATER FOOTPRINTING

2.1. Corporate water accounting

Water accounting is carried out by corporates primarily due to the drive to identify and reduce water-related business risk (and therefore seize opportunities), whether through building competitive advantage, ensuring long-term operational viability, or maintaining and/or improving social license to operate. Cost reduction, strategic planning, brand management/corporate reputation and corporate ethics/philanthropy are given as the predominant drivers of water accounting (UNEP 2011). Application of water accounting may contribute to advancing sustainable water management as shown in Figure 1.

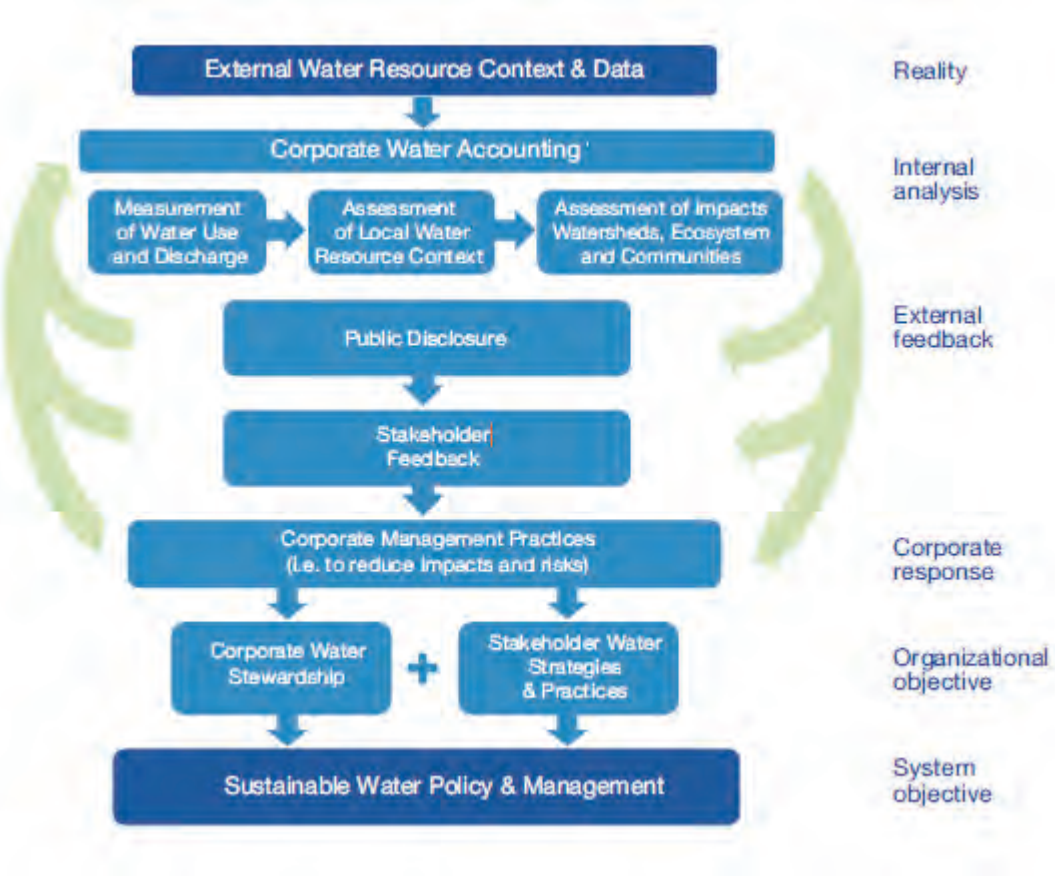


Figure 1: The role of water accounting in advancing sustainable water management (UNEP 2011)

According to UNEP (2011), there are generally four inter-related applications for water accounting:

- Operational efficiency
- Water risk assessment or identification
- Management of water related social and environmental impacts and water stewardship responses
- Communicating water risk or performance with stakeholders

Considering the above, there are sufficient drivers for corporates to take account of the water embedded within the products they make. There are a number of tools available to carry out water accounting. Each tool depends on the context of the risks which need to be mitigated and the company involved. The range of tools which can be used for corporate water accounting are reviewed at a later stage in this document. This research explores the use of water footprint tools to calculate corporate water use. The water footprint provides transparency in water accounting as it includes all consumptive uses of water and facilitates the analysis on the sustainability of the Water Footprints. It can inform decision-makers in the evaluation of the efficiency of measures taken (UNEP 2011).

2.2. Overview of a water footprint

The Water Footprint (WF) concept was first developed as an indicator that could map the impact of human consumption on global fresh water resources. It refers to all forms of freshwater use (consumption and pollution) that contribute to the production of goods and services consumed by the inhabitants of a certain geographical region (Hoekstra & Chapagain 2008).

Water footprinting (as defined by the Water Footprint Network (WFN) provides a methodology through which companies assess their water use and its spatial and temporal dimensions. Such assessments provide insight into subsequent business risks and impacts on catchments, ecosystems, and communities. The water footprinting methodology was initially created as a tool for water resources management and this still remains its primary use. For these purposes, water footprinting 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 (CEO Water Mandate 2011: 81).

Specific products, companies, individuals and geographic areas may have their water footprints calculated. The water footprint of a product, which is the amount of water consumed directly (operations) or indirectly (supply chain) to produce the product is distinct to the water footprint of an individual, which refers to the total amount of freshwater used to produce the goods and services (direct and indirectly) consumed by this individual.

A water footprint is able to provide the following information:

- Type of water used: Blue- (related to fresh surface or ground water), Green- (related precipitation stored in the soil as soil moisture) and Greywater (related to water pollution).
- Spatial and Temporal localisation of the Water Footprints: all components of a total WF are specified geographically and temporally.
- Virtual Water Flows: The virtual water flow between two geographically delineated areas is the volume of virtual water that is being transferred from one to the other as a result of product trade.

The water footprint of products; the basic information provided by water footprints (WFs) can be used by the private sector to perform risk assessment, as a planning tool, to identify hotspots in their supply chains or to couple it with tools including Lifecycle Assessment (LCA) methods in order to perform benchmarking of products (UNEP 2011). The drivers to why a corporate would carry out water footprint as a water accounting tool are explored.

2.2.1. Drivers to water footprinting

The water footprint allows a company to understand their relative importance in a catchment with respect to water use, as well as the relevant point along the value chain which is most water intensive. It is generally the first step which is required to identify what the physical risks of water scarcity are to a company's operations. The temporal and spatial scale at which the water is used or consumed must be taken into account, as the local conditions of the use impact the level of risk associated.

Figure 2 below gives an indication of the types of water risks facing business. The drivers for using a water footprint are grouped according to their ability to help mitigate or understand the risks facing business through water. Depending on the type, scale and point of risk impact, a number of different water risk tools may be applicable in the effort to mitigate the risk.

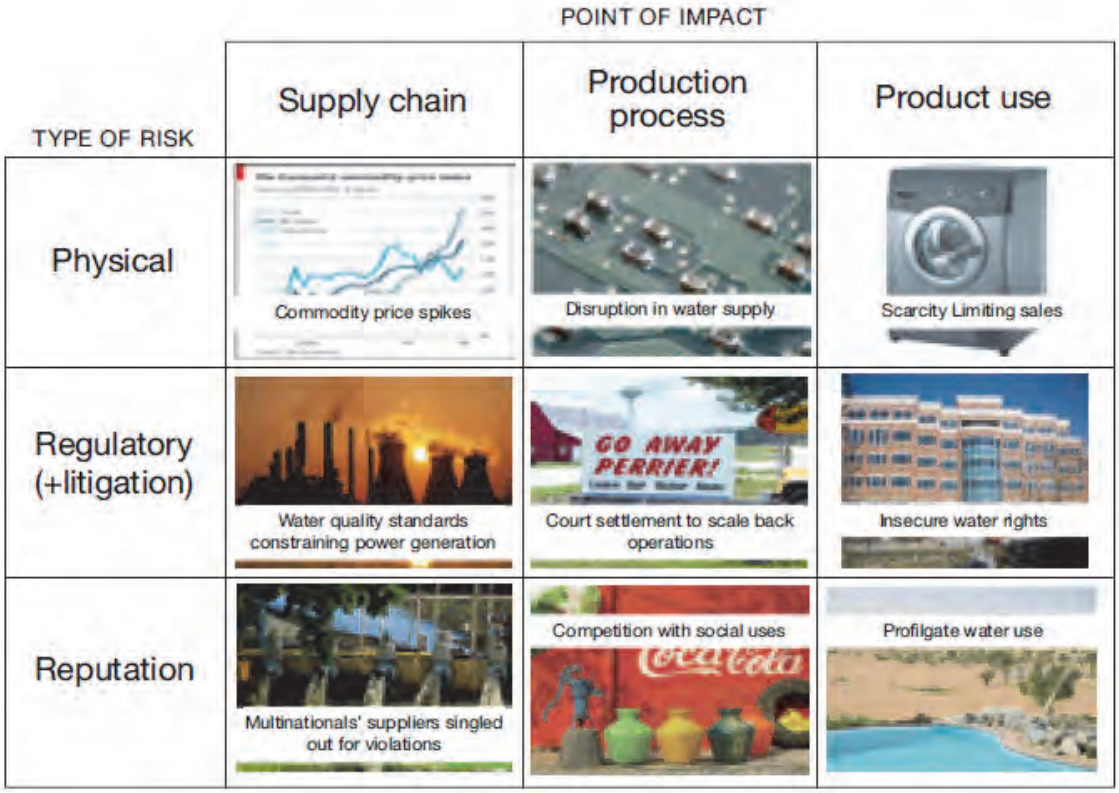


Figure 2: Examples of Water Related Risk through the Value Chain; (Source: UNEP 2011).

The drivers to using water footprints as a corporate are grouped according to physical, reputational and regulatory risks, and are expanded as follows:

2.2.1.1. Physical Risk:

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. Importantly, the water footprint must be contextualised to the local water reality. This needs to be done through a sustainability assessment. Without the context of the relative water use compared to the local reality, the water footprint value is not particularly useful.

As a result of physical water risk, companies may want to act within or outside of their "factory fence." Carrying out a water footprint will help inform this decision on what scale the best risk minimisation may take place. Efficiency measures may be through internal optimisation of production or through engagement in the supply chain. A sustainability assessment following the calculation of the actual water footprint is also a helpful indicator of the physical risks impacting a company relative to its surroundings. The uses of a water footprint are explained further.

– Internal efficiency

A water footprint is useful due to its distinction between green- and bluewater use. To mitigate bluewater impacts and associated risks, companies might improve their water use efficiency or engage with affected parties to improve their access to water services. Therefore internal efficiencies will become the primary focus. Green water use optimisation is typically related to land use change rather than internal water use

efficiency. 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). Therefore, companies may consider the distinction between green- and bluewater useful in helping them understand the types of impacts their production system might have on surrounding ecosystems and communities.

– Supply Chain efficiency

For many businesses, their supply-chain water footprint is much larger than their operational footprint. " As a result, companies may conclude that it is more cost effective to shift investments from efforts to reduce their operational water use to efforts to reduce their supply-chain water footprint and associated risks" (waterfootprint.org) .Achieving improvements in the supply chain may be more difficult – but can often prove to be more effective. Businesses can reduce their supply chain water footprint and their risk exposure by making supplier agreements or by simply changing suppliers. Among the various alternative or supplementary tools that can help improve transparency are: product labelling, certification and water footprint reporting. This transparency can ultimately help the consumer to make informed choices on the water sustainability of the product they are buying, driving demand and new markets for sustainable goods and services (CDP South Africa 2011).

– Sustainability assessment

A water use right alone is not sufficient to manage water-related risks. Physical water risk has both a spatial and temporal dimension. The sustainability assessment step of a water footprint is an important step to understanding the local context of physical water risk. The spatial dimension is driven by the fact that the local context is critical to determining the relative value and importance of water within the corporate water footprint. For example, a litre of potable water in a "water-rich" region is unlikely to be as precious as a litre of potable water in water-scarce Namibia, regardless of the actual Rand value associated with each (CDP South Africa 2011).

The sustainability assessment step compares the water footprint found in the accounting step to available freshwater resources for the relevant time and place. A sustainability assessment may include environmental, social and economic sustainability, as well as primary and secondary impacts.

Additionally, a sustainability assessment will differ based on whether the assessment is regarding a product, or whether the assessment is regarding a geographic area. Some guidance on sustainability assessments has been developed, but this step evolved after the accounting step and thus is less developed.

The three components of sustainability considered are environmental, social and economic. If a blue, green or greywater footprint prevents any of the below from being satisfied, then the footprint is considered unsustainable.

- Environmental sustainability – This has a quantity and a quality dimension. Environmental flow requirements must be met in order to sustain ecosystems, groundwater flows must remain within certain limits, and water quality must remain within specified limits.
- Social sustainability – A minimum amount of freshwater at a certain quality must be allocated to basic human needs, including drinking, washing, and cooking within a catchment or river basin. Additionally, a minimum amount of freshwater must be available for the secure production of food supply, though this consideration can look beyond the catchment or basin due to trade. If a blue-, green- or greywater footprint prevents the minimum amounts from being met, then the footprint is not sustainable.
- Economic sustainability – Water should be allocated in an economically efficient way, meaning that the benefits of the footprint should outweigh the full costs, including opportunity costs and externalities.

When considering the water footprint of production for a basin or catchment, the sustainability assessment can be done for the specified area of production. If considering the sustainability of a water footprint for a product, then the geographic origin of water inputs to that product must be identified, and a sustainability assessment must be undertaken for each geographic area.

2.2.1.2. Reputational Risk

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.

The potential reputational risk being faced by a company may also be informed through the use of water footprinting. Depending on the nature of the business, the relative water consumption of the company at a specific site may help understand the relative water importance of the enterprise, and therefore the resultant importance in the catchment. This may be important in terms of the company reputation as a high water user/polluter. WF studies have helped 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 (UNEP 2011).

Through carrying out and communicating the results of a water footprint, consumers, civil society groups, and the investment community can compare different companies‟ social and environmental impacts in order to inform their actions and decision-making. If contributing positively to a community's water situation, or if being as efficient as possible, the results of a water footprint may contribute positively to a companies' reputation (Morrison et al. 2009).

This information may become important not only to the surrounding local community itself, but also to the wider consumer population too. Evidence of the value of a water footprint to communicate the water situation can be seen through the case of Coca-Cola in Kerala, India. The Kerala incident caused significant reputational damage to the company, affecting reputation across the globe and not only in India itself. It situation alerted the company to their material dependence on water and the need to address issues of sustainability – environmental, social and economic – proactively by quantifying and disclosing their water risks.

Daniel and Sojamo (2012) indicate the relative importance of brand value depending on how multinational the company is. "Reputational risks are of special importance to companies that have a global corporate name to protect, whereas companies such as SABMiller or Diageo are known through their local brands, and reputational damage to one of them will not have as much impact on their global corporate brand, as it would have for companies like Coca-Cola or PepsiCo" (Daniel and Sojamo 2012). Therefore reputational drivers are more relevant for companies with a global corporate brand business model, and that beverage companies are exposed differently to physical water scarcity than food companies.

2.2.1.3. Regulatory Risk

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.

Good corporate governance and due diligence is the foundation to good risk management practice and is critical to reputational matters. This is specific to each company, and is under the control of the company. If managed well, can enhance the company's reputation, and if not, destroy the reputation. It is generally recognized by most organisations that without risk there is no reward, and generally, the larger the risk the larger the reward (Spedding and Rose 2008).

Water footprints may form the baseline data requirements for water disclosure regulatory requirements. These include disclosure requirements required through the public or financial sectors regarding the water use of the company for investment or good governance purposes. King III is one such example, where, an understanding of one's importance hydrographically within a catchment may help in outlining the steps towards sustainability taken by the company.

The King report philosophy consists of three key elements; leadership, sustainability and good corporate citizenship. The reports (King I-III) view sustainability as the primary moral and economic imperative, where a company's standing as a juristic person under the constitution require that it should operate in a sustainable manner.

King II highlighted the requirement of a triple bottom line, where companies needed to account for not only economic and financial, but also social and environmental issues. Corporate citizenship and integrated sustainability are highlighted. In the King III (2009) sustainability is further emphasized. Directors have the accountability to shareholders to ensure that the company's resources are utilised to ensure the continued viability of the company. Environmental as well as social sustainability are seen to be important. The economic value of a company is no longer based purely on the balance sheet, but must include non-financial issues including brand reputation, stakeholder relations, environmental sustainability, social responsibility and quality of governance. King III proposes that financial reporting and sustainability reporting and disclosure for the company are integrated. King III is a requirement for all companies listed on the JSE.

2.2.2. Function of the water footprint assessment

The water footprint allows a company to attempt to mitigate water-related risks. In terms of physical water risk, carrying out a footprint will help a company 1) quantify its internal water use so as to benchmark future efficiency measures and 2) compare the relative water saving gains that may be made by focusing on the supply chain as a pose to only "within the factory fence." In this respect the water footprint acts at a corporate level, helping internal optimisation of the business.

In terms of reputational risk, a water footprint is a good tool to begin conceptualising the importance of a particular company relative to the rest of the catchment or community. Understanding ones role within the local hydrology is critical before engagement with the community may take place. Consumer and client awareness of what a company has done in terms of ensuring water security to the surrounding catchment is a powerful tool for improving brand reputation. This is especially true of large multinationals. For smaller companies however, the local reputation as large or polluting water users is also important to manage. Without water accounting data to support ones actions, improving ones reputation may be difficult. In the case of reputational risk, there is a form of self-regulation which arises through the use of a water footprint assessment to indicate to other consumers or stakeholders the measures which have been taken to mitigate risks.

Lastly, regulatory risk can be managed through understanding ones water footprint. With increasing water stress, water accounting requirements will grow. Being able to know what water use and discharge has been over time, and being able to quantify ones water use throughout the value chain is a useful tool to ensure compliance with

water disclosure requirements. Whether or not water use accounting is required legally through government, in terms of good corporate governance and the King III requirements, it is a good proactive policy to be able to understand ones contribution to sustainability. Note that water offsetting is an element of water engagement, which will require some form of regulation in the near future. The area is still nascent, and requires further research into which cases water offsetting on a local scale is relevant. Therefore, from a government view too, there is potential for the use of water footprinting to ensure corporates are using water appropriately.

The following figure indicates the range of functions which water accounting tools may meet. Water footprint too is able to meet a number of these functions.

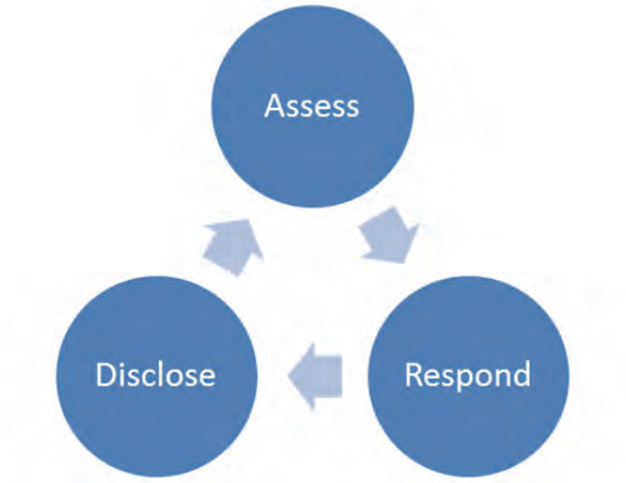


Figure 3: Function of water risk tools

The accounting mechanism of water footprint helps companies assess the risks they are facing. This is especially true when the water footprint is done in conjunction with a local context assessment of the catchment. Both social and environmental considerations need to be taken into account to ensure all elements of sustainable water use are considered. Following an assessment of water risks internally, the company may consider responding to the risks identified. Therefore, water accounting mechanisms may support a company in its response to selected water risks. The responses to water risks may be internal or external, depending on the capacity interest and extent of company and stakeholder engagement in risk reduction. Lastly, water accounting tools may be used to disclose information. This may be to investors, stakeholder, consumer, customers or to a regulator in government or industry.

There are a number of tools and metrics able to calculate a company's risk to water. The water footprint is a clear, robust, simple tool which is the first step requirement before more nuanced risk investigations can take place. Water footprinting is not the panacea, and further investigation is required for a more complete understanding of water risk. A water footprint is useful particularly in the assessment and disclosure phases of water accounting use. Therefore, the practicalities of using this tool are investigated. In a later chapter, consideration of other tools is done to illustrate that there are a number of assessment and risk mitigation tools available. The choice of tool depends heavily on the context.

3. WATER OFFSETTING AND NEUTRALITY

This section undertakes a comprehensive review of water offsetting and neutrality both globally and in South Africa, to develop understanding on the opportunities and challenges in the application of this concept to the South African situation. This review is undertaken in the broader context of company water risks as it relates to their reputation, investment and regulatory needs and requirements.

Understanding water offsetting and neutrality is important for highlighting the opportunities and challenges companies may face in trying to respond to their water related business risks and how to overcome those challenges. A case study approach will be undertaken in this review to try and evaluate the opportunities for water offsetting and neutrality and how they can be adopted for the South African context, by answering the following questions: -

- What are the key principles and application of water offsets and water neutrality?
- What are the market-based approaches for achieving water offsets and neutrality?
- Are there opportunities for water offsetting in South Africa taking into consideration how the concepts have been applied globally?

This review will address these critical questions regarding water offsetting and neutrality by firstly undertaking a comprehensive literature review on the concept of water offsetting and neutrality, highlighting some key case studies globally and provide a synthesis of the opportunities and constraints of applying the concept in South Africa.

3.1. Water Offsetting

3.1.1. Definition, principles and application

Water offsetting refers to a process of reducing the water footprint of an entity such as a business operation by undertaking interventions that help to compensate for their negative impact on water resources, after internal water footprint reduction measures have been implemented (Hoekstra 2011). The water footprint that is offset, which can be referred to as 'residual water footprint' are often very difficult to overcome due to various constraints ranging from financial, technological and energy requirements (DWA et al. 2012). However, by undertaking interventions elsewhere of equivalent value, it is possible to compensate for the residual water footprint with a resultant environmental impact comparable to in-house interventions. As a result there are two key principles that need to considered for a water offset scheme to be legitimate: -

- Firstly, only residual water footprint should be offset, as a result the user needs to demonstrate that all effort to reduce their water footprint have been undertaken.
- Secondly the offset must be of equivalent value and attributable to the same location where the footprint is located such as a catchment, river or water supply system.

According to the National Water Resources Strategy II (2013), water offsetting is defined as: *the residual water footprint is offset by making a 'reasonable investment' in establishing or supporting projects that aim at the sustainable and equitable use of water*

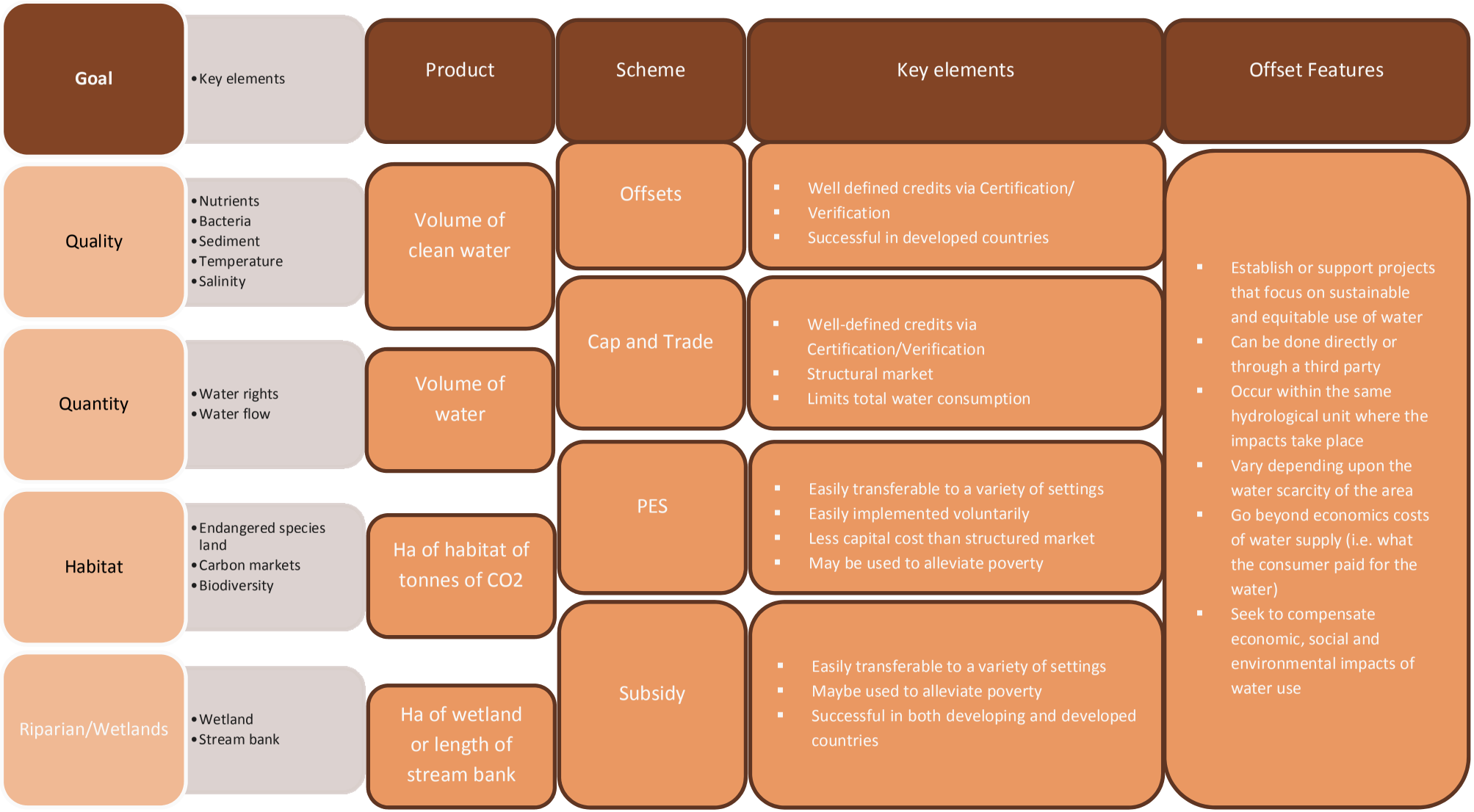


Figure 4: Key elements on the structure of water offset schemes (source: Kaiers et al. 2008)

Water offset schemes are an element of a well-defined market schemes for environmental products as illustrated. Under this arrangement water offset are mechanisms for achieving a specific environmental goal, which could be water quality or quantity, habitat protection or restoration of riparian areas. For the water offsetting to work, just like in any other market arrangement, requires a well-defined setting and in some cases regulation, hence government could be a significant player if the offsetting is related to a water regulation situation. Whereas in a case where it requires engaging with local landowners, issues of property rights might dictate the nature of and viability of a specific offset program.

3.1.2. Reasons for offsetting

There are various reasons why a company might want to engage in activities that will result in water offsets. Most of the motivation for offsetting is related to the need for water users and specifically companies to reduce their impact on water resources and other users, in order to meet regulatory requirements that govern water resource management. Water resource management policies are therefore key drivers of water offsetting. In the USA for example, the Clean Water Act of 1972, which promotes sustainable water resource management in the country, developed a Water Quality Trading Policy, which provides guidelines for the use of market-based approaches for water quality management (EPA 2004).

Policies that govern water quality management have led to the implementation of specific measures such as the allocation of water quality caps and appointment of non-point source baselines. These measures create a suitable environment for implementing water offset programs to ensure that water users comply with the regulatory requirements set out in the various policies and strategies.

Finally, the existence of a market structure as a result of the policies that require users to reduce their footprint, create a suitable environment for offsetting to take place between users who have flexibility in relation to the degree to which they can reduce their water footprint internally at a low cost, with those users whose activities cannot leverage them to reduce their footprint at a reasonable cost. Under this circumstance, a market structure can easily spring up in cases where both parties who engage in offset have a chance to benefit from the transaction.

3.1.3. Types of water offsetting and frameworks

There are two main types of water offsetting frameworks, namely voluntary and regulated water offset schemes. According to Keiser et al. 2008, regulated programs focus on direct cost implications of compliance, whereas voluntary schemes recognize a resource need or resource issue that affects short term or long term corporate profits, customer needs or community sustainability.

Elements of voluntary schemes have been extensively reviewed in Keiser et al. 2008, below are some of the key elements relevant to this study: -

- Voluntary schemes are generally flexible and easily used in a wide variety of socio economic setting
- Amenable to scalability and transferability
- Voluntary schemes can be implemented in either bilateral or multilateral exchange, with or without an intermediary
- Buyers maybe anyone who benefits from water conservation or would like to offset their water use
- Sellers maybe anyone who can provide a water offset through restoration of ecological services or implementation of water conservation practices
- An offset should represent a specific volume of water or another agreed upon metric

Key elements of regulated water offset schemes

- There is need for a clear policy goal that needs to be achieved
- Penalties for non-compliance should be higher than offset costs
- There should be a rigorous certification process for offset credits
- Credits need to be defined using standardized unit of measure such as volume/unit time
- Baseline performance that identify when credits can be generated.
- Program should have an overall evaluation framework
- The program needs to have a clearly defined legal authority
- Public transparency of transactions is very important to prevent abuse of the system

3.1.4. Benefits of water offsetting

Despite the challenges and flaws in the implementation of water-offset schemes, there are benefits that can be achieved from water-offset schemes, as discussed by DWA et al. 2012.

Regulatory compliance benefits

Various regulatory benefits could accrue from the implementation of water-offset schemes linked to some key regulatory sectors such as social regulation (pro-poor tariffs), compliance regulation and economic regulation. Water resource regulation mechanisms could also benefit, through mechanisms that are required for example to manage water and wastewater services. Specific regulatory benefits linked to water offsetting include (DWA et al. 2012):

- Protects the interests of the consumer by securing water supply through the implementation of water use efficiency and reduction
- Ameliorates the negative impacts of water user, through improved water quality, recycling and more efficient treatment
- Assists local municipalities in achieving compliance in regard to water quality

Environmental benefits

Due to the high demand for scarce water resources, immense pressure is exerted on the environment as water demand grows and in some cases outstrips water supply. In addition to the water quantity issues, pollution of water resources also presents a major threat to the environment. Water offset schemes have the potential of alleviating this situation as it promotes water efficiency among key users and it also ensures that potential polluters account for their action. In the long term if well implemented, it is likely to reduce the negative impact of water use on the environment, to ensure that everyone benefits.

Socio-economic benefits

The socio-economic benefits of water offsetting are linked to the heightened level of awareness on the challenges of water scarcity that might accrue in the course of its implementation. This is because water offset schemes require the support of various stakeholders for them to be implemented successfully, raising awareness levels in the course of doing so. Water offsetting schemes specifically in developing countries can be used to leverage development and service delivery to poor communities, as has been evidenced in South Africa through programs such as the Working for Water program that has created massive employment opportunities.

Business benefits

With increasing regulation of water resource use, the cost of production for business related to their water use is likely to increase. Water offsetting however, offers businesses to explore cheaper ways of complying with regulatory requirements, without negatively impacting their productivity. Other benefits include investment incentives that allow enable companies to innovate in regard to water efficiency; asset conservation that allows industry to purchase offsets rather than replace assets; political benefits as reward for being responsible water stewards.

3.1.5. Issues with water offsets

Water offsetting is distinct to that of 'normal' or general offsetting. Water offsets and neutrality present particular challenges that make their implementation very difficult, some which are highlighted as follows (Gerbens-Leens et al. 2007):

- Allocating responsibilities among supply chain entities for reducing water footprint, and for any other corresponding offset is complicated due to the local nature of water impacts
- What would be a water offset in time and space? Is offsetting at all possible in water? Are offsets, projects or payments?
- What would be a suitable price?
- How to link offsets to specific hydrological issues i.e. water from aquifers but returned to rivers, water taken in wet or dry seasons
- Are there any differences in applying the concept of water neutrality and offsets to individuals and communities as opposed to businesses?
- Due to the temporal and spatial characteristics of water resources, trading of water units is difficult across large areas of across large spaces of time. This makes the trading furthermore complex.
- What could be the adverse consequences of such an approach due to the public nature of water resources

3.2. Water neutrality

Water neutrality was conceived as a means of sparing water users into action to mitigate their water footprint, by reducing their water consumption and pollution and offsetting their residual footprint (Hoekstra 2008). It's based on three key principles of review (water footprint) reduce (internal measures) and replenish (water offset). Internal measures to reduce consumption include water saving technologies, water conservation measures and wastewater treatment. Offsetting measures can include investing in improved watershed management or supporting poor communities that do not have access to clean water to set up and maintain their won water supply system.

According to the 2013 National Water Resources Strategy (NWRS), water neutrality is defined as: *the reducing of the impact of the water consuming activity in making the impact 'water neutral' by simultaneous investment in water conservation measures of other alternatives. Water neutral thereby means that one reduces the water footprint on an activity as much as reasonably possible, and offsets the negative externalities of the remaining water.*

Water neutrality can therefore be referred to as a goal that a water user can seek to achieve after they have undertaken all measures to reduce their water footprint and have successfully offset their residual water footprint (Hoekstra 2008).

Even though the concept of water neutrality initially received a lot of support, with time it became apparent that the concept is potentially misleading because it is impractical for water neutrality to be achieved in practice. Unlike carbon neutrality, from which the concept of water neutrality was derived (Hoekstra 2008), the complexities associated with water consumption make it impossible to achieve water neutrality. Here are some of the challenges encountered in seeking for water neutrality: -

- In order to be water neutral, it would require that the water offset takes place in the same basin from where the water was abstracted. This makes it impractical for business, because most business operations are not linked to hydrological boundaries, with their water footprint going through various hydrological boundaries (Gawel & Kristina 2011).
- The impact of water abstraction on freshwater ecosystems is directly linked to the timing of the abstraction and the quantities that have been abstracted. As a result, releasing water back into the system will not necessarily mitigate the impact of abstraction that has already taken place.

Because of the challenges associated with water neutrality, some companies like Coca-Cola that made a public declaration to become water neutral received criticisms and accusations of 'green-washing'. However, in South Africa the concept of water neutrality has been successfully tested by WWF, which is one of the case studies in this report.

3.2.1. Policy environment for water offsetting in South Africa

The water policy environment for the implementation of water offsetting and water footprint in South Africa is impacted by two key legislations that govern water resource management, namely the National Water Act, 1998 (NWA) and the Water Services Act, 1997 (WSA).

The NWA was designed as framework legislation with numerous principles and approaches that enable effective management of water resources. These include the principle of IWRM, which promote the philosophy of managing water in an integrated fashion and promote equitable access to and sustainable use of water resources and the polluter pays principle.

Provisions in the NWA such as the Resource Directed Measures (RDM) and the Source Directed Measures (SDM) ensure that water resources are well managed and may also provide the framework under which the regulator could implement water offset schemes. For example in relation to water quality offsets, the Waste Discharge Charge System (WDCS), will levy charges on waste discharge by water users, which could in turn create opportunity for implementing water offset scheme.

From an institutional perspective, the establishment of Catchment Management Agencies (CMAs) could aid the implementation of water-offset schemes as these institutions play a key role in the mobilization of stakeholders in the catchment. If CMAs get involved in water offset schemes, a potential market could be established by the CMA as the regulator of such a market. Even though the Catchment Management Strategies (CMS), of the current CMAs have not considered water offset schemes, if such a policy accepted by the national department of Water Affairs, it could drive the implementation of CMS on the ground. Such a move could help CMAs 'take-off the ground' faster as the water offset scheme could motivate key stakeholders to pick interest in the operations of the CMAs, especially the private sector who until now have not really engaged in the CMS processes adequately.

The Water Services Act (WSA) deals mainly with issues to with the supply of potable drinking water and sanitation, supplied by the municipalities to their users, which could comprise domestic users, industry and other sectors located in urban areas. The WSA contains rules about how municipalities should provide water supply and sanitation services to their users.

The role of the regulator under this act is to ensure that water is used efficiently and that the delivery of reliable sage drinking water is undertaken in an equitable manner. The water delivered to end-users must also be safe and of high quality. As a result a lot of focus is placed on ensuring contaminated water is well treated and that effluent discharge is well managed.

This policy framework provides a suitable environment for the implementation of water quality offsets, due to the fact that ambitious effluent targets are required to be set for business and municipalities. As productivity increases in industry for example the cost of meeting the regulatory requirement increases, presenting a part platform exploring water offset opportunities between different water users.

In the development of a potential water offset scheme, the following perspectives are worth noting (DWA et al. 2012):

- From industry perspective – it is about offsetting – earning recognition for effort and earning water benefits or water credit (i.e. water use is already relatively efficient);
- From a municipal perspective – it is about soliciting support from offset opportunities with industry or stronger municipal players in order to achieve water saving or effluent quality compliance (i.e. compliance to water use license or authorisations);
- Both water users are ultimately striving to achieve some form of recognition (i.e. "Drop" Certification as one possible instrument), however their respective baselines regarding water use are significantly different and accordingly there is a natural synergy for them to work together, so as to achieve their respective sought outcomes.

3.3. Market based approaches to water offsetting and neutrality

Market based approaches for managing water are innovative mechanisms that do not only mobilize resources for better management of water resources, but often form the basis for implementing interventions such as water offsetting and neutrality. Market based approaches also help to frame the water challenges in terms of the water user and encourage strong participation of stakeholders compared to other top-down approaches.

Water offsetting/neutrality are in many ways market based approaches for water resource management or may require a market structure for their successful implementation. In those section, key market based approaches are discussed further, to develop understanding on which measures are suitable for the implementation of water offsetting and neutrality in South Africa.

Principles for market based approach to water management

Water trading refers to the trade of water use rights between users. "It's the water use rights that are traded. In the field, this means that one farmer can irrigate his field with a certain amount of water, and not another farmer when the first one holds the water use rights" (Hoekstra 2011). Water markets have only been implemented in a few countries or states, such as California and Chile. Other forms of water markets are in the form of virtual water trading through inter-basin transfers or across political boundaries.

According to Dinar 2008, there are some key principles that govern water markets for them to operate efficiently, these principles include the following: -

- Market should have many identical sellers and buyers, each with complete information on the market rules, and similar transaction costs
- Decisions made by each buyer or seller is independent of decision made by other sellers and buyers
- Decisions made by one individual should not affect the outcome of another individual

- The individuals or economic agents operating in a competitive market are motivated to maximize their profits
- It requires defining the original allocation of water rights
- Creating the institutional and legal frameworks for trade,
- Investing in basic infrastructure to allow water transfers
- Water markets can only work when users embrace the new institutional mechanisms of the market and if the marker caters to their particular needs (Easter et al. 1998)

Advantages of water markets

- The buyer benefits because the water market encourages increasing availability of water
- The environment may benefit in case water is trading involves agriculture, because it will result in a shift towards water efficiency in agriculture and reduction in irrigation related pollution
- With the water market, farmers may afford to internalize externality costs
- Empowerment of water users by requiring their consent for any re-allocation of water and compensation for any water transferred
- Provides security of water rights tenure to the water users
- Marketable rights to water may induce water users to consider the full opportunity cost of water, including its value in alternative uses
- Provides incentives for water users to take account of the external costs imposed by their water use, reducing the pressure to degrade resources

Disadvantages of water markets

- Transfer of water from agriculture to urban sector may reduce return flows which will affect other parties
- Pervasiveness of externalities such as changes in downstream and return flows, pollution, overdraft of water tables, waterlogging and adverse often irreversible environmental impacts
- Rights holders may perceive imposition of administered prices as expropriation of those rights.

3.3.1. Payment for ecosystem services (PES)

PES are innovative market-based approaches incentivize sustainable land management and ecosystem protection (King et al. 2008). PES involves offering incentives to landowners to pay to reduce pollution emanating from land use activities on their land. The best examples of PES that have been widely cited include PES schemes found in Costa and New York (Pagiola 2008; Appleton 2002). PES provides a direct relationship between the buyer and supplier, as a result has been regarded as both economically efficient and environmentally sustainable (King et al. 2008). PES schemes are different from other incentive based approaches to land management because: -

- They are voluntary transactions with well-defined environmental service (ES)
- There is a willing buyer, willing seller arrangement

The efficacy of PES still poses many challenges, especially in relation uncertainty of the equity of its impacts on livelihoods especially poor sectors of the society (Landwell-Wills and Porras 2002).

PES schemes are designed to recognize the goods and services that accrue from the environment. Watersheds provide important services, which include provisioning services (e.g. water supply) regulatory services (e.g. flood attenuation) supporting services (e.g. biodiversity habitats) and cultural services (e.g. aesthetic enjoyment) (Table 2). Due to the very nature of watersheds however, these services are seldom valued because they lie outside the

domain of markets (Postel & Thompson 2005). This view is starting to change with the advent of the concept of payments for ecosystem services.

Ecosystem goods and services provided by healthy watersheds (Postel and Thompson 2005).

- Water supplies for agricultural, industrial, and urban-domestic uses
- Water filtration/purification
- Flow regulation
- Flood control
- Erosion and sedimentation control
- Fisheries
- Timber and other forest products
- Recreation/tourism
- Habitat for biodiversity preservation
- Aesthetic enjoyment
- Climate stabilization
- Cultural, religious, inspirational values

There are several mechanisms for implementing payments for environmental services (PES) at the watershed level as a form of economic incentive to secure the critical services provided by the watershed. Payments for watershed services usually involve downstream beneficiaries making a payment to upstream landowners as an incentive to protect the watershed. These types of payments can be categorized into three main types (Hanson et al. 2009, 2011; Greiber 2009):

- Private transactions
- Cap and trade transactions
- Payments made to generate public benefits

3.3.1.1. Private transactions

The private transactions referred to here are voluntary payments made by downstream beneficiaries of an ecosystem service to upstream providers of the service. This typically involves paying landowners upstream to maintain the watershed in such a way as to avoid any negative impact on downstream water users such as altered water quality, reduction in stream flow or flooding. Another characteristic of these private PES transactions is that in some cases there is cost sharing among the private parties involved and if a land purchase is involved upstream, it may be leased back to the owner with the objective of ensuring the protection of the watershed (Greiber 2009). In cases where the transaction with the upstream landowner does not involve leasing the land, they may get paid to undertake restoration activities on the landscape such as riparian protection and changes in agriculture practices.

3.3.1.2. Payments made to generate public benefits

Payments that are made for public benefits constitute an arrangement where a government entity is involved, and may include collecting fees, land purchase or granting of rights to use land resources (Greiber 2009). These arrangements mostly involve Municipalities, local government and utilities. This is the most common form of PES, because of the simplicity of its set up, where the public entity is the sole buyer or seller of the ecosystem service.

In cases where the government is the purchaser of such ecosystem service, it may take the form of engagement that ensures the protection of 'public goods and services'. For example government may pay landowners to

protect a watershed to yield benefits to the general public as opposed to designated groups such as those involved in private PES transactions. Public goods are generally underfunded because they are benefits that are enjoyed by all, and watershed payments can be a useful mechanism for boosting such areas (Hanson et al. 2011).

There are several examples of regulator driven PES schemes, such as the widely implemented land stewardship programme under the United States Department of Agriculture (USDA). Under this scheme private landowners sign agreements the government authorities to ensure that they conserve the natural resources in their private lands, such as wetlands, soils, floodplains and forests. The government will in-turn pay the landowners for undertaking such conservation activities.

Another widely cited example of is that of the Catskills watershed in New York City, where the authorities opted to conserve the upstream watershed as an alternative to building additional water treatment plants. To-date more than $1.5 billion has been spent by the city to sustain the critical water supply services provided by the Catskills watershed. The payments in this scheme are directed towards forest conservation, habitat rehabilitation and the creation of green corridors to link up reservoirs. Investing in this green infrastructure turned out to be way cheaper than the construction of a water filtration plant.

3.3.2. Cap and trade

These types of transactions are based on existing rights such as pollution or abstraction limits, and a trading scheme is then established to trade those rights. In these transactions credits maybe issued by an authority to a particular individual who engages in an activity that results in a watershed protection, such as pollution control. The individual who owns the credits can then choose to sell them to any person who is embarking on an activity that might result in them exceeding the limits of the pollution requirement as set by the regulator. There are several examples of cape and trade schemes globally, mostly notably the United States Clean Water Act, which has a wetland-banking scheme. The wetland banking scheme requires landowners who damage wetlands to offset that by restoring and protecting other wetlands either on site or elsewhere. In this approach players therefore have to purchase credits in order to meet their mitigation obligations (Greiber 2009). Cap and Trade schemes can be rather complex, requiring some clear guidelines as outlined by Greiber 2009 below: -

- Clear definition of those activities that have a negative impact on ecosystem services and thus lead to mitigation obligations;
- Development of transparent standards to quantify the unit of exchange (e.g. based on their actual value and/or function, or based on the size and/or geography of the concerned land);
- Determination of units of restored, created, enhanced or preserved ecosystem services which will be converted into tradable credits;
- Establishment of procedural frameworks for opening, managing and closing mitigation banks, for protecting the resulting ecosystem services in perpetuity, and for ensuring fair trade;
- Creation of insurance and liability systems to guarantee long-term offsetting and stewardship success.

3.3.3. Water banks

A water bank is an institution that offers to buy and sell water under some set of rules regarding prices and quantities in a given area" (Dinar et al. 1997). It's a tool for leasing water between willing water rights holders and users, under a temporary arrangement without the permanent change in water rights. The concept of water banking is based on the premise that water is an economic good and must be treated as such, which when allowed to operate under free market forces can operate efficiently to balance supply and demand. Water is however, more than just an economic good; it's a basic human right it therefor can be treated as any other commodity.

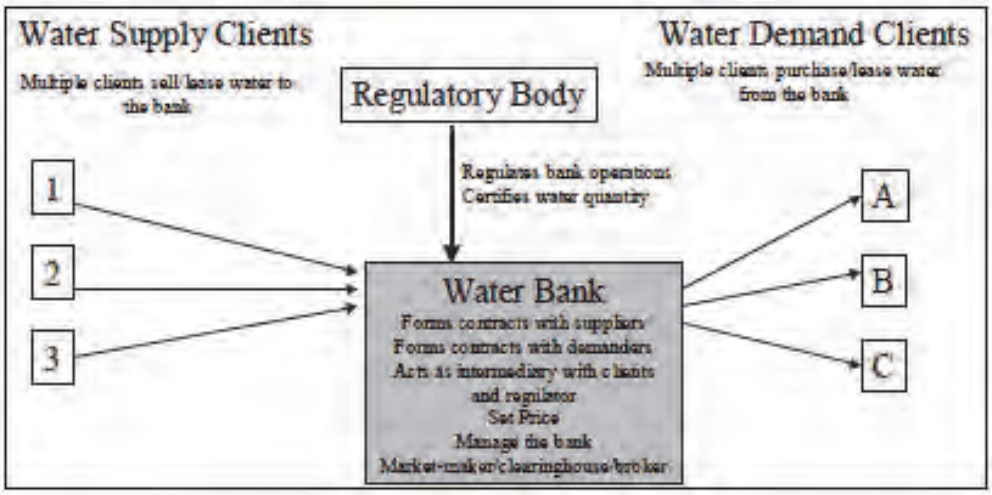


Figure 5: Water banks conceptual model (Source: DoE 2004)

A water bank functions like an intermediary, where water rights holders can 'deposit' their rights, to free up water that can be withdrawn by other water users who need the resource, without the depositor losing their original water right. If water is withdrawn based on the rights that have been deposited in the water bank, the depositor gets paid an amount equivalent to how much water was withdrawn. In some cases an administrative cost might accrue and a buyer will pay slightly higher fees to account for such fees.

In a comprehensive review of water banks in the western States of the US, water banks were found to serve the following purpose, in addition to the overarching goal of facilitating transfers (DoE 2004): -

- Create a reliable water supply during dry years.
- Ensure a future water supply for people, farms, and fish.
- Promote water conservation by encouraging right holders to conserve and deposit rights into the bank.
- Act as a market mechanism.
- Resolve issues of inequity between groundwater and surface-water users.
- Ensure compliance with intrastate agreements of in stream flow.

3.3.3.1. Types of water banks

Water banks are mostly classified based on their source or type of water entitlement, however due to the variations in wide range of institutional and legal structures; water banks can be classified into multiple types (DoE 2004). In this review three key types of water banks are recognized, namely institutional, surface storage and groundwater banking.

Institutional banking

Institutional banks only provide legal mechanisms for exchanging water rights and often referred to as 'paper banks' (DoE 2004). They are developed to address physical water shortages or for application in large geographic areas. Institutional banks are also commonly used for environmental flow purposes, where water supply and delivery of water is subject to hydrologic and regulatory variations (DoE 2004). A major characteristic of institutional banks is that they require a long term deposit of rights, to ensure long term contracting. Examples of institutional banks found in the western states include Idaho Water Supply Banks and Texas Water Bank, both of which have a minimum contracting period of 5 years.

Surface storage banking

Surface water banks are linked to physical water facilities such as a reservoir, where water can be stored based on different allotments and exchanges can be carried out. Surface storage banks provide a greater reliability of supply compared to institutional banks (DoE 2004). This is because entitlements are based on specific volumes of available water, hence reduce the chances of speculation. A major characteristic of surface storage banks is that, they operate on an annual basis and deposits and exchanges are limited to a single year (DoE 2004).

A good example of surface storage water bank is the California Drought Water Bank, which was set up as a result of a prolonged drought in California. The aim of the drought bank was to enable transfers of water from agriculture in the northern California area to urban, rural and agricultural sectors in southern California.

Groundwater banking

Groundwater banking provides a mechanism for exchanging water rights in relation to withdrawals from an aquifer. This type of banking is still relatively new and has not been widely implemented, particularly in the USA, which has pioneered water banks for a long time. Water banks are being developed to primarily address the challenges associated with the depletion of groundwater resources. A good example of a ground water bank is that found in the Deschutes Basin, Oregon (DoE 2004). The Deschutes groundwater mitigation program was developed in response to the over exploitation of groundwater resources in the basin, with the intention to allow water development while at the same time mitigating the potential negative impact of groundwater withdrawals on surface waters in the basin.

The Deschutes groundwater banks works in such a way that to obtain a groundwater permit, the permit seeker must first obtain groundwater mitigation credits. The groundwater mitigation credits can be obtained through activities such as aquifer recharge and water conservation projects. Applicants can either obtain permanent credits from individuals or obtain temporary credit transfers from the mitigation bank.

3.4. Case studies on market based approaches to water offsetting

3.4.1. Great Miami River watershed water quality credit trading program

This program provides funding to agricultural producers who want to undertake nutrient reduction practices in the Greater Miami river watershed, to prevent runoff into rivers and streams. It's a voluntary program targeting local farmers who voluntarily agree to change their farming practices to reduce phosphorus and nitrogen runoff. The projects generate credits that are sold to wastewater treatment plants to meet their regulatory requirements. Funding for the program comes from wastewater treatment plants in addition to a grant from USDA Natural Resources Conservation Service.

The key motivation for this initiative is that about 40% of Ohio Rivers and streams do not meet state guidelines for fishing and swimming and other uses. In order to reverse this situation, new regulations were put in place that required wastewater treatment plants to further reduce pollutants. The offset program was put in place because of ever increasing cost of treating water in the wastewater plant, because it was cheaper to work with upstream landowners to reduce pollutant loads than to treat onsite.

To operate the scheme, projects are sought voluntarily and reviewed by an advisory committee comprised of representatives of wastewater treatment works, farmers, environmental groups and local community based organizations. This provides a wide stakeholder representation in the offset program to ensure that the program is effective.

3.4.1.1. Measures of success and benefits

Measures of success for the Trading Program include:

- Attainment of Ohio's water quality standards.
- Reduction (or an increased rate of reduction) in nutrient loading to rivers and streams.
- Improved biological index scores.
- Increased money invested and money saved.

Direct benefits include:

- Increased use of management practices that benefit water quality.
- More sustainable operations with lower costs for agricultural producers.
- Reduced compliance costs for wastewater treatment plants.
- Increased number of stream miles that meet Ohio's water quality standards.
- Increased recreational use of the Great Miami River Watershed's rivers and streams.

3.4.2. Murray- Darling salinity trading

This is a program that was designed to implement the Murray Darling Water Allocation Plan (WAP). The WAP policy affects water allocation transfers, conversions from water holding to water taking allocations and variation licenses.

The WAP has specific requirements for salinity management in the M&D, hence water license transactions cannot be authorized in cases where it could lead to water quality deterioration. To overcome this hurdle provision is made for water license authorization to take place in cases where the negative impact of the activity can be offset elsewhere through activity that reduce salinity on the system.

To implement the offset program, salinity zones are designed for the implementation of the program through a system of salinity credits and debits designed to offset the impact of salinity from irrigation projects.

A salinity register that records all action that reduces or increase salt loads into rivers is maintained by the states of New South Wales, Victoria and South Australia. Under this program actions that result in increase of salinity result in a debit while credits accrues to activities that result in salinity reduction.

Salinity impact zones have been established along the entire length of the Murray River, and each of the zones provides an indication of the future salinity impacts on the river, and how it will be managed for that section of the river. These zones determine the condition under which activities that have an impact on salinity will be licensed. The three main categories of the salinity zones are as follows: -

- Low salinity impact zones - license will be approved, as long as there are salinity credits available in the same region.
- High impact zones - under this category, transactions will be allowed only when the proponent is able to fully offset the salinity impact on the system.
- High salinity impact (salt interception) - this is for cases where the activity results in salt interception. Under this condition, the transaction will be approved only when the intercepted salt can be fully managed within the capacity of the interception scheme.

The South Australian Government owns all salinity credits generated and their assignment does not imply change of ownership. The revenue generated by the government from the issuance of salinity credits is used for activities that reduce salinity by working with irrigation communities and other salt interception interventions.

3.4.3. Wetland mitigation banking

This is a program that focuses on degraded wetlands that need to be restored as an offset in anticipation of wetland impacts associated with development projects. The credits created from the wetland-banking program can be used to offset unavoidable development projects on other wetlands. The credits that are generated in the restoration project are linked to the total area of the wetland and/or functional value of the wetland.

Implementation of wetland mitigation bank is undertaken under a clearly defined market set up, a mitigation banker who is responsible for the establishment of a wetland mitigation bank, under specific environmental guidelines. An instrument that mandates the bank to approve restoration, enhance, create or preserve a wetland governs the wetland mitigation bank. Under the mitigation rules, a specific time frame is set for when the process of approval of restoration process should be completed.

For wetland mitigation credits to accrue, the mitigation should take place before the impact on the wetland occurs, however credits of up to 15% may be released before the development is completed.

The market for wetland mitigation is comprised of several entities, with the seller of the credit being a Mitigation bank sponsor whose wetland intervention results in credits being generated. Several banks in the USA have been approved over the years to act as mitigation bank sponsor totalling to more 500 banks.

The buyer of the wetland credits are permit holders or entities, whose activities will result in negative impact on the wetland and to offset that impact, credits can be bought from the mitigation bank. Buyers of such credits could include public and private developers of land, such as industrial constructions, residential developers and departments of transport and utilities.

In order for the wetland mitigation banking to be effective, it requires a rigorous review process to ascertain that the mitigation has taken place. This is achieved through a review team that is constituted by representatives of US Army Corps of Engineers, local regulatory agencies and community representatives to oversee activities of mitigation bankers.

3.4.4. Storm water quality offset scheme in Melbourne

This offset program is in the form of financial contribution to Melbourne Water for the management regional water quality works (Melbourne Water 1999). The scheme involves investing in restoration activities elsewhere in the catchment as an offset to pollution loads generated by a development. The mechanisms for offsetting vary depending on the nature of the development, with residential developments treated differently from industrial development.

The storm water offset program was established on the premise of best management practices for storm water management, which stipulate that water treatment must take place at the source as opposed to the traditional end of pipe solutions. The advantage of treating water at the source is that it's more practical both at small and large scale and has the potential of effectively achieving environmental outcomes (Melbourne Water 1999).

Participation in the storm water-offset program is dependent on the type of land use activity, whereby industrial and residential areas are treated differently: -

- Industrial subdivisions that are 5ha or greater are required to fully achieve best practice objectives (Table 1) within the development. On the other hand industrial subdivisions that are less than 0.4ha are encouraged to meet best management practices, but are not subject to offset requirements.
- For residential areas, the law requires best water quality objectives to be achieved within the development, and offsets are only allowed for developments that are less than 1ha.

Even though this water offset program appears to be well established and fully entrenched in Melbourne's water policy strategy, from the information available it was difficult to ascertain how successful the program has been. Considering that all new developments and rezoning activities have to adhere to this policy, it's likely that the potential negative impact of such developments have been minimized. However, it's difficult to ascertain the efficacy of this approach to infrastructure that was in existing prior to this policy.

Table 1 Shows the performance objectives that need to be achieved by developments for the effective management of water quality (Source: http://wsud.melbournewater.com.au)

Pollutant	Receiving water objective:	Current best practice performance objective:
Post construction phase:		
Suspended solids (SS)	Comply with SEPP (e.g. not exceed the 90thpercentile of 80 mg/L) (1)	80% retention of the typical urban annual load
Total phosphorus (TP)	Comply with SEPP (e.g. base flow concentration not to exceed 0.08 mg/L) (2)	45% retention of the typical urban annual load
Total nitrogen (TN)	Comply with SEPP (e.g. base flow concentration not to exceed 0.9 mg/L) (2)	45% retention of the typical urban annual load
Litter	Comply with SEPP (e.g. no litter in waterways) (1)	70% reduction of typical urban annual load (3)
Flows	Maintain flows at pre-urbanisation levels	Maintain discharges for the 1.5 ARI* at pre-development levels
Construction phase:		
Suspended solids	Comply with SEPP Effective treatment of daily run-off events (e.g. >4 months ARI).	Effective treatment equates to a 50%ile SS concentration of 50 mg/L.
Litter	Comply with SEPP (e.g. no litter in waterways) (1)	Prevent litter from entering the storm water system
Other pollutants	Comply with SEPP	Limit the application, generation and migration of toxic substances to the maximum extent practical
1 An example using SEPP (Waters of Victoria 1988), general surface waters segment. *2 SEPP schedule F7-Yarra Catchment-urban waterways for the Yarra River main stream.* *3 Litter is defined as anthropogenic material larger than five millimetres.*		

3.4.5. Columbia basin water transaction program

Unlike the other case studies reviewed above that focus on water quality, the Columbia Basin Water Transaction program (CBWT), is used to secure surface water flows to rivers and streams in the basin. The CBWTP program was established in 2002, with the mission to support innovative, voluntary, grassroots water transactions that improve flows to tributary streams and rivers in the communities of Columbia basin.

The Bonneville Power Administration in partnership with the National Fish and Wildlife Foundation established the program. The main motivation for establishing the program was due to the high water withdrawals during peak growing seasons that resulted in many streams drying up hence negatively impacting on the habitats of in stream biota, specifically salmon, steelhead and trout.

The program operates through a scheme of water rights acquisitions that are either permanent, leased, purchased or saved through water use efficiency to replenish water flows in the system (CBWTP 2011). Financial and technical support is offered to various institutions such as water trusts, state water agencies and tribes to engage in water conservation and management initiatives. Various stakeholders are involved in the implementation of the program, which include farmers, ranchers, and irrigation districts to ensure flows are sustained in the surface waters in the basin.

The program has been very successful so far with 5.8 million acre-feet of water released back into the system in otherwise chronically oversubscribed rivers and streams throughout the Columbia basin.

3.4.6. WWF-SA Water Balance Program

This water-offset program is one of the first programs to pilot the concept of water neutrality, as it was originally conceived. Under the original scheme private sector participants of the water neutral program committee to the 3Rs of Reviewing their water use, take all reasonable measures to Reduce their water use, and offset any residual water use by investing in a program that will Replenish flows (Nel et al. 2008). Replenishment was achieved by investing in removing of alien invasive species that are thought to reduce surface flows from rivers and streams.

After the initial piloting of the scheme by some key corporates in South Africa including SAB and Woolworths, some significant changes were implemented to the offset program. This was mainly because of the criticism labelled at the concept of water neutrality, whereby it is argued that a company cannot in the true sense of the word be water neutral, because replenishing water into system does not offset the impact that has already taken place as a result of the abstraction. Neutrality also requires that the water is returned to the same catchment from where the water was originally abstracted, company supply chains however transcend hydrological boundaries.

Following the challenges encountered in the initial piloting of water neutral program, and general criticism even at the global level on the concept of water neutrality, the WWF water neutral program was rebranded into the WWF-SA Water Balance Program.

The Water Balance Program still operates under the same principle of water offsetting, but is now more of a Corporate Social Responsibility (CSR), than strategic water offset program that companies could genuinely be credited for. There are a couple of reasons as to why the Water Balance program is not regarded as a strategic water offset program, firstly the program focuses on offsetting operational water use of its participants, as opposed to the entire water footprint of the company, including its supply chain. Emphasis on operational water footprint can be potentially misleading, because for a typical business such as a beverage company, most of their water footprint lay in their supply chains as opposed to their operations. Secondly, the program even though emphasizes that participants should firstly start by reviewing, reducing and then replenishing their water use, at the moment the program does not have the capacity to monitor internal water reduction schemes by its participants or the participants are not willing to emphasis internal water reduction measures because of the high cost implications.

The strength of the program is that it is was able to mobilise financial resources that are invested in protecting some the critical high water yielding catchments in South Africa. There are currently three key corporate

participants in the program with a high potential for growth, through the incorporation of more corporate participants.

3.4.7. Coca-Cola water replenish program

This case study is unique from the other case studies reviewed because it focuses on a company to try and understand how companies go about achieving their water offset goals. Coca-Cola is an interesting company to review in this regard because it has set for itself very ambitious targets for reducing their water footprint and to find measures to offset their residual water footprint, this following major water risks that the company has faced over the years.

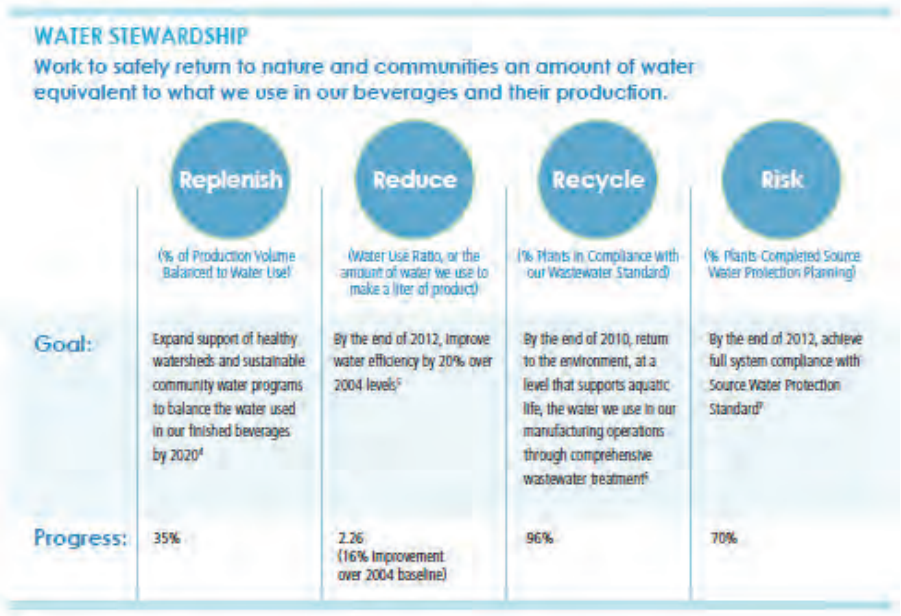


Figure 6: Coca-Cola's water stewardship goals (Source: Coca-Cola 2012)

Coca-Cola as a result was one of the first companies to endorse the concept of water neutrality and for which the company has received a lot of criticism. The company set for itself an aspirational goal to achieve water neutrality for its operations, and thought that would help them to achieve the following (Coca-Cola 2010): -

- Advance the social and water conservation science by engaging NGO's and the other science organisations such as the Water Footprint Network, The Nature Conservancy and the WWF;
- Strive to do more as the business grows by expanding their investments in watersheds and communities where they operate;
- Raise global awareness and action on the importance of water stewardship by supporting initiatives such as the CEO Water Mandate and the Global Water Challenge; and
- Driver toward a truly water sustainable business on a global scale by expanding efforts to address water risks through source water protection.

As the concept of water neutrality, water footprint and water stewardship has evolved over the last two years; the company's position on water stewardship has also evolved. As a result Coca-Cola now has very clearly defined commitments and measureable goals on water stewardship. The company has made public commitment to: -

- Leverage water for positive human impact
- Building internal water use efficiency
- Invest in environmental sustainability

- Address global water challenges

In seeking to achieve the water stewardship goals the company has set if for itself, it has made it clear that it does not mean that they intend to make less products, but rather produce more using smart technologies. For example to achieve their water reduction goals, they intend to be more efficient by:

- Using ionized air instead of water to rinse product packages
- Reusing treated process water for landscape irrigation and truck washing
- Advancing their monitoring of water use and efficiency

To achieve their water recycling goals, Coca-Cola has established internal wastewater treatment standards that apply across all their facilities globally. The intention is that all their facilities will achieve 100% of their set wastewater treatment standards, and so far 96% are compliant, with the non-compliant being mostly new acquisitions, but are being closely monitored.

In relation to their water replenishment efforts, the company reported that it balanced 35% of their total water use by undertaking diverse activities that support community needs for safe and sustainable water sources (Fig 7). The company acknowledges the challenges of accurately calculating water offsets, and has worked with The Nature Conservancy (TNC) to develop a methodology to help them calculate the correct amount of water they need to offset.

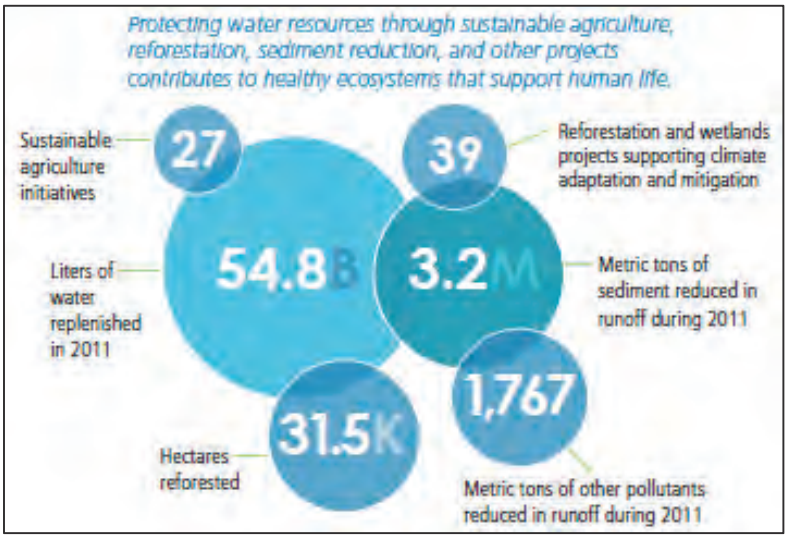


Figure 7: A schematic of Coca-Cola's progress in achieving its water stewardship targets (Source: Coca-Cola 2012)

The water stewardship program Coca-Cola has embarked on represents an increasing trend among companies that are concerned about the water risks they face and are proactively putting measures in place to manage their risks. A lot of the measures that have been instituted for managing water risk are outside the factory fence, in recognition of the fact that most of company water risk lay in their supply chains. Even though companies have traditionally engaged with their surrounding communities and invested substantially in social capital, most of those investments were on an ad hoc basis because they were not viewed as being critical for business continuity. This new trend of investing in the broader landscape as a strategy to manage company related water risk is critical, because it ensures full commitment by the company and hence interventions that the company has invested in are more likely to be sustainable in the long run.

3.4.8. Sasol: Water loss reduction project

This is an innovative partnership between a parastatal company (SASOL), a local Municipality (Emfuleni) and a donor agency (GIZ). The aim of the partnership is to undertake a water conservation project, to enable the Municipality achieve a 15% reduction in water demand by 2015 and SASOL will in turn benefit as a result of improved assurance of water supply from the Municipality in case of water shortages or during the implementation of a compulsory water reduction measures for water users.

The location of the project is in the Vaal river basin, which is a critical basin for supporting South Africa's economy, since 60% of the country's GDP depends on water from this basin. The basin however faces severe challenges as water demand has outstripped supply in the basin. It is therefore expected that drastic water conservation and demand management interventions are likely to be implemented. Such measures are likely to impact all water users in the basin as water use restriction might negatively impact company productivity.

Even though water demand has outstripped supply in the basin, the water challenges are attributable to a large extent to poor water infrastructure that in some cases result in water losses of more than 30% due to leakages. It is therefore self-intuitive that for water users to avoid potential future water restrictions, one of the most pragmatic interventions is to reduce these water losses while at the same time implementing other water demand measures. It was on this premise that the water loss reduction project was conceived.

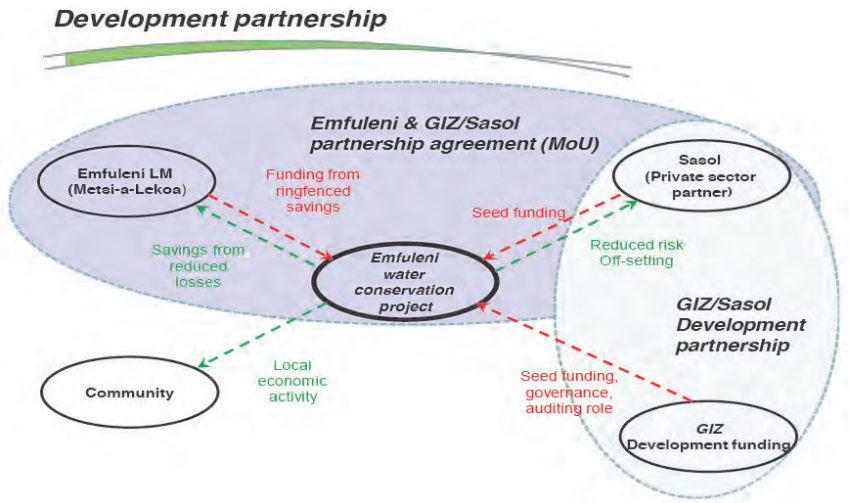


Figure 8: Conceptual model of the water loss reduction project (Source: DWA et al. 2012)

The objectives of the project are as follows: -

- Undertake initiatives to reduce physical water losses in priority areas through retrofitting and repair of leaking water infrastructure
- Raise awareness on water conservation measures to change behaviour
- Build technical skills to support water infrastructure maintenance

Expected outcomes of the project are as follows: -

- Reduce water loss in the Municipality by 12 million m^3 by 2014
- Increased revenue for the Municipality
- The project has a potential spinoff effect of job creation as a result of the skills development including technical personnel required to fix the leakages.

- Improved assurance of supply for SASOL as a result of the commitment to invest such substantial amount of resources.

The figure 8 illustrates how the project is being operationalized, indicating the role of the key players and the flow of benefits between the stakeholders (Fig. 8). Under this arrangement, funding is provided by SASOL and GIZ under a private-public partnership arrangement, to undertake water loss reduction activities among other initiatives. The Municipality is not required to provide funding at the onset of the project; however funds generated by the Municipality as a result of savings from reduced water losses are ring-fenced for future water conservation interventions. GIZ in addition to providing the partial funding plays a critical role of providing oversight to ensure that agreed decisions are adhered including procurement procedures. The expected beneficiaries of the program are as follows:

- SASOL, who could potentially receive future preferential treatment in case the water authorities implement water restriction measures in case of severe water shortages. The preferential treatment could be based on the fact that the company helped the Municipality to reduce their water losses hence helped to replenish water into the system.
- Emfuleni Municipality, benefits from the program by making financial and water savings as a result of the water leakage reduction initiative.
- Local Community, more water is freed up for the local communities to benefit from by engaging in productive economic activities. Communities could also benefit from jobs that are created in the course of implementing the water conservation measures, in addition to skills development.

In summary this case study is a good example of a company that tries to manage its water risk and in the course of creates shared value for everyone involved. Many companies have recognized this kind of thinking and tools are starting to emerge that help companies understand their risk better (WWF 2011) and guidelines that provide a framework for companies to engage in collective action (CEO Water Mandate 2012). Even though this project is still more less a pilot study and the benefits have not yet started accruing, it could potentially be a game-changer on how water offset schemes are implemented under complex private-public partnership arrangements.

3.5. Application and opportunities for water offsetting in South Africa

Market based approaches present a potentially useful approach to incentivize water resource management in South Africa. It should however be noted that South Africa presents very unique challenges that might hinder the effective application of such innovative approaches. For example South Africa has an excellent water management framework, but due to lack of capacity its implementation is a major challenge. In addition to that is the historical baggage the country is still carrying, where access to water resources has not yet been equitably distributed. The introduction of market driven approaches to water management is therefore likely to encounter serious implementation challenges due to negative perception of market driven mechanisms.

To implement market based approaches require a rigorous capacity building and awareness rising to take place at all levels of society, ranging from the public to private sector and communities, to build understanding on the opportunities such approaches present.

It is also important to note that some of the market based approaches being advocated can simply not work in South Africa's situation. For example wetland mitigation banking, cannot work in South Africa because of the complexity of implementing such a scheme and the fact that it could be open for abuse.

Some market based approaches such as water quality trading schemes being implemented on the Greater Miami River, and programs that are based on the acquisition of water rights could potentially be implemented in South

Africa. Indeed the case studies drawn from South Africa reflect this trend, with the SASOL and WWF case studies focused on flow replenishment into river systems.

There are various opportunities for water offsetting in South Africa ranging from the policy level to catalytic initiatives on the ground.

- There is wide recognition that water poses a major challenge to South Africa as a result of increasing scarcity and changes in consumption patterns that is going to impact all sectors of the South African economy. This has led to various players both in the public and private sector to implement risk mitigation measures to reduce their potential exposure to water risk. As a result there is appetite for innovative approaches that could help steer the country away from perceived threats the country is facing.
- There is a suitable policy framework under which innovative water offset schemes could be implemented. Both the National Water Act, 1998 and the Water Services Act, 1997 have clearly defined the role of various water users and the regulatory obligations they are expected to meet in relation to their water use and how they impact others. For example the water pricing strategy clearly outlines the mechanisms for how water resources should be financed; with water user obligations are clearly defined. The Waste Discharge Charge System (WDCS) will also come up with a clear mechanism for levying charges on water users that discharge waste. This creates the potential of generating credits that can be exchanged between willing buyers and sellers in the landscape.
- The fact that the National Water Resource Strategy (NWRS) is supposed to be regularly updated presents an opportunity at the policy level to insert any new provisions that might be required to facilitate the implementation of water offset schemes if such approaches are approved by the regulator.
- As shown in the South African case studies reviewed in this study, the concept of market based approaches is not new to South Africa; the key issue that needs to be explored is how these innovative approaches that are being implemented can be scaled up, whether voluntarily or under some form of a regulatory mechanism.

3.5.1. Proposed framework for water offsetting

In a separate study (DWA et al. 2012); a comprehensive framework for the application of water offset in South Africa was developed, with key elements of the proposed framework summarized below.

The water offset program, that was commissioned by the Department of Water Affairs was aimed at reviewing the potential of implementing water offset scheme in South Africa, with the specific objectives of: -

- Promoting the adoption of voluntary offsetting, as a precursor to future mandatory and regulated water offsetting;
- Defining potential participants in water offsetting including both providers and purchasers;
- Provide a basis for developing generic rule, conditions and guidelines for participation and trading;
- Provide a basis for defining the units of exchange for water credits
- Provide incentives for widespread adoption of offsetting instruments
- Guide and inform the development of a water neutral scorecard measured program
- Incentive private and public enterprises to develop the capacity to adapt their business strategies to purse their water sustainability objectives both in their direct operations and supply chains.

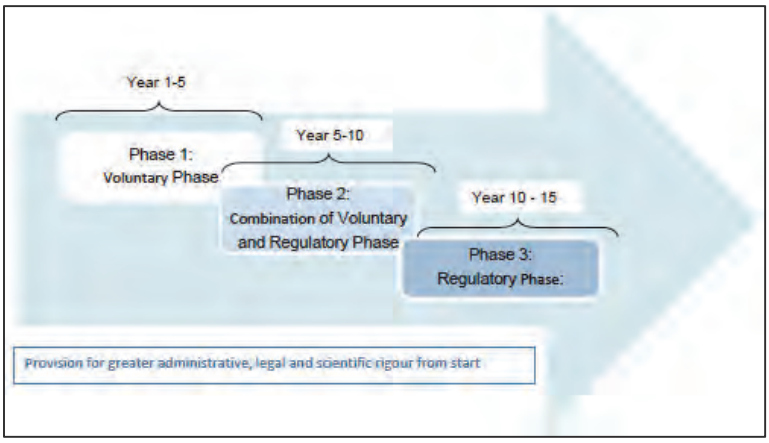


Figure 9: Implementation phases of the proposed water footprint framework (Source: DWA et al. 2012).

The proposed framework for water offsetting is comprised of three phases, which comprise of i) voluntary phase, ii) combination of voluntary and regulatory phase, iii) regulatory phase. Each of the phases is seeking to achieve a specific objective in the proposed water offset framework, as outlined below (DWA et al. 2012).

Phase 1: Voluntary Phase (5 year process): This initial phase is to gain acceptance and legitimacy to encourage participation.

Phase 2: Combination of Voluntary and Regulatory Phase (10 years): Although still mainly voluntary, during this phase DWA as Regulator will step up controls to enforce compliance by organisations to:

- Quantify their water footprint,
- Start defining and implementing water reduction targets
- Enforcing compliance in terms of license conditions specifically relating to abstraction limits and effluent discharges

Phase 3: Regulatory Phase: (15 years): The long term goal is that water offsetting will be part of a fully regulated system, which will also facilitate the transition to fully operational markets system in terms of aspects such as Water Trading, Water Credit Trading and Water Futures. In addition it will start having significant impacts on decision-making with regard to allocation of water resources, water resource development and limitation on effluent discharge.

If this proposed water offset program framework is accepted by the DWA, it will be the first attempt to recognize water offset schemes at the policy level and could pave the way for the implementation of such schemes in South Africa if a well-defined policy framework is established.

3.5.2. Water and offsetting observations

In summary market based approaches are gaining traction globally as innovative tools for addressing the global water crisis, as shown by the various case studies that have been outlined. In South Africa the opportunity for using such innovative approaches have been recognized and there are some potentially catalytic projects that are being implemented. From a policy perspective however, the government has shown signs of exploring such approaches as evidenced by the recently commissioned study that sought to develop water offset framework.

There is a need to test further the efficacy of market-based approaches before they can become official water policy in South Africa. This is important because innovative tools are often conceived from a theoretical perspective and when tested on the ground, in many cases they might not be feasible because of design flaws

that may hinder their uptake. The concept of water neutrality is a good a concept of an innovative approach that could not be implemented as originally conceived, without it being perceived as misleading, because in practice it's impossible to be water neutral.

Even though market based approaches hold massive potential, their application can only be undertaken under a specific context, especially in South Africa where major challenges in water policy implementation are still highly prevalent. For example, one of the most important sources of pollution is effluent from informal settlements, which is attributable to lack of effective service delivery; such a problem can therefore not be addressed through market-based approaches. It's therefore important to note that market based approaches should not be seen as the panacea to addressing the country's water challenges, but rather complement well established and tested mechanisms for water management.

4. WATER RISK TOOLS

Current water risk assessment tools are being used by companies to "calculate enterprise-wide and product water footprints" (Sarni 2011). Water stewardship requires productive stakeholder engagement at the watershed scale, hence companies need to know how they are using water and be aware of options to improve water management. Water risk tools, the majority of which use some form of water accounting methodology, contribute to a company's understanding of its water situation. Other tools are targeted towards financial institutions, and investigate the extent of water risk disclosure by corporate companies.

Water-related risk information may be gathered and used in numerous fashions by different sectors and stakeholders. Risk information is either targeted towards financial institutions or corporate companies themselves. Tools aim towards disclosure of risk information, or help companies and financial institutions filter their most imminent risks. Additionally, risk data may be used at a basin or country level for public sector planning.

Before risk pertaining to a location or company may be identified, an understanding of the water situation is required. This is most often done through water accounting. In order to itemise and understand water risk, a form of water accounting needs to take place so that the status quo of the water resource is understood. Although water accounting has not yet reached the level of standardisation achieved by carbon accounting, methodologies and tools for water accounting are emerging (Sarni 2011).

The following figure indicates the different roles of water accounting tools in helping to assess, respond or disclosure water risks.

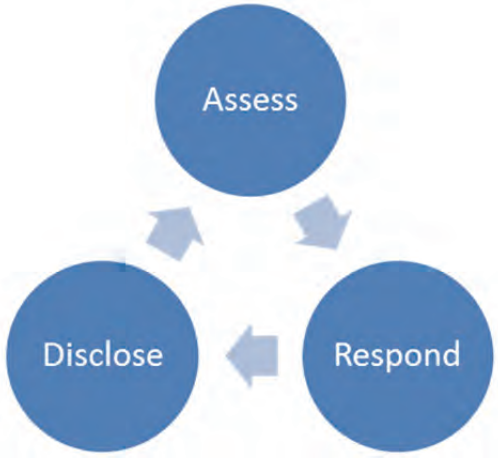


Figure 10: Functions of water risk tools

Water footprint analyses can be used within a number of assessment, response and disclosure tools in order to collect information. Ultimately the WF tool is most useful in the disclosure and assessment phase of water risk awareness. A water footprint analysis alone is unable to interrogate the equivalent catchment impacts without the use of an additional contextualising tool, or by carrying out a sustainability analysis.

The following examples of tools mirror the focus of whether or not they are primarily built to assess, disclose or response to water-related risks. Related to the above framework is whether or not the assessment is for internal purposes, disclosure to investors or to customers/consumers or government. Responses may be to mitigate risks internally, or they may be to dispel concerns in the catchment at a reputational level.

The World Business Council for Sustainable Development (WBCSD) Global Water Tool is an example of a "dashboard" tool which is particularly helpful in assessing risks. The second risk tool example has been developed by the World Resources Institute (WRI) as a manner through which companies may assess their risks geographically within a catchment scale. This form of assessment is useful in understanding water risks associated with the context of the region. The third risk tool example has been developed by WWF and DEG. The Water Risk Filter includes an information collection phase of the facility in addition to geographic contextual information. Therefore, this tool attempts to act as a bridge between the assessment and disclosure forms of risk tools. The Water Risk Filter also has mitigation response options.

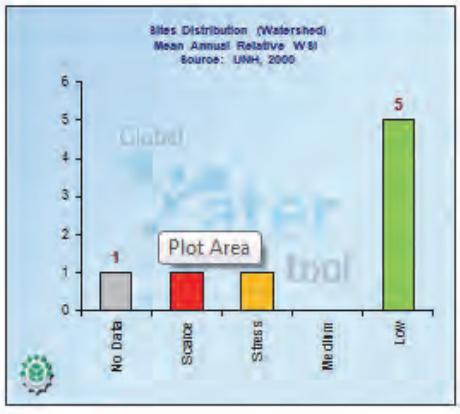
4.1. World Business Council for Sustainable Development Global Water Tool

The WBCSD tool has become commonly used among the private sector as the tool aims to help corporations and organisations map their water use. The Global Water Tool also helps assess risks across their global operations and supply chains. The tool may be used to compare sites with key external water-related data, to create indicators, inventories, and risk and performance metrics and do geographic mapping. The output of the tool may allow comparison of the company's water use with water supply and treatment availability on a watershed scale. The ultimate goal is to enable effective risk management and improved communication with stakeholders as water consumption and efficiency are calculated. Through clarifying relative water risks at a global scale, prioritisation of particular water risks within a catchment is possible.

The tool is publically available to enable widespread use. Excel based, the tool requires water use and discharge as inputs. This is then linked to the regional/national water data according to the coordinates entered of the business or organisation. The tool is very good at risk hot-spotting globally. The figures below illustrate one of the possible outputs of the Global Water Tool, comparing types of industry and their water stress.

c) Mean Annual Relative Water Stress Index (WSI) (Source: UNH, 2000)

Sites	No Data	Scarce >1.0	Stress 0.4-1.0	Medium 0.2-0.4	Low <0.2
All Sites	1	1	1		5
	13%	13%	13%		63%
Industrial		1			3
		25%			75%
Office/Retail			1		1
			50%		50%
Suppliers	1				1
	50%				50%



The scope of the tool is water specific, providing a rough measurement of water use efficiency and assessment of key impacts. The output determines relative water-related business risks in addition to providing information on countries and watersheds. The tool involves many disparate components including key water GRI indicators, inventories, risk and performance metrics and geographic mapping.

Companies have used the tool in different ways. For example, The Dow Chemical Company used the tool to show that nearly 40% of its sites around the world will experience some degree of freshwater stress by 2025, and it also helped inform the development of sustainable water management strategies for these sites. Lafarge used the GWT at both corporate and site levels, and found it particularly powerful for raising awareness. Caterpillar customized the GWT to make its own set of water metrics combining external

information and water use. Sites that are ranked as medium and high-risk are then analysed further. And PepsiCo inputted data for more than 600 of its site into the GWT, which provided compelling visuals through maps and Google Earth. The company uses the GWT with local employees, communities, suppliers and technical experts to reduce their water impact. Importantly, the GWT fits well with other water tools, for example both Dow and Caterpillar combined the use of the GWT with the Global Environmental Management Initiative's 'Collecting the Drops: A Water Sustainability Planner,' while Lafarge and PepsiCo linked it to their testing of the Water Footprint Network's methods)

- **Target:** Operational water use of private companies
- **Scope:** Global scale
- **How:** Excel based tool
- **What:** Risk indicators

Advantages:

- The Global Water Tool is increasingly recognized as the best available approach for companies to assess water risks and has been endorsed by the Global Reporting Initiative, applauded by the Carbon Disclosure Project, and integrated into Wal-Mart's Supplier Sustainability Assessment.
- Large amount of data free of charge
- Used by many corporates already and map potentially be altered to include public sector fields.

4.2. World Resources Institute (WRI) Aqueduct Water Risk Tool

Current water tools do not factor regulatory and reputational water risk and opportunity to their clients, instead only assessing physical risk (Sarni 2011). Hence the development of the Water Initiative, released by the World Resources Initiative (WRI), General Electric (GE) and Goldman Sachs (GS) which quantifies the corporate risk and opportunities facing companies and their investors. The goal of the initiative is to standardise a water index able to identify and mitigate water-related corporate risk. 20 weighted factors capturing water quality, availability, regulations and reputational issues were aggregated to achieve the index.

The water index is designed so that water risks are communicated transparently to companies and investors. Publically available data is used regarding physical scarcity of water and water quality, coupled with regulatory setting, social factors and reputational issues. WRI, GS and GE believe that the water index will allow each of the companies to provide more robust analysis of water risks and opportunities to their clients (Sarni 2011). Ultimately, this mapping tool will allow users to combine and compare different components of the water risk assessment.

The figure below depicts the framework of the WRI Risk Water Index. The three categories were determined by WRI in collaboration with industry experts, financial analysts, and water specialists. The indicators were chosen based on their relevance to company managers as well as the data availability in the public domain: *Access and Growth Constraints: are risks from increasing water scarcity.*

- *Cost Risks: are risks from deteriorating water quality, more stringent regulations, or increasing water prices.*
- *Disruption Potential: are risks from poor water governance, increasing competition for water resources and social concern around water issues.*

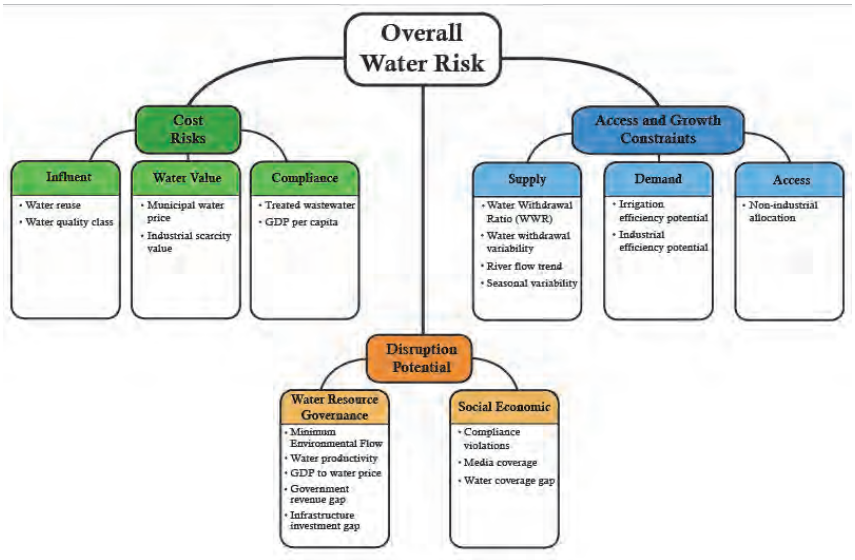


Figure 11: Aqueduct risk evaluation framework

The tool is still under development. On completion it will be an online based risk analysis for the river basin a company is located in. It is intended for investors, and is good tool for location hot spotting. The figure below shows the high level risk analysis data available for countries that have not been further researched.

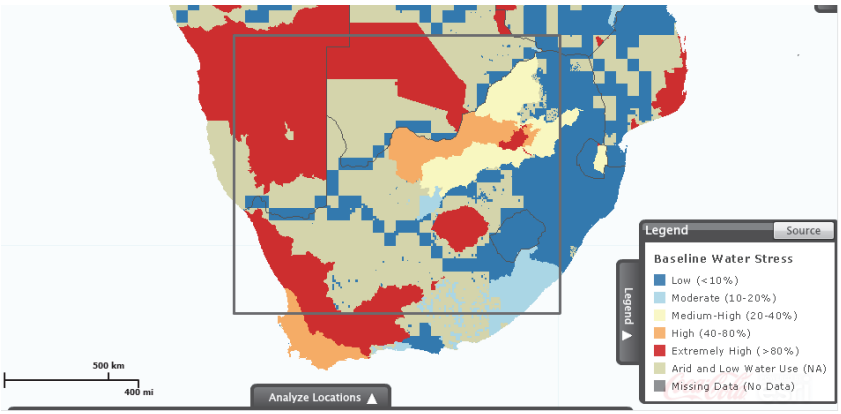


Figure 12: South Africa Aqueduct Risk Profile

Aqueduct is able to highlight potential problem areas and facilitate engagement between public and private stakeholders seeking to address water risks. “In many regions around the world, water scarcity from climate change and pollution is starting to impact a company’s performance, yet few analysts account for water-related risks,” says Jonathan Lash, President of WRI (Press release 2007).

There are three different levels to the prototype version of the Water Risk Atlas: Inputs, Results and Map. The inputs allow you to choose the basin being analysed and allows one to select pre-set risk profiles established by WRI and industry experts. The map button calculates the water risk for the river basin based on the indicator weights selected by the user. The overall water risk score is revealed by a number indicating the level of risk faced by the industry selected relative to the Yellow River Basin (current full example available on the website).

This initiative to measure water risks and opportunities is sponsored and supported by Goldman Sachs, GE, and the World Resources institute. Coca-Cola have been integral in the development of the program, and have contributed comprehensive, geo-spatial water resource data, algorithms and modeling capability.

Numerous opportunities for expansion of the tool have been highlighted. These include:

1. Depictions of current water, energy and agriculture using baseline global water stress with additional overlays depicting:
    - Locations of rain fed and irrigated agriculture
    - Locations where a small number of key food/energy crops are cultivated (rice, maize, soy, palm oil, etc.)
    - Locations of thermal and hydropower electrical power generation facilities
2. Depictions of water, energy and agriculture under carious IPCC scenarios of water use, population growth, economic development and climate change in 2025, 2050, and 2095; using maps of long-term change in water stress, visual overlays will be added depicting:
    - The locations of rain fed and irrigated agriculture
    - The locations where a small number of key food/energy crops are cultivated.
    - The locations of all thermal and hydropower electrical power generation
3. Bar charts summarizing the global exposure of food and energy system to water stress and changes in water stress over time (current through 2095).

- **Target**: Financial institutions and companies
- **Scope:** Large catchment areas. National aggregate data used.
- **How:** Index calculated with 20 weighted factors informing water stress
- **What:** Map indicating areas of risk

Advantages:

- Large amount of support
- Clear and easy to understand map output
- May interrogate different types of water stress or scarcity

4.3. WWF-DEG Water Risk Filter

WWF and the German Bank DEG recently issued a report providing a practical approach for financial institutions to assess their water risks. The report also gives details of a practical tool created to help investors understand and analyse their exposure to water-related risks (Water 21 2011). The report indicates that business risk may be categorised into three inter-related themes: physical risk as a result of too little, too much or polluted water; regulatory risk which results due to the stricter regulation required as water availability reduces and reputational risk which involves the public and media awareness regarding how well companies are handling the resource scarcity. These risks may cause “disruption of supply, and in worst cases, termination of business operations” (DEG and WWF 2011).

The risk evaluation itself is divided into basin-specific and company-specific risks. The Water Risk Filter also has a pre-assessment that only requires basic input of the country or basin the company is located in as well as the relevant industry sector. The enables a high level risk screen at the first point of contact. The pre-assessment tool screens potential high risk countries by sending them an online water risk questionnaire containing questions on water use, monitoring processes, governance and regulation. The World Business Council for Sustainable Development Global Water Tool is then applied to the responding countries. This creates a bank of high-level water scarcity information at river basin level, which is the input parameter for the Risk Filter.

Companies are mapped as overlays on two GIS maps, one representing the threat to human water security and biodiversity and the second showing the proximity to WWF’s priority river basins. A set of risk indicators based on

publically-available datasets chosen and compiled as part of the project are used. This includes country datasets of detailed descriptions of the country risk and 33 relevant water indicators. All of these resources are used by the Water Risk Filter to highlight areas that may require special consideration concerning the company's water risk exposure.

The goal of the Water Risk Filter is to quantify the water related risks for a certain investment. The risk methodology seeks answers to a set of carefully drafted questions which result in scores, and which have certain weightings to eventually determine the risk level of an investment. This is in line with standard risk assessment methodologies. The difficulty is to determine the right set of questions (also called risk indicators), a predetermined set of potential answers, scores and weightings that reflect the importance of the answer or indicator, respectively. Furthermore, the risk indicators should reflect the influence of a company's geographical location (river basin), and of both the direct (own) and indirect (supply chain) operations of the company. By splitting these basin and company related risks, the risk framework developed for this project results not in a single risk level per investment, but provides a high level strategic direction for the investor.

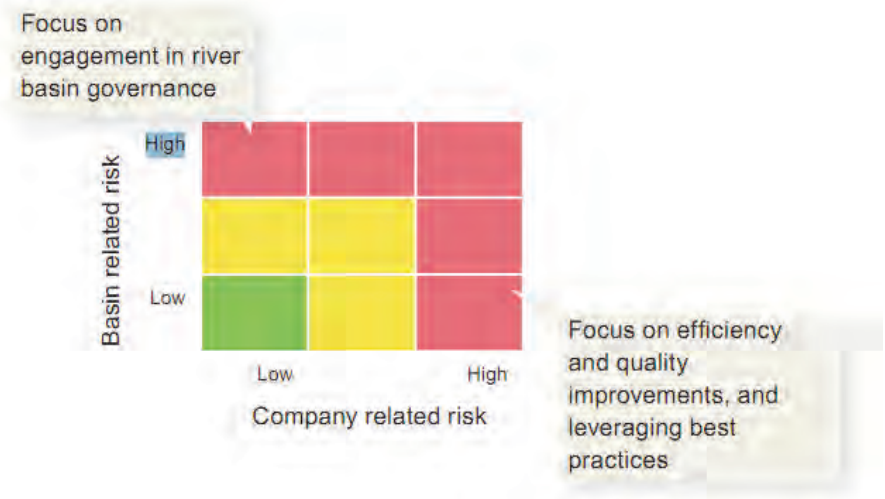


Figure 13: Conceptual Framework of the Water Risk Filter

The Water Risk Filter consists of two different parts:

- A pre-assessment tool to be used for all client companies, to attain a high-level water risk indication. The full Water Risk Filter shall only be used when the pre-assessment tool returns a high risk.

- A comprehensive Water Risk Filter, which contains a thorough and holistic risk assessment.

The calculated risk levels in the Water Risk Filter are reflected on two levels, a matrix in which all assessed companies are plotted and as detailed risk levels for the specific company.

The matrix as shown in figure 8 below provides an overview of the risk levels of DEG's portfolio. It shows which companies should focus more on internal solutions or external solutions. If the risk assessment can be performed on an annual basis, progress in risk mitigation across the portfolio can be monitored.

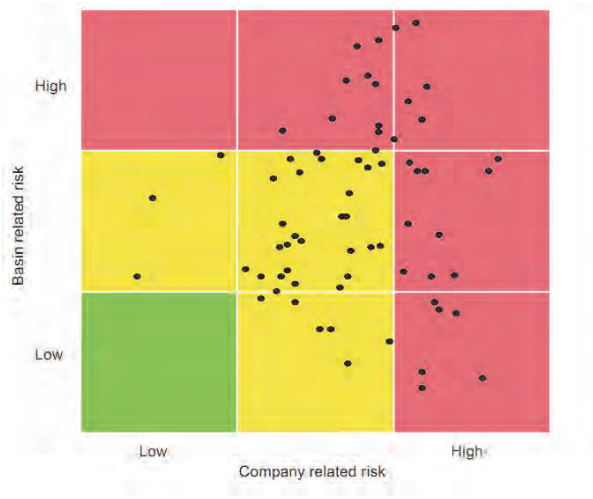


Figure 14: Results of the Water Risk Assessment of DEG's portfolio

More detailed risk levels for all companies can also be displayed. This provides useful information to engage with a specific company to actually begin to explore efforts to mitigate aspects of certain water risks. The company and location specific results are shown in two ways. First, in the 'heat map' the basin and company related risks are split into more insightful risk indicators, showing Physical (with quantity, quality, impact on eco-system, dependence on hydropower and supplier's aspects), Regulatory and Reputational risk levels. The colour coding visualises the resulting risk levels (green represents low, yellow medium, and red high risks)

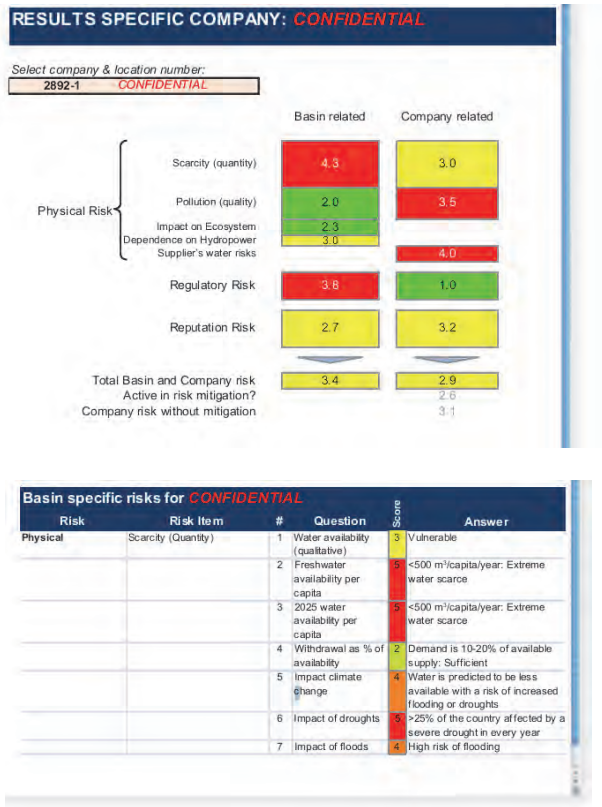


Figure 15: Heat map of an individual company Water Risk Assessment

- **Target:** Financial Institutions
- **Scope:** Local and global
- **How:** Pre-assessment and in-depth risk assessment questionnaire.
- **What:** Risk factors for different investment opportunities, within company and between companies

Advantages:

- Considers water risk specifically
- Output is clear and easy to understand
- Large amount of data used to support findings

5. REPORTING AND DISCLOSURE

Water footprint assessments play an important role in helping companies meet their reporting obligations to either investors, the regulator or to consumers. Due to the increasing level of awareness on water risks, companies need to develop a good understanding of their dependence on water and to satisfy its stakeholders including the regulator. Water footprint assessments therefore play a critical role in helping companies collate information on their dependence on water and use it for various purposes, ranging from developing internal water management and risk mitigation strategies to informing interested investors on the water related risks the company faces. In this section there are a few examples of how water footprint assessment could be used to meet reporting and disclosure requirements.

5.1. Sustainability Reporting

All companies in one form or another are required to provide information on their business activities, either to the regulator, investors or the general public. This is because companies are not operating in a silo but rather a microcosm of society and with that comes some level of responsibility to report to their various stakeholders.

Sustainability reporting is used by companies to provide information on their economic, Environmental, and Social and Governance (ESG) performance. This kind of information is used by various stakeholders such as governments to ensure that companies operate within the set regulations and by shareholders to monitor the performance of the company.

Sustainability reporting is regarded as key principle of corporate governance, with listed being obligated to produce annual sustainability reports. In South Africa the King III report (IODSA 2009) provides the framework for sustainability reporting. Even though the King III report is not a law most of its principles and guidelines are reflected in the Companies Act, 2008. Johannesburg Stock Exchange (JSE) has also adopted King III as the reporting guide for listed companies.

Water footprint assessment is a source of useful information for sustainability reports. For example SABMiller used water footprint assessment of their beer products to set a target for how much water should be used to produce a bottle of beer. Without knowing the water footprint of beer, it would have been difficult for SAB to set very clear targets to achieve that water management goals.

Sustainability reporting is not only important for companies to report on the performance in relation to the ESG, but it also helps companies to gain some value from their efforts in such initiatives through gaining competitive advantage.

Sustainability reporting does not only serve external needs but also helps to identify gaps and opportunities internally to consolidate a company's product and process, in addition to rallying wide internal support.

Over the years, corporate sustainability reporting has been increasing, as many companies are starting to focus on achieving the triple bottom line of environmental, social and corporate governance (ESG). As a result the application of tools such as the water footprint assessment is starting to gain wide acceptance.

5.1.1. Global Reporting Initiative (GRI)

The Global Reporting Initiative (GRI) provides the frameworks that companies can use as a guideline for their sustainability reports. The GRI frameworks used by companies to report their EGS performance include reporting guidelines, sector guidelines and other resources to ensure organizations are transparent on their EGS issues.

A distinguishing feature of GRI reporting format is that it strives to make EGS reporting comparable to financial reporting. For example, one of GRI's key recommendations is that sustainability reporting and annual reports of companies should be integrated into a single report. This would allow sustainability reports a comparable level of scrutiny as the financial report of a company.

The GRI frameworks are widely used and regarded as the most credible standard for sustainability reporting because they were produced through an extensive process of stakeholder consultation. This multi-stakeholder process involved wide consultation with representatives of various sectors including business, civil society, labour, investors, academics and governments among others.

In South Africa, many large companies with global linkages use the GRI reporting format, and the King III Report also recommends it as a preferable format for corporate reporting.

5.2. CDP Water Disclosure Project

The water disclosure project is a global reporting framework on water use by key companies, as a way of helping them understand their water risks and to drive sustainable water management in general. The CDP-Water Disclosure is driven by investors who are concerned about the water risks faced by the companies they invest in and are keen to get assurance from companies that they understand their water situation and are putting measures in place to manage their potential risks.

Each year companies listed in various some key stock exchanges globally are sent a questionnaire requesting them to disclosure their water use and any risks they face and the mitigation measures that have been put in place. In 2012 for example the CDP Water Disclosure, supported by 470 key investors sent out information request to 318 companies listed on the FTSE Global Equity Index Series (Global 500). Key findings included the following (CDP Water Disclosure 2012): -

Most of the companies surveyed (53%) reported that they have experienced water related risks in their operations that have resulted in business interruptions and damage to property as a result of extreme events such as flooding, with a financial cost as high as US$200 million;

Better water management by a company presents a good business opportunity for sale of new products or services, which helps build the brand of a company;

However, companies also reported that even though the risk posed by water is recognized by companies, it is still not being viewed as a strategic risk and hence there is little buy-in at the board level, which is critical for the provision of oversight on water related policies, strategies and plans;

There is an increase in the level of awareness on supply chain water related risks by companies. This is critical for a holistic approach to managing water risks of companies whose water footprint largest water footprint in many cases is in the supply chains.

The above summary of the CDP Water Disclosure findings, clearly show the significance of doing a water footprint assessment. The water disclosure information request is categorized into three key section related to water management and governance, risks and opportunity and water accounting. The set of questions on water accounting deal exclusively with information that is generated from a water footprint assessment, such as the impact of a company's operations on local habitats and company action and outcomes related to their impact on other users.

South Africa faces enormous water challenges related to an increasing population with demand having outstripped supply, poor water infrastructure and declining water quality have all been translated into a potential risk for companies operating in South Africa. Companies face the risk of water supply interruptions both in their operations and supply chains, poor water quality with associated treatment costs and reputational risks for high impact companies. This has motivated some companies, especially the large multinationals and key public sector enterprises to start reviewing their relationship with water, implement strategies and publically disclose their water related business for clients and investors.

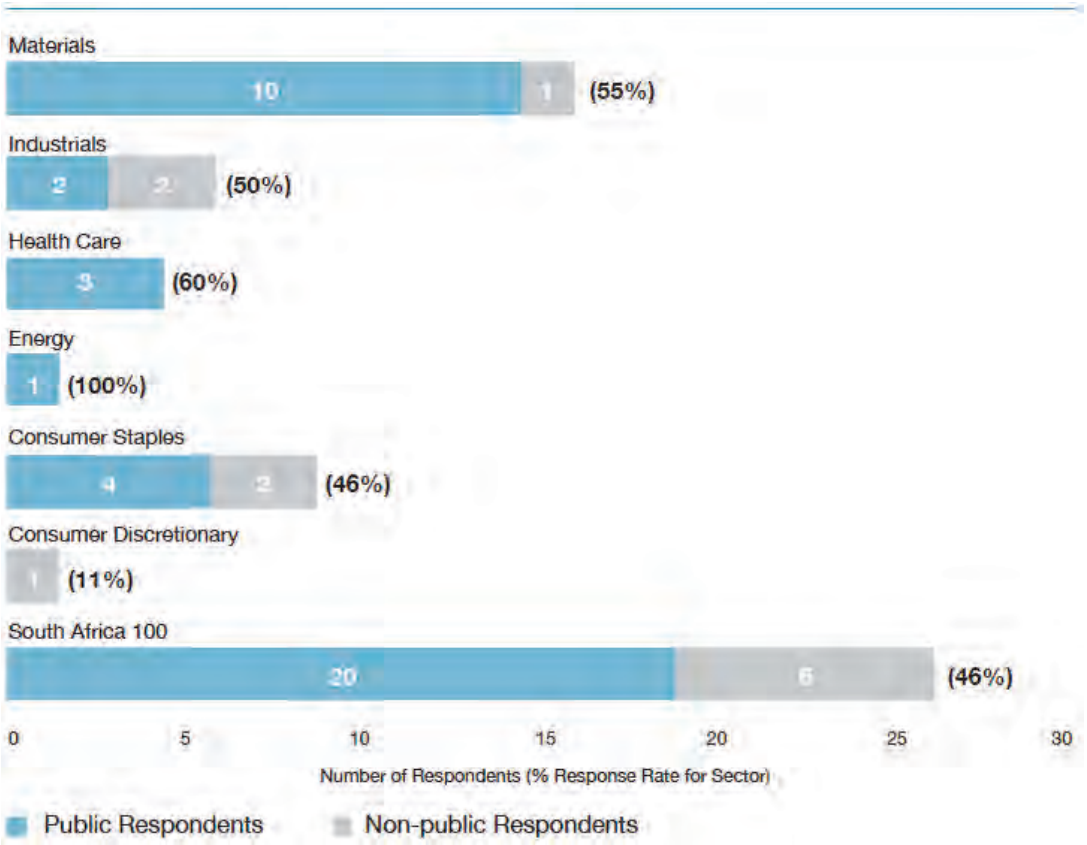


Figure 16: Profile of sectoral participation in the CDP Water Disclosure Report for South Africa

Companies perceive participation in the CDP Water Disclosure as a major step in satisfying investor concerns regarding the risks companies face and the mitigation measures being implemented.

In South Africa, the water disclosure has been implemented twice so far in 2010 and 2012. In 2012, a total of 56 companies from the 100 largest companies listed in the JSE were invited to participate in the water disclosure project. A total of 26 companies responded to the survey in addition to 6 other companies that voluntarily disclosed their information. Most of the key sectors in the South Africa were represented, with the consumer discretionary sector having the lowest response rate (11%).

The key issues that companies reported on in relation to their water related risks are summarized below:

The level of risk and opportunity reported by South African respondents is both widespread and substantial. This finding illustrates that a majority of companies recognize that water can be a serious impediment to business, and should provide the impetus for companies to develop robust water strategies.

Respondents are much less confident in identifying and reporting on supply chain water risks. This is a clear indication that many companies have still not undertaken a comprehensive water footprint including their supply

chains. Indeed only a handle of companies in South Africa have measured their water footprint. It can however be expected that as companies recognize the importance of understanding their supply chain water risks, the uptake of water accounting tools including water footprint tools will increase dramatically to satisfy the information needs.

In relation to taking action in response to water risks faced by companies, the water disclosure survey identified the following key issues in South Africa:

- There is a mismatch between the magnitude of identified risk and the governance of the risks.
- South African companies are recognizing that water stewardship requires multi-faceted action, which includes local stakeholders and cooperative partnerships.
- There is a need to improve target setting as well as verification of water accounting data
- An accepted common approach to corporate water accounting principles is needed.

The summary of responses above, illustrate how the questions asked in the water disclosure survey span then entire spectrum of the water footprint assessment protocol. For example companies required disclosing whether they have a water strategy, how much water they are using and if they have identified any perceived risks, and how they are responding. All these questions are broadly aligned to the water footprint assessment protocol, which range from setting a goal to water accounting, sustainability assessment and response strategy.

The issue that is not clear from the water disclosure survey is lack of adequate information on the tools that companies are using to generate the information being solicited in the surveys. This is quite important as it would give some insight into the robustness and credibility of the information companies are disclosing. Companies need to be encouraged to use the many readily available tools that could help to effectively account for their water use and in turn help build traction for a wider uptake of these tools and approaches.

5.3. Alliance for Water Stewardship

AWS was established in 2009 and is comprised of a number of organisations globally in an effort to develop an international water stewardship standard. Similar to the Forest Stewardship Council (FSC), the aim of the AWS is to develop market-based standard that will help companies to achieve set sustainability standards for catchments. These standards if well implemented could potentially lead to improved flows in rivers, water quality and the protection of high conservation value areas. The key motivation for developing the AWS standards is based on the premise that current regulatory tools are inadequate in proactively driving water stewardship even though they manage water use to some extent (Hepworth et al. 2011).

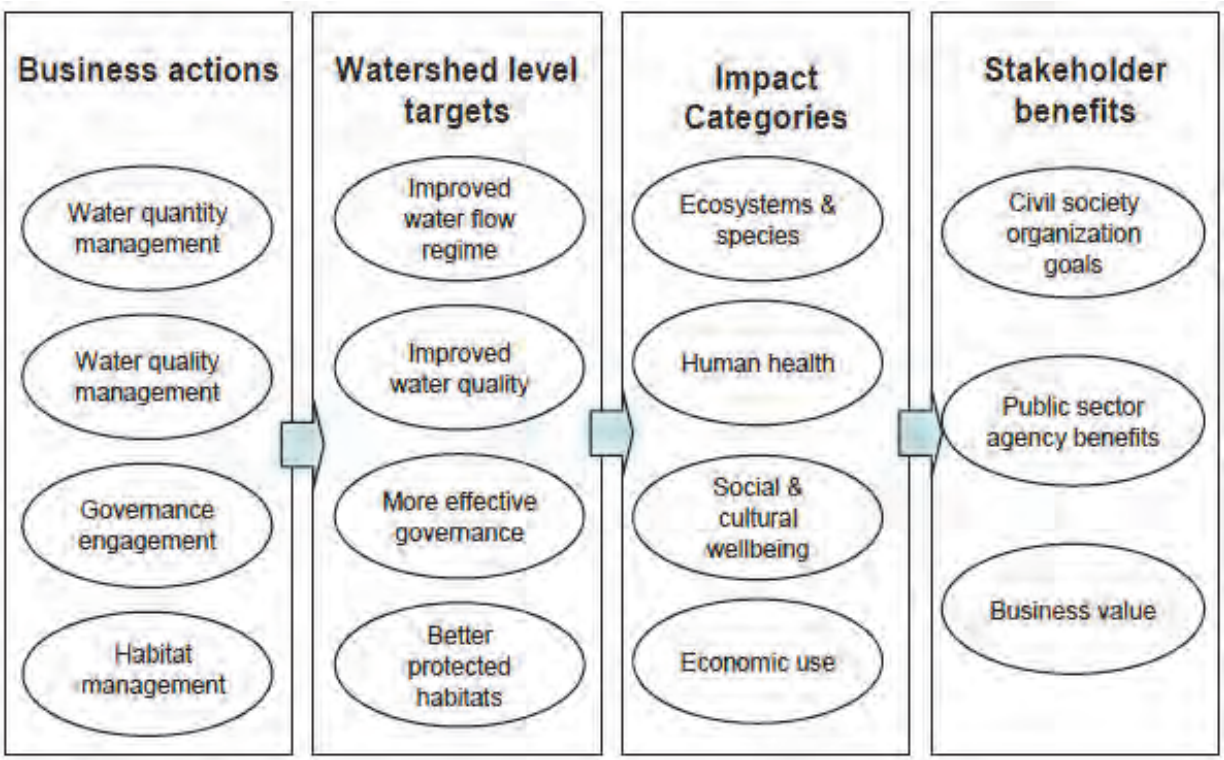


Figure 17: Theory of change as outlined by AWS

AWS intends to work with stakeholders, specifically business to ensure that any actions they take in relation to catchment protection will result in benefits to various stakeholders in society that are reliant on ecological services shared by business. This effect, for the last 3 years AWS has been leading a global roundtable of key stakeholders to develop the water stewardship standards, with various case study pilot to try and refine the standards. A final beta version of the draft is due for realise in 2013, with on-going tests and development of cases in various regions globally.

The draft standards are is comprised of 6 key steps as illustrated below:

Step 1: Commitment to the Standards

This is probably the most important step in the AWS process, where it requires stakeholders to voluntarily commit to participating in the implementation of the standards. This requires buy-in from the leadership of the organisation to ensure effective participation in the process through time and resource allocation and driving regulatory compliance and rights related issues. The criteria for assessing commitment to the process will include the development of a water strategy by the organisation, and the level of compliance with legal and regulatory requirements, and participation in other related initiatives.

Step 2: Gather and process information

Once a participant has shown commitment, this need to be translated into action and one of the critical issues is to gather information that would help the stakeholder to implement the standards. Information on water use trends, its impact and stakeholders among others is required to develop the water stewardship. Companies that have undertaken a comprehensive water footprint assessment will be in better position to gather this information, as they would have done so in the water footprint assessment.

Step 3: Plan how the AWS will be implemented

This step is concerned with how a specific site that would like to implement the standard envisages its performance and that of the catchment being improved. Some undertakings in this step could include creating a site water stewardship plan, implementing a legal compliance and contributing to a catchment plan. The key issue in this step is that the information gathered in the previous steps need to speak to implementation plan, to build a coherent story.

Step 4: Implement

Effective implementation of the plan needs to take place, while at the same time risk mitigation and improvements in performance are being managed. Specific issues to address in this step include, improving water balance, site water quality and the status of important water-related sites amongst others.

Step 5: Evaluate

This step is intended to review how the site has improved relative to the actions that were defined in the plan in Step 3. The evaluation should include a comprehensive review of the lessons learnt to inform the next iteration of the action plan defined earlier. Based on the results of the evaluation, the action plan might be revised in order to achieve the desired results.

Step 6: Communicate and disclose

Transparency and accountability are extremely important, and one way of ensuring that these principles are adhered to is through open communication and by disclosing how much progress has been achieved relative to the commitments that were made. Disclosing is also useful for informing potential investors who might be concerned about the risks faced by the companies in which they have invested their funds.

Therefore it is evident that WF assessments are extremely useful in developing understanding on how water is used to produce goods and services, and this information could be used to develop strategies for water management and reporting requirements. If AWS or similar initiatives receive wide uptake or is enforced through regulations, information generated from water footprint assessment of various entities such as catchments, a company or a product will be vital for informing the implementation of the standards. Based on the AWS process described above, it's clear that every step will require substantial amount of information on how water moves within a specific site, the different stakeholders and the impact of the water use on the sustainability of the catchment.

Looking at the steps involved in water footprint assessment will be useful for determining the kind of information that such assessment could generate and their usefulness for the implementing the standards. For example the scoping element of a water footprint assessment speaks directly to the first step in the AWS standard related to making a commitment, because it also requires the identification of a goal and purpose for participation in the project. The water accounting and sustainability elements of water footprint assessment, address the issues related to planning and information gathering. Finally the response step speaks to the implementation, evaluation and communications elements of the standard. The significance of water footprint assessment and the information it can generate should therefore be viewed as being critical for the implementation of such a standard. It is hoped that as the AWS gains wider traction, the uptake of water footprint tools will also increase and vice versa.

6. POLICY, LEGAL AND INSTITUTIONAL CONSIDERATIONS FOR WATER FOOTPRINT APPLICATION IN SOUTH AFRICA

In the previous sections it was argued that water footprint assessments could be used by companies to meet internal company focused needs such as managing their water related risks (physical), or used to generate information for stakeholders. A third dimension of water footprint application is to respond to set regulations that govern water resources. For a country like South Africa, where water poses a major constraint to its economic development prospects, it is increasingly becoming important that companies demonstrate good water stewardship that go beyond achieving the minimum compliance. Companies that commit to undertake water footprint assessment are therefore in a better position not only to comply with regulations but are better placed to clearly articulate their water dependence and impact on resource than their competitors.

Water offsetting and trading are mentioned in the NWRS (2013) as potential mechanisms allowed for in the NWA. However, the concepts need further refinements and operationalization as part of a policy review before implementation. The core functions of implementing a public or private sector water-neutral scheme, allowing the balancing of water accounts through public and private interventions. Implementation of water offsetting is hoped to minimise the gap between the available water supply and demand nationally, particularly in water stressed catchments. The promotion of water-friendly growth and development is lauded as an outcome of offsetting too.

6.1. Water Footprint as a Planning Tool at the National and Basin Scale

Water resources in South Africa are governed primarily by the National Water Act, 1998 and the Water Services Act 1997. Other sister legislations such as the Biodiversity Act, 2004, CARA 1983 are also applicable in the management of water resources. These regulatory tools among others provide a useful starting point to examine how companies could use water footprint tools to comply with the set regulations.

6.1.1. The National Water Resource Strategy

The National Water Resource Strategy (NWRS) is the blueprint document for managing water resources in South Africa as defined by the National Water Act, 1998. The NWRS is supposed to be revised every five years to inform water resource management in the country. Its key principles are based on the premise that water is a basic human right and needs to be preserved for current and future generations. It was recognizes that water is important for promoting socio-economic activities.

Equitable water allocation is therefore given a high priority in the NWRS in order to meet the needs of competing water users and to provide for environmental protection.

Even though the NWRS provides the overall guidance for water resource management, it's a broad national scale framework and hence it can only be used to a limited extent at the Catchment Management Agency (CMA), where most decisions on water resource management are made.

In relation to the application of water footprint tools in the context of NWRS, national level water footprint assessment could potentially be used to inform strategic decisions related to how water use and management. For example decisions on bulk water allocation for either municipalities or strategic water users is undertaken at the national level, in additional to other dynamics such as the movement of water across international boundaries.

6.1.2. Catchment Management Strategies

The application of water footprint tools at the catchment level is perhaps more practical compared to the national scale, as the focus of water footprint assessments tend to be on basins, businesses or a specific product. The information generated from the assessment of an entity could also be useful for informing how catchment management strategies (CMS) are developed and implemented.

The issue that needs to be explored here is the extent to which water users apply water footprint tools at the catchment level as a mechanism for complying with regulatory requirements? And to what extent are the local water management authorities using water footprint tools for decision-making at the catchment level?

The application of the water footprint at the catchment level requires understanding of the process of developing a CMS and how the application of control measures such as the Resource Directed Measures (RDM) and the Source Directed Controls (SDC) could benefit from water footprint tools:

- Resource Directed Measures (RDM), comprise the classification of the resource, setting up of resource quality objectives and the determination of the reserve. The RDM are geared towards managing water at its location such as a river, wetlands and in conjunction with all the other related ecosystems. This is achieved through setting specific resource quality objectives that is undertaken when the resource is classified.
- Source Directed Controls, (SDC) which are contained in Chapter 4 of the NWA deals with the regulation of water use, specifically the control of source of impacts on the water resource. The SDC principles encompass the setting up of water quality standards for wastewater, wastewater discharges, and pollution prevention and waste minimization technologies. The SDC therefore gives rise to the RWQO that are outlined in the resource quality objectives.

In terms of the water footprint concept, RDM is related to blue- and greenwater footprint and SDC measures are geared towards minimizing the greywater footprint. It is therefore useful to explore the extent to which water footprint tools could be used to interpret the RDM and SDC measures both in the context of the water users and the regulator. The most useful concept of water footprint in this regard is the water footprint assessment of a catchment, a business entity or product.

Since the primary role of the CMA is to ensure equitable allocation of scarce water resources among competing users, having a good understanding of the basin water footprint is critical for effective water allocation and prioritization. This was the key principle that was adopted during the development of the Breede/Overberg Catchment Management Strategy. Some of the key insights from the water footprint of the Breede that informed the CMS include the following (BOCMA 2012): -

- New allocations of water and changes to existing allocations must be cognizant of the differing economic and social impacts of providing water to different locations for the cultivation of different crops in the Water Management Area (WMA).
- In relation to crop types, higher input efficiencies translate into higher yields, which result in more efficient water use.
- Consideration should be given to a shift away from lower value crops, particularly those that use irrigated bluewater.

The usefulness of the water footprint analysis for the Breede was that hydrological information was overlaid with socio-economic data, to provide critical analysis of the water situation in the basin. The economic and water

balance analysis showed that irrigated agriculture takes up the largest amount of water consumption in the basin (69.4%), and that water consumption is not equally distributed across the catchment (BOCMA 2012).

Table 2: Water footprint of the Breede WMA (Mm3)

Million m³	Total	Upper Breede	Central Breede	Lower Breede	RVS	Overberg West	Overberg East
Green WF*							
Rainfed crops & fodder	222.5	8.2	4.9	37.0	35.1	70.2	67.0
Irrigated crops & fodder	166.1	56.6	46.7	10.1	17.8	33.9	1.0
Green WF	388.6	64.8	51.7	47.1	52.8	104.1	68.0
Blue WF*							
Rainfed crops & fodder	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Irrigated crops & fodder	541.2	187.5	226.0	16.5	53.0	56.7	1.4
Blue WF	541.2	187.5	226.0	16.5	53.0	56.7	1.4
Total crops & fodder WF	929.8	252.3	277.7	63.7	105.8	160.8	69.4
Water for livestock**	1.6	0.0	0.5	0.1	0.1	0.6	0.3
Industrial use**	33.06	13.62	10.56	1.12	1.72	6.03	0.01
Rural	0.25	0.22	0.03	0.00	0.00	0.00	0.00
Urban	32.8	13.4	10.5	1.1	1.7	6.0	0.0
Residential**	21.5	4.4	1.5	0.6	3.0	10.0	2.0
TOTAL	984.4	270.4	289.7	65.4	110.6	176.9	71.4

*: Own calculations
**: WARMS data

Catchment water footprint assessments are important for developing understanding on the linkages between economic indicators and water consumption metrics, to give an indication of how many jobs per unit of water will be required to produce goods and services (BOCMA 2012). This kind of analysis will help in water resource planning and allocation at the basin level.

Even though water footprint tools proved to be useful in the development of the CMS in Breede CMA, its application in the policy arena is still very isolated globally. Hopefully as more CMAs get established in South Africa, the use of water footprint to inform the development of CMS will be more widely in the water resource policy and planning arena in South Africa.

Spain is one of the very few countries globally that have gone a long way to incorporate water footprint principles in their water policy. Aldaya et al. (2012), states that Spain was the first country in the EU to adopt a water footprint approach in evaluating government policy. The government further approved a regulation that would involve water footprint assessment of various socio-economic sectors as criteria for developing River Basin Management Plans as required by the EU Water Framework Directive.

Similar to the step that has been undertaken by Spain, a useful approach for South Africa would be to suggest that all CMAs should undertake a water footprint assessment as a pre-requisite to the development of CMS. Such a requirement would enrich the process of developing the CMS, because of the comprehensive analysis of the water situation that would have been carried out in the water footprint assessment. This analysis would also help to identify any existing information gaps and inform the prioritization of knowledge management at the catchment level resulting in overall improvement in water resource management. Finally the information generated by the catchment water footprint assessment would feed directly into the sustainability assessment that is undertaken if a specific business entity would like to assess its water footprint.

6.2. Water Footprint as a Tool for Management Water in Supply Chains

Water users including the industrial sector are subjected to various regulatory requirements in South Africa, depending on their water use patterns and impact on the resource. Large water users in general need a water license to be able to abstract or discharge water into the system. Failure to adhere to water license conditions could have severe consequences for a water user such as the withdrawal of a license or a large fine.

Water use license and authorization falls under various sections in the NWA as outlined below:

- Engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);
- Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- Disposing of waste in a manner which may detrimentally impact on a water resource;
- Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- Altering the bed, banks, course or characteristics of a watercourse;

Most industrial activity results in some form of waste generation, or requires substantial amount of water use. As a result all industrial water users according to the NWA are required to be registered, failure to do so will result in a fine. The information supplied is used by the regulator for better management of the resource, including its allocation and determination of water use charges. The application of water footprint tools by water users will therefore play a critical role in generating the information that is required by the regulator.

6.3. Institutional Application of Water Footprint Tools for Management

6.3.1. Water as a Response to Regulatory Risk

Water offsetting is an innovative approach to help companies manage their impact of their water use by ensuring that they contribute towards the management of the resource base, and for managing their physical water risks. This happens in two main ways: –

- Companies that are interested in the sustainable management of the resource base voluntarily contribute an amount equivalent to the quantity of water they use for the management of the catchment where their operations or supply chains are located. This is a model that has been advocated by WWF and is being implemented in South Africa (Nel et al. 2008).
- The second version of water offsetting is where companies either internally or in conjunction with local authorizes embark on implementing water use efficiency measures, and expect to be given different treatment in case of water shortages and the regulator all major uses to reduce their usage. In essence such companies are trying to be good stewards in their everyday operations, but require this to be acknowledged during periods of severe water challenges.

These water-offset practices are still under review, being explored by companies in terms of their applicability locally. Although scope does exist, the extent of their application is limited both geographically and temporarily. This limits the range of cases where offsetting may justifiably be used. In essence, water offsetting is an element of water engagement, which will require some form of regulation in the near future. The area is still nascent, and requires further research into which cases water offsetting on a local scale is relevant.

Building efficiency in the water supply chain is critical to managing physical water risk, but could also pose a regulatory risk to a company, hence the importance of effectively engaging the regulator. This risk could arise when a water user has achieved optimum water use efficiency, with additional measures becoming financially prohibitive or directly impacting its production. When the regulator is forced to introduce water use restrictions, those users that are already efficient in their water use might be at a disadvantage compared to those who have not implemented water efficiency measures.

Water offsetting offers the opportunity for companies to engage the regulator to recognize their efforts in implementing water efficiency measures. The argument is that companies that are already 'doing good', could potentially receive preferential treatment in cases where the regulator is forced to introduce water restrictions during periods of severe water shortages such as drought. This would allow water restrictions to be negotiated on a case-by-case basis, so that users that are already optimally efficient can continue to operate without the marginal cost of water user efficiency becoming prohibitive. Such a measure could also incentivize water users to voluntarily implement water use efficiency measures.

As stated earlier the potential implementation of water offsetting is still in its infancy and there are some pertinent questions related to the institutional and legal framework for implementing such measures. Disparity in how water allocation measures are implemented could also hinder the potential rollout of water-offset measures. For example decisions on bulk water allocation in South Africa are made at the national level including water for strategic users, the rest of the allocation is made at the local level (Municipalities). The interplay between Municipalities and the National Department of Water Affairs complicates the opportunity for implementing water offsetting schemes.

7. CLOSING OBSERVATIONS

Water footprint assessments focus on the calculation of the actual quantities of water used with less emphasis on vulnerability at source. Understanding the water value chain is critical for enabling the water user to engage with the regulator, because water allocation decisions are made at various scales and dimensions. Discussions on bulk water allocation for example occur at the national level, whereas other water use decisions are made at the Municipal level. Each these levels where decisions are made are varying levels of assurance of supply. Hence undertaking a critical analysis of the water value chain of user will empower them to engage more effectively with the regulator.

Corporates can drive change. As some of the most powerful and intensive water using institutions in the world, recognition of the risk which water insecurity poses is powerful. Corporates may be driven to investigate their water risks for a range of reasons. These could be for internal risk mitigation at operational level or systemic-wide risk mitigation for reputational purposes. This represents a corporate view of risk mitigation. However, the stakeholders, customers or investors of a product may demand risk assessment takes place. In such cases, the risk assessment is a self-regulatory driver due to the fact that the corporate would like to showcase their achievements made. Lastly, government may require the use of water risk tools to ensure risks are appropriately dealt with. Regardless of the driver to engage in mitigating water risks, the effects are generally positive for the entire catchment. The movement from the private sector towards engaging in this space offers an opportunity to the public sector. Currently, there are no regulations requiring water accounting (whether or not water footprinting) to gauge the intensity of industrial water use. This policy or regulatory gap is an opportunity for the public sector to ensure risk mitigation is appropriate without perverse impacts.

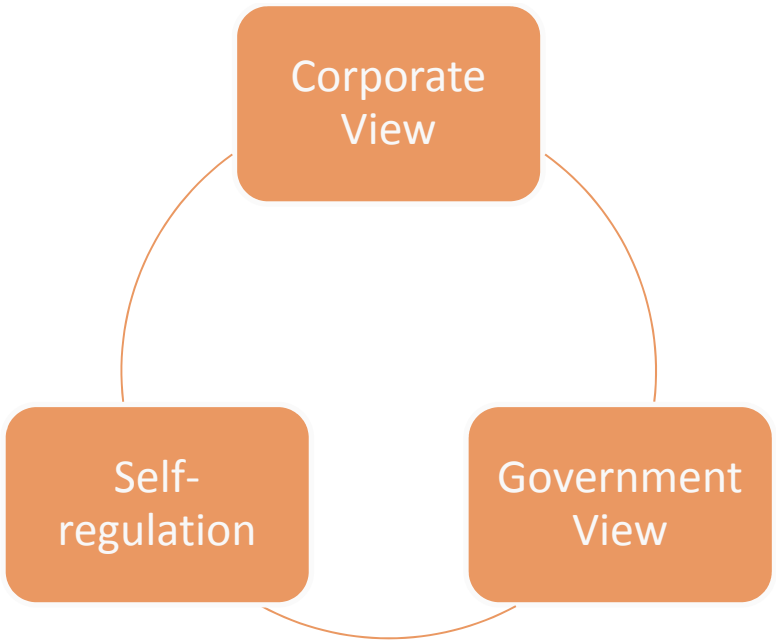


Figure 18: Different drivers of water risk assessment

Should the public sector decide to integrate water footprinting into current water policy a number of considerations need to be made. These include whether or not the requirements will become mandatory, or if it is used only when water stress is evident. Including water risk tools into municipal by-laws will not be an effective use of resources, as the risk assessment may become purely an accounting process, without the cognisant awareness and understanding of the facility on the boarder catchment and vice versa. Therefore, considerations

of the role of water risk tools in policy needs to be thoroughly investigated to ensure that there are no perverse side effects. Water accounting is possibly a good first step before requiring a risk assessment phase. Without adequate understanding and knowledge on the catchment and water situation at hand, it is unlikely appropriate risk mitigation scenarios will be developed. During water restriction periods, it may be appropriate to require companies to carry out a water risk assessment. However, as indicated in the previous explanations on the water footprint methodology, this may be become misinterpreted. Firstly, depending on the climate, agricultural water footprints may change significantly. This is not only between seasons, but between years too. Therefore, the value in the water footprint it to gain an understanding of the water resource flows as a pose to a single embedded water value.

Possibly more powerful than requiring water footprinting legally from a government perspective, is if private companies begin to self-regulate and benchmark themselves voluntarily or due to social pressure. This form of engagement has the potential have a greater effect than purely requiring accounting of water use and discharge, etc. from a regulatory perspective. This response also has the potential to be more effective due to the weak government regulatory presence in many countries. Therefore, regardless of what is required through legislation, companies are still not compliant. A benchmarking between companies, whereby those that do not achieve persistently are recognised through their consumer or investor base is likely to be particularly powerful. In such a case, an industry forum or association is the preferred implementer. The association or industry forum is then able to ensure the “rules of the game” are followed appropriately.

There is a large number of other risk tools in addition to these selected. Each tool is developed for a particular audience with particular focus. However, water footprinting is often the underlying data which is able to inform the risk mitigation process. Accounting of water use and impacts is critical in order to understand the magnitude of particular risks against others. All of the tools are ultimately used to assess, respond or disclose risks. A number of the other tools include WF within their architecture. The Water Footprinting tool itself is used mostly for assessment and disclosure of risks. Therefore, although useful, water footprinting is not the panacea. As indicated, there are a number of water risk tools which are useful in communicating risks which companies may face. Depending on the focus of the risk mitigation, the drivers in reducing the risk, as well as the level of risk being faced, risk response tools may differ.

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