# VALUING WATER

### A GLOBALLY SUSTAINABLE APPROACH FOR THE PHARMACEUTICAL INDUSTRY

Kristina Donnelly, Therese Dorau, Melinda Koslow, Susan Lorenz



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#### **EXECUTIVE SUMMARY**

Water resources around the globe are at risk from expanding demand and decreased availability. All sectors of society rely on water for operation – agriculture, industry, power generation, and domestic users all require a constant, clean supply. As a result of population growth and environmental stress, more than one billion people do not have access to clean water, putting a strain on both people and societies, and leading to high costs to ensure supply is not diminished in any sector. As both water availability and quality are projected to decrease in the future, every sector is at risk and might want to reconsider their current relationship with this important resource.

This analysis focuses on the water-related risks to the industrial sector, specifically the pharmaceutical industry. Drug discovery and processing are water-intensive processes that require large amounts of high purity water, presenting a risk to the continuation of business operations. In a changing and uncertain future, the pharmaceutical industry's relationship with water must also necessarily change in order to continue manufacturing high-quality drugs at a low cost.

Six different categories for water-related business risk are outlined and include: changing business demands, stakeholder issues, supply chain, source water quality, regulatory environment, and water availability and climate change.

This document helps companies concerned about these water-related business risks address the following questions:

- Why should pharmaceutical companies consider water in the business structure?
- Who are the global and local players in the movement toward enhanced water management?
- What types of quantitative and qualitative steps can be taken by the pharmaceutical industry to be proactive in water management?
- Where are the locations that may be additionally stressed due to our changing environment?
- When can pharmaceutical companies act and at what time-scale?
- How can pharmaceutical companies manage water risk and adequately value water?

#### **EXECUTIVE SUMMARY**

By taking a hands-on approach to managing water-related business risk, pharmaceutical companies can avoid costs and instead create value. The pharmaceutical industry has a unique opportunity to enhance its mission of sustaining human health by leading other industries in proactive and innovative water management.

Pharmaceutical companies have a number of options when it comes to adapting their relationship with water to a changing future. However, navigating these options can be costly and time-consuming. In addition, the cost of water for these companies, compared to other resources, is minimal, shielding its importance from business decisions that relate to it. This document presents a decision-making framework designed to help companies save time and resources required to inform options analysis. It is in the form of a comprehensive and easy-to-use Water Valuation Tool consisting of six key steps: Sponsorship, Learn, Plan, Act, Share, and Re-Evaluate. Each step is designed to help a company learn new and innovative ways to value water beyond the traditional cost.

Global companies are currently benefiting from considering water use not only in every-day facility operations, but future business planning as well. Included in this document are case studies, along with an example of how this Water Valuation Tool is applied. This decision-making framework will assist corporate users to design strategies most fitting to individual situations and internal business structure.

# VALUING WATER: A GLOBALLY SUSTAINABLE APPROACH FOR THE PHARMACEUTICAL INDUSTRY

# 1

#### INTRODUCTION

Market-based organizations can gain competitive advantage by thinking about environmental issues in new and innovative ways. Corporations are skilled at managing a variety of risks and developing these into opportunities. Going beyond reactionary risk management means proactively considering the impacts of future environmental issues on the growth of business.

In the myriad issues companies must address, environmental issues may not stand out. However, consideration of these issues could create numerous leadership opportunities and financial benefits. This document suggests possible approaches to explore these opportunities and benefits. Specifically, this document focuses on environmental issues related to water resource management.

Current water costs do not provide the price signals necessary to motivate sustainable water-related decisions. Traditionally, water has been considered inexhaustible, and the need for water sustainability may not always be incorporated into future business planning. However, as global change begins to affect the hydrologic cycle and water scarcity increases, manufacturing operations may experience challenges regarding their water use and the potential for cost increases. Additionally, as the global market expands into developing regions or regions with strained water supplies, water issues may become a part of regulatory, marketing, and public relations management. These business and social drivers suggest that corporations may want to consider building water sustainability frameworks

Corporations hoping to explore new perspectives on water management might consider the following issues:

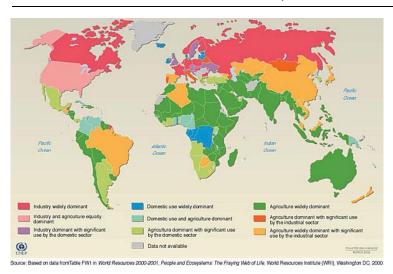
- How a corporation can avoid business risks related to water use
- · How corporations can think about valuing water, given the low cost of this resource today
- How corporations can make decisions about water and plan for an uncertain future
- How a corporation can gain competitive advantage and take a leadership role in changing the way industry values water

The goal of this document is to explore these questions in terms of water-related business risk. It will also suggest a framework corporations could use to approach water management in the future. Before describing risk and the water management framework, a brief introduction to basic information regarding industrial water trends and pharmaceutical development is provided.

#### 1.1 INDUSTRIAL WATER TRENDS

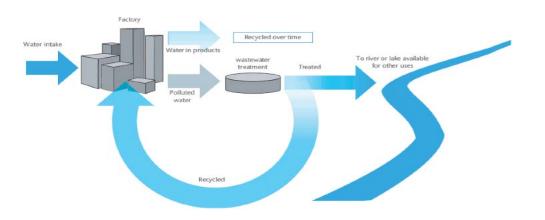
Regardless of location, many users including industries, agribusinesses, and municipalities, compete for freshwater. After agriculture, industry is the largest global user of water. Industrial use of water varies by geographic region and level of economic development (Fig.1). Generally, the higher the income level of a country, the higher the industrial water footprint.

#### FIG. 1 Global Freshwater Withdrawal by Dominant Sector



Although the amount of water used varies by industry, all manufacturing operations use water in similar ways (Fig. 2). For example, in most industries the largest use of water is for energy production, such as in cooling towers, boilers, and thermal power generators.<sup>2</sup> Water is also a necessary medium for waste disposal and equipment cleaning. Due to the nature of its production processes, the pharmaceutical industry has a unique relationship with water.

#### FIG. 2 Water in the Industrial Process<sup>3</sup>



# 1.2 PHARMACEUTICAL RESEARCH AND DEVELOPMENT

Pharmaceutical companies are involved in researching, developing, marketing and distributing drugs. The discovery and development of a single drug is a costly and time-consuming process, often taking 10-15 years, and costing approximately \$800 million USD.<sup>4</sup> Only one of every 5,000-10,000 compounds that results from the drug discovery process ever makes it to the market.<sup>5</sup>

Large volumes of high-quality water are needed for a number of different pharmaceutical manufacturing processes. Today, the industry is quickly transitioning into manufacturing increasing amounts of biological products for the prevention, diagnosis, and treatment of cancer and other diseases. One of the first biological products to reach the market was insulin for the treatment of diabetes. Biological drugs are substances made from a living organism or its byproducts such as antibodies, interleukins, and vaccines. Since these substances are produced from biological processes, they require considerable energy and water inputs. These new products are even more expensive to develop than conventional pharmaceuticals, at an estimated cost of \$1.2 billion USD.

As mentioned above, production of biological pharmaceuticals in general requires more water than conventional drugs. Additionally, certain biologicals require Water for Injection, which must be sterile and devoid of minerals and microbes. Water for Injection is mainly used with drugs that need to be diluted or dissolved in aqueous solution for patient use. <sup>10</sup> In order to treat water to this level of purity, manufacturers require large input quantities, which go through several cleaning phases to reach injection quality. Current water purification technologies result in large quantities of water 'rejected' which cannot always be reused. For these reasons, a shift towards biological products may increase the pharmaceutical industry's reliance on water. <sup>11</sup>

# 2

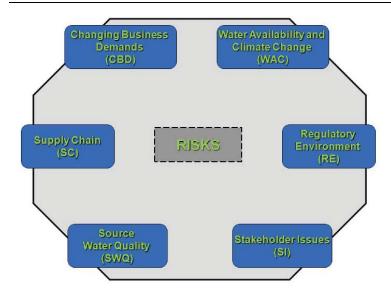
# DEVELOPING A SUSTAINABLE APPROACH TO WATER USE

#### 2.1 WATER-RELATED BUSINESS RISK

Onsidering water-related business risk provides the opportunity for corporations to think differently about water use. The risks described below are intended to encourage proactive thinking, present new ideas, and provide insight into why companies may want to consider new water management strategies.

The following sections categorize and describe six water-related business risks the pharmaceutical industry may potentially face (Fig. 3).

Risk Scheme FIG. 3



#### 2.1.1 Changing Business Demand (CBD)

New product trends, globalization, and other market drivers are affecting the pharmaceutical industry. Novel pharmaceutical products, as mentioned in Section 1.2, are changing corporations' relationships with water resources. Additionally, as India and China develop economically, the global market is shifting more towards this region of the world, increasing the demand for pharmaceutical products in these locations.

#### Business risk:

Two key market shifts are particularly relevant for global pharmaceutical corporations. The first is the expanded demand for biopharmaceuticals, including fermentation products such as proteins or antibody-based drugs and vaccines. If this trend continues, the need for large volumes of high-quality water will necessarily increase. Firms may want to be cognizant of how these new production processes could impact business in situations where source water is limited or contaminated.

#### FIG. 4 Populations without Access to Safe Drinking Water<sup>12</sup>



The second market shift involves the expansion of a global market for pharmaceutical products. Aside from new production capacity, these growing markets may call for new marketing strategies and a different array of products designed to target a new customer base. Sensitivity to these new customers, including their socioeconomic, cultural, and water needs, may aid in successful expansion. Additionally, if production takes place in a region of new customer activity, a company prepared to show its commitment to the water and basic health needs of its new customers may find itself at a competitive advantage.

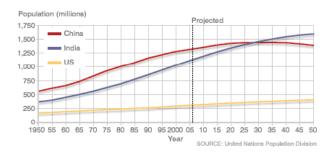
An additional aspect of this expanding market involves human capital. As new workforces are tapped, companies must be prepared to manage an employee base with different beliefs, values, and basic needs. If standards of living in a new production area are low, employees will likely lack access to clean water and sanitation services (Fig. 4). A disease-vulnerable workforce may cause lower productivity, increased human resource costs, and increased absenteeism, all of which will increase the set of business risks that a company must manage.

#### Case Study: China and India

India and China are rapidly expanding markets for many reasons. Economic and social indicators suggest key impacts on manufacturers. Not only are India and China projected to grow rapidly (Fig. 5), but people in these countries will also be making more money (Fig. 6), consuming more (Fig. 7), and living longer (Fig. 8). These trends make it vitally important that companies adjust product offerings and marketing strategies to be viable in India and China's booming markets.

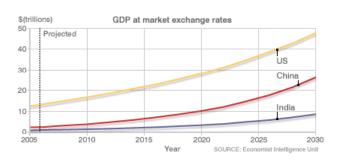
#### Population growth in India, China, and US<sup>13</sup>

FIG. 5



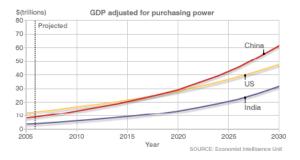
# Predicted Economic Growth in China, India, and US – GDP at Market Exchange Rates<sup>14</sup>

FIG. 6

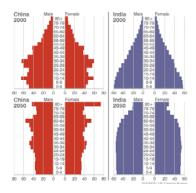


# Predicted Economic Growth in China, India, and US – GDP Adjusted for Purchasing Power<sup>15</sup>

FIG. 7



#### FIG. 8 Population (Millions) by Age Group - 2000 and 205016



#### **Business Opportunity:**

A company can anticipate how water needs change with changing product focus. Working with water suppliers and water treatment facilities, coupled with innovative recycling, reuse, and treatment strategies, may potentially mitigate risk. This can give the company competitive advantage; the firm can more steadily and more cost-effectively produce these newly-demanded products.

As standards of living increase worldwide, the market for pharmaceutical products will grow significantly. Being a good corporate citizen may help secure a company's "license to operate." Building relationships with stakeholders in each new production location and consumer market will prevent potential shutdowns and reputation damage. Additionally, as interest in "socially responsible investing" continues to grow, companies can benefit from investment activities focused on socially and environmentally responsible actions.<sup>17</sup>

#### Case Study: PEPSI CO. in India

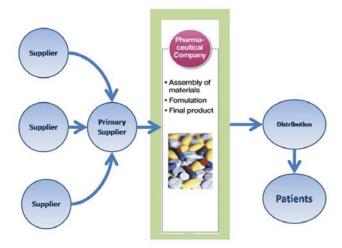
In 2003, PepsiCo India set the goal of being "water-positive" by 2009. This plan followed a period of criticism from regulators and community leaders in India regarding water use by PepsiCo, Coca-Cola, and other foreign beverage companies. To achieve this goal, PepsiCo India instituted a system of water "debits" and "credits," enabling PepsiCo to improve water efficiency in the plant, in local agriculture, and in nearby communities. PepsiCo has promised that its investment into these "credit" activities would ensure that the amount of water saved will be greater than the amount of water used by its manufacturing process, or "debits." As part of this initiative, PepsiCo has collaborated with local farmers and communities to improve conditions near its Indian locations, garnering cooperation and support of many stakeholders in this market. This has led to improved "license to operate" as well as new joint investment projects with Indian state and local governments, evidencing the existence of business opportunity arising from proactive water resource management and responsible geographic expansion. 18, 19

#### 2.1.2 Supply Chain (SC)

As global markets expand, supply chains may become more horizontally integrated. To save costs, manufacturing of inputs and products are often contracted out to suppliers in various locations (Fig. 9). These suppliers may not experience the same water-related issues as their customers in the pharmaceutical industry.

#### Example Pharmaceutical Supply Diagram<sup>20</sup>

FIG. 9



#### **Business risk:**

Pharmaceutical companies could be potentially impacted by water use along the supply chain as suppliers also realize the challenges of water management. These suppliers may experience regulatory, social, and geophysical constraints, which could potentially impact input delivery, product production, or distribution. The overall value chain can also include the consumer product and disposal phases. Some organizations may choose to manage water issues in these phases as well.

#### Case Study: Anheuser-Busch

Anheuser-Busch (A-B), the world's largest beer brewer, experienced significant cost increases and production disruption due to a shortage of both aluminum and barley in 2001. These shortages were precipitated by drought conditions in the US. Aluminum manufacturing is dependent on hydroelectricity in many regions. Hydroelectric power users experienced price increases and generation losses due to a combination of drought and increasing energy demand. This caused a decrease in availability of this energy input, slowing aluminum production. In addition, reduced barley production resulted from competition among agricultural water users during the growing season. Overall, the cost and limited amount of these key inputs were detrimental to A-B's production capacity.<sup>21</sup> These water-related issues along the supply chain emphasize the importance of a systems approach to water management.

#### **Business Opportunity:**

Pharmaceutical companies have the opportunity to be leaders in the management of supply chain water issues. Fostering collaborative relationships and common goals among suppliers and partners can allow management to negotiate the water risk along the supply chain. Broadening the view of water use to incorporate all aspects of production may allow a company to be proactive and less vulnerable to increased costs, decreased availability, and other interruptions to business operations.

Additionally, pharmaceutical companies are sometimes important customers for these suppliers, and therefore have some influence in defining water resource management strategies. Durable agreements with contractors and suppliers may both enhance corporate reputation and help suppliers address their own water-related risks. While enforcement of these mechanisms can be challenging due to the global nature of manufacturing supply chains, these approaches have value<sup>22</sup> when they proactively address water-related issues before the pharmaceutical industry is impacted.

#### Case Study: Wal-Mart's Greening of the Supply Chain

Wal-Mart is a major, influential customer of many manufacturers. The retailer has been able to further its own environmental goals by taking advantage of the large share it holds in many product markets. The company is working closely with suppliers and manufacturers to identify ways to reduce environmental impacts while keeping costs low. This includes offering technical and strategic support for suppliers as well as designing and enforcing criteria that suppliers must meet. Wal-Mart makes a commitment to market products that meet these criteria, which spurs innovation in design. Upstream companies are incentivized to improve products because it is a cost of doing business with Wal-Mart. Because of these efforts, the media has recognized Wal-Mart as being a leader in "greening" the supply-chain.<sup>23</sup>

#### 2.1.3 Stakeholder Issues (SI)

Water users, including industry, can learn to cooperatively manage water resources and negotiate water allocation. Pharmaceutical companies that consider stakeholder issues can avoid conflict over and reduced access to water supplies.

Traditionally, the standard "players" in corporate engagement were shareholders, regulators, and employees. However, emerging issues and enhanced public awareness now require the inclusion of community members, consumers, non-governmental organizations, and neighboring agricultural, industrial, and commercial developments (Fig. 10).<sup>24</sup> Without anticipating the interests of these stakeholders, unexpected conflict may arise. Conflict could result in loss of water allocations and potentially suspended production, as well as possible impacts on reputation and relationships.

Additionally, some companies are working to make their business dealings more transparent. These efforts have been extended to include honest and thorough reporting of environmental impacts. Recent media coverage of corporate environmental strategy has encouraged the development of voluntary reporting programs like the Global Reporting Initiative (GRI) (Box 1).



#### Global Reporting Initiative (GRI) Guidelines<sup>25</sup>

BOX 1

Corporate transparency regarding natural resource use has become increasingly more important in recent years as stakeholders come to expect this type of information. Reporting schemes such as the GRI help companies report the information most valuable to the public.

Many reporting companies use or draw on the GRI reporting guidelines as a framework for their sustainability reporting. This framework sets out the principles, standard disclosures and indicators that organizations can use to measure and report their economic, environmental, and social performance. Within the environmental indicators, there are four water related metrics. These are: EN8 -"Total water withdrawn by source"; EN9-"Water sources significantly affected by the withdrawal of water"; EN10-"Percentage and total volume of water recycled and reused"; and EN21-"Total water discharge by quality and destination".

The GRI allows corporations to develop a benchmark for water use and actively assess environmental impacts. By using this standardized reporting framework, a corporation also provides an increased level of transparency, as many stakeholders and partners are well-versed in and expect GRI reporting.

GRI also provides a set of forward-looking indicators that encourage corporations to think about how they need to mitigate future water-related risk. GRI 'leading' indicators indirectly relating to water and, more broadly, climate change, include: EC2-"Financial Implications and other risks and opportunities for the organization's activities due to climate change" and SO5-"Public policy positions and participation in public policy development and lobbying initiatives."

The GRI also encourages corporations to include in their sustainability reporting a statement on current and long term relevance of sustainability to the corporation, and their strategies for dealing with future water impacts. Reporting on water via GRI will help corporations to not only know their water footprint, but recognize potential for cost-saving conservation measures.

As pharmaceutical companies expand into new geographic locations, they may be vulnerable to different stakeholder-related risks. Business planning can benefit from an understanding of the norms and principles of a different set of cultural, religious, and po-

litical institutions. This awareness can expand a corporations' ability to conduct business in these new areas.

In addition to natural resources, companies also rely on human capital for their business operations. As any prosperous company has learned, retaining and attracting good employees is an important component of its business. For individuals, the actions of a company are becoming more relevant when making employment decisions, and some corporations are taking notice. The Economist alludes to this as well; "Ask almost any large company about the business rationale for its Corporate Social Responsibility (CSR) efforts and you will be told that they help to motivate, attract, and retain staff." Companies may therefore want to stay apprised of issues important to their human capital.

#### Case Study: Apple Computer-Climate Counts Rating

A non-profit organization called Climate Counts, funded by Stonyfield Farm, Inc., focuses on informing consumer purchasing decisions. In the summer of 2007, Climate Counts released a score-card that rated many large corporations on carbon management initiatives. As a part of its scorecard, Climate Counts created a pocket shopping guide that shows and ranks the climate scores of the different organizations. Apple Computer received a score of 2 out of 100. Apple had already been facing pressures from many stakeholder organizations<sup>27</sup>, which increased the impact of the scorecard results. Apple received negative press for this carbon management rating, with articles in the Wall Street Journal Online and MSNBC.<sup>28</sup> This type of stakeholder attention could distract a pharmaceutical company from its primary business activities.

#### Business opportunity:

Companies that are open to early action on environmental issues can improve stake-holder relationships by being involved in or initiating collaborative local water management. Working with stakeholders also could provide the benefits of outside perspectives and new opportunities for partnerships. This cooperative effort can lead to innovative solutions while managing challenges and creating value for all parties.

#### Case Study: Proctor & Gamble

Proctor & Gamble (P&G) has developed a unique approach to engaging stakeholders through its Children's Safe Drinking Water program, a key component of its "Live, Learn and Thrive" initiatives. The PUR product is a small packet of powder that can purify ten liters of water, killing bacteria, viruses, and parasites. P&G has committed to long-term, not-for-profit distribution of PUR in the developing world to help improve water-related health. P&G distributes this material through many non-government organizations including Population Services International. The program has provided more than 750 million liters of safe drinking water in areas suffering from water-borne diseases. This program has provided P&G the opportunity to build a reputation within the global community as an organization committed to water issues, and has allowed the company to network with many important international governments and non-government organizations.<sup>29,30</sup>

#### 2.1.4 Regulatory Environment (RE)

The environmental movement of the 1970s brought a change in the federal approach to pollution management, and water was one of the major targets for reform. These new approaches, specifically the 1972 Clean Water Act (CWA), focused on point-source discharges. Over the years, technological advancements have further decreased impacts of discharge on the local environment. However, regulation continues to evolve and compliance costs are a consistent factor in business planning.

#### Business risk:

Environmental regulation on industry continues to respond to new and increasing pollution concerns.<sup>31</sup> These regulations historically have been fairly rigid "command and control"-type policies, which can be complicated and costly to address. Some governments have begun experimenting with more flexible approaches to industry compliance.

One type of regulatory mechanism involves market-based approaches to water management. These approaches can include regulated pricing mechanisms, which are changing in many OECD (Organization for Economic Co-operation and Development) member countries. Some utilities have shifted toward volumetric charging, where high-volume users will no longer benefit from discounted pricing structures. This may encourage large customers to reduce water use to prevent cost increases. Regulators are also utilizing innovative pricing schemes to address wastewater management. For example, treatment plants in France will charge additional fees for industries discharging more toxic or hard-to-treat pollutants, 32 incentivizing users to improve on-site treatment or modify processes to avoid pollutant creation.

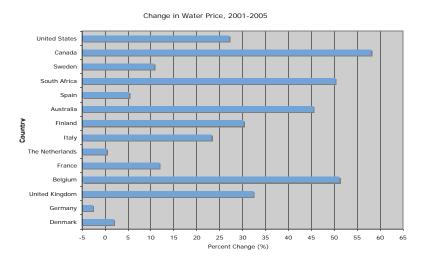
The costs to produce and deliver safe, clean water are rising globally (Figs. 11, 12). This is due in part to the impacts of changing regulations and regulated pricing mechanisms. These costs can be especially variable in areas where reliability of water delivery infrastructure and availability of government resources are issues. In addition, rising energy costs have increased the price of transporting and treating water (Box 2). Regardless of type or level of regulation, water price uncertainty is an issue industries could consider as they move into the future.

#### The Link between Water and Energy<sup>33</sup>

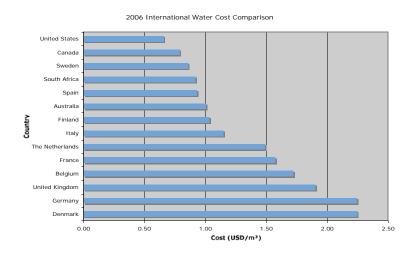
BOX 2

Not only is energy required to produce water, water is required to produce energy. For example, in the US, 190 billion gallons of water are withdrawn every day to help produce electricity at fossil fuel and nuclear power plants. At current population levels, this represents over 6,000 gallons per person per day. These numbers are projected to rise as the global population and therefore water and electricity demand continues to grow. If increases in water use put a strain on availability, different sectors of society (domestic, energy production, agriculture, and industry) may find themselves in competition for access to limited water resources. Conversely, water shortages also may reduce energy availability. Proactive users may be better able to manage the impacts these changes will have on their operations. Consideration of the water-energy nexus can help to buffer impacts that future energy situations could have on water availability throughout the pharmaceutical industry.

#### FIG. 11 Change in Water Price, 2001-2005<sup>34</sup>



#### FIG. 12 2006 International Water Cost Comparison 35



The survey was based on prices as of July 1, 2006 for an organization with an annual usage of 10,000 m³. All prices are in US cents per m³ and exclude VAT. Where there is more than a single supplier, an unweighted average of available prices was used. The percentage change is calculated using the local currency in order to eliminate currency movement distortion.

#### Case Study: Coca-Cola in India

Coca-Cola built a \$25 million USD facility in Plachimada, India in 1998.<sup>36</sup> The state government's initial allowance for the use of 132,000 gallons per day was contingent on the continued permission of the local council of tribal elders. However, in 2002, the council refused to renew Coca-Cola's license, citing depletion of local freshwater resources and pollution discharges. Although appeals to the High Courts resulted in the reinstatement of Coca-Cola's license, the local council continued to protest the plant operations and sought appeals with the Indian Supreme Court.<sup>37</sup> Concurrently, other water users were not targeted by activists or local government. This is an example of the strong influence local agencies can exert in regulatory decision-making. Companies around the world must prepare at all levels for uncertain regulatory environment in the future.

#### **Business opportunity:**

Being aware of potential changes in regulation can allow companies to prepare for compliance and avoid future costs. Pharmaceutical companies working closely with regulatory agencies can gain an understanding of how these changing regulations may affect corporate planning. New regulation can lead to increased costs and higher water prices, but preparing in advance for changes in regulation can help companies avoid these costs.

There is also potential for companies to occasionally participate in negotiated rule-making, working collaboratively to develop regulations that both protect the environment and meet the needs of industry. As some companies have learned, working with regulatory entities, and not against them, can be an effective way to participate in rule-making. By engaging with these entities and anticipating future regulatory change, pharmaceutical companies could avoid compliance costs, foster partnerships, and have a voice in policy discussions.

#### Case Study: Coca-Cola Beverages Hrvatska

Coca-Cola Beverages Hrvatska (CCBH) in Croatia voluntarily modified its wastewater treatment facilities to a level more stringent than that required by regulation. It made a number of upgrades and modifications to its treatment systems, including drainage reconstruction to separate the technological wastewater from the rainwater and sanitary sewer system. They also built reservoirs to allow reuse of purified water for on-site irrigation purposes. As a result, CCBH was able to both save money and reduce its need for the use of potable water for outside irrigation.<sup>38</sup>

#### 2.1.5 Source Water Quality (SWQ)

Concerns about water quality are becoming common. Urbanization, agricultural runoff, and industrial discharges are some of the environmental stresses encountered by local water systems.

#### Business risk:

Pharmaceutical companies are cognizant of the impacts of polluted source water on both the local environment and on the bottom line. Expensive pre-treatment costs may result from polluted source water, especially for processes requiring very high-quality water. Production facilities that use groundwater, for example, may risk reduced availability of freshwater or contamination of the aquifer, which can lead to increased pumping and treatment costs. In addition, plants utilizing surface water downstream from agricultural and other industrial facilities may see changes in source water quality. If water quality declines, companies may need to pay more for source water treatment. While all companies are historically careful to ensure high-quality discharge, some companies also focus on water quality at the point of intake.

#### Case Study: Drinking Water in New York City

New York City's municipal drinking water supply comes primarily from surface water in the Catskill Mountains in upper New York state. This water historically had been of very high quality. However, agriculture, including livestock and dairy farming, is a major industry in the Catskills region. Agricultural runoff, as well as pollution from wastewater treatment plants, septic systems, and storm water runoff had led to degradation of water quality for downstream urban users and potential risks to human health. This increased pollution, along with the 1989 Environmental Protection Agency's (EPA) Surface Water Treatment Rule requiring source water filtration, put the city at risk of increased costs, lawsuits, and health issues. Complying with new regulations would have required the installation of a filtration system at an initial cost of \$3-8 billion USD<sup>39</sup> and an operations and maintenance budget of \$2-5 million USD, effectively doubling the cost of water for the nine million people utilizing New York City's municipal supply. In 1990, these source water quality issues forced municipal government to either face significant pre-treatment costs or to develop alternative methods to protect source water from contamination.<sup>40</sup>

#### **Business opportunity:**

The pharmaceutical industry has the opportunity to prevent pollution from even entering its facilities by taking steps toward restoring water quality at the source. Constructed wetlands and other remediation strategies can be effective at controlling and removing pollution. Investing in these kinds of systems can provide significant savings by reducing the level of treatment required before water enters the production process.

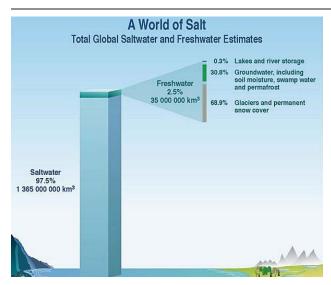
#### Case Study: Coca-Cola in Brazil

The Coca-Cola Company is fundamentally reliant on a continuous supply of freshwater at its production facilities. Because of this need, the company as a whole requires each of its plants to monitor the quality of its source water and formulate a plan to protect it. Its operations in Brazil, for example, invested more than \$2 million for source water protection in the Jundiaí River watershed, working with local communities to build a new solid waste landfill and a wastewater treatment plant. At the same time, Coca-Cola was able to reduce its water use by 58%, and create a number of educational projects for local communities. Through innovation and cooperation, Coca-Cola was able to protect the quality of its source water and capitalize on multiple benefits of these new projects.

#### 2.1.6 Water Availability and Climate Change (WAC)

Climate change and decreasing freshwater availability may create risk for global manufacturing operations. While many consider freshwater to be renewable on a global scale, it is finite on a local level (Fig. 13). A combination of industrialization, urbanization, and population pressures are increasing demand for water. At the same time, water levels are falling in many major lakes and rivers around the world, including the Yangtze in China and Lake Superior in North America.<sup>42</sup>

#### Total Global Saltwater and Freshwater Estimates

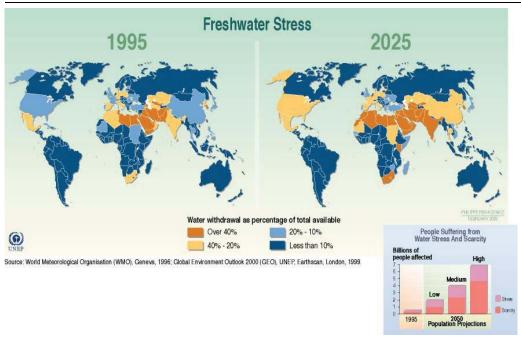


#### Business risk:

Nearly 40% of the world's population lives in water stressed areas, where the current per capita water supply is less than 1,700 m<sup>3</sup>/year. This proportion is expected to exceed 50% by 2025 (Fig. 14).<sup>44</sup> This trend is correlated with population and economic growth.

FIG. 13

#### FIG. 14 Global Freshwater Stress, 1995 and 2025

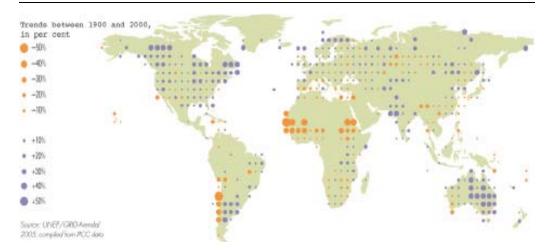


The Intergovernmental Panel on Climate Change (IPCC) is recognized as the global standard for producing scientific information on climate change. IPCC research suggests that climate change has the potential to exacerbate water stress. Some primary climatic drivers for water availability are precipitation, temperature, and evaporation. The combined effects of climate change, including temperature increases, evaporation increases, and seasonal fluctuations, will further reduce water availability.

Although some areas will receive more precipitation as the climate changes, global precipitation totals will be reduced. With a high degree of confidence, the IPCC states that, overall, the earth's hydrologic balance will be negatively impacted by climate change, with repercussions for water resources and ecosystems around the globe. In addition, the IPCC is highly confident that areas in which runoff is projected to decline are likely to face a reduction in the value of services provided by water resources. Urrent climate models project increased precipitation at high latitudes and in the tropics and decreasing precipitation in the sub-tropics (Fig. 15). A warmer climate implies more water vapor in the atmosphere; however, distribution of the water vapor will be unpredictable and unstable, resulting in some areas of flooding and other areas of drought.

#### Changes in Precipitation Amounts⁴



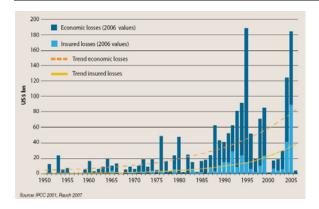


Regions receiving increased precipitation will realize greater flooding and extreme weather events.<sup>49</sup> Increases in drought and flooding events can be both socially and financially disruptive. Between 1990 and 2001, over 1.5 billion people were affected by floods.<sup>50</sup>

Companies may choose to consider how changes in water availability and water-related aspects of climate change could impact global business (Fig. 16). Natural disasters may lead to disruptions in employee attendance, workplace safety, and daily operations. Additionally, reduced water availability could have potential impacts in a number of management areas, including water cost, water conflict management, and water use disclosure and transparency.

#### Economic Losses Due to Natural Disasters 51





#### Case Study: Nuclear Plants in the Southeastern United States

"You need a lot of water to operate nuclear plants," says Jim Warren, executive director of North Carolina Waste Awareness and Reduction Network, adding, "this is becoming a crisis." Nuclear plants require approximately 825 gallons per mega-watt hour<sup>52</sup> for reactor cooling. As of early 2008, 24 of the nation's 104 nuclear reactors were in areas experiencing severe drought conditions. In January, nuclear plants across the southeastern US faced the possibility of having to shut down due to drought impacts. Should a shutdown occur, the region's utilities would need to buy expensive replacement power from other energy companies, forcing users to pay higher electric bills.<sup>53</sup> This water shortage and its link to the energy supply has impacted the operations of many manufacturers in this area.

#### Business opportunity:

Water availability and climate change risks can be transformed into opportunities with a proactive and strategic approach to valuing water. Company-wide water conservation strategies may allow pharmaceutical companies to reduce uncertainty, gain first-mover advantage, and avoid financial losses potentially associated with decreasing water supply. A company's positive reputation as a global pharmaceutical and health corporation can be enhanced by a dedication to water conservation and recognition that water, like pharmaceuticals, is important to good health.

#### Case Study: General Motors de Mexico

General Motors (GM) de Mexico has felt the impact of decreasing water availability and the resultant increased costs. To mitigate this situation, GM de Mexico undertook several innovative programs to reduce water consumption, reuse treated effluents, and suppress pollution. New systems have decreased the salinity of the water supply that serves the engine and transmission plants. Employing solar evaporation ponds has helped GM de Mexico avoid further discharge of a salt-laden waste stream. From 1986 to 2000, GM de Mexico was able to reduce the average amount of water needed to produce a vehicle from 32 m³ to 2.2 m³, reducing annual well water withdrawal from 1.47 million m³/year to 700,000 m³/year. At the same time these reductions took place, the company increased auto production seven-fold and engine production by 50%. They have won many conservation and environmental awards for these efforts, building a positive reputation within the community.<sup>54</sup>

#### 2.1.7 Conclusion - Business Risks in Perspective

This section has outlined the following water-related business risks for the pharmaceutical industry: changing business demand, supply chain, stakeholder issues, regulatory environment, source water quality, and water availability and climate change. By recognizing these risks corporations can gain competitive advantage and protect financial capital. The rest of this document presents a framework for transforming these water-related business risks into business opportunities by valuing water beyond its dollar cost.

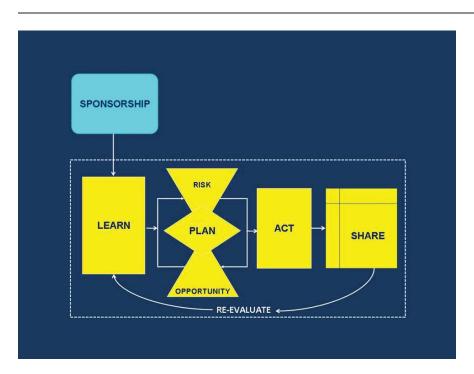
# 2.2 WATER VALUATION TOOL

Water is an essential component of all manufacturing processes, including pharmaceutical production. In the face of global transformations, stresses on natural resources can affect a company's operations. Expanding water management may be costly, but unexpected expenses due to water-related business risk in the future may be greater.

What follows is a water valuation tool a decision-making framework to help pharmaceutical corporations understand, plan for, and benefit from the water-related business risks (outlined in Section 2.1).

# Water Valuation Tool Diagram





The tool consists of six necessary and important steps:

- 1. Sponsorship to drive change at the highest levels of management. This will embed water valuation into the core functions of the company through the development of water prin ciples, policies, and management programs.
- 2. Learn about water use and management at each of the company's operational locations. It is necessary to establish a concrete baseline to envision and develop an improved relationship with water.
- 3. Plan innovative water management actions at each site, as well as company-wide.
- 4. Act on water policies and principles by implementing the strategies created.
- 5. Share results with the entire company and assess the success of the projects.
- 6. Re-evaluate the process and the results to make improvements for the next decision-making exercise.

Moving sequentially through each part of the tool can guide a company towards valuing water beyond its monetary cost. This is an iterative guiding process. Commitment to continuous improvement is important to being a leader in sustainable water management.

# 2.2.1 Step 1: Sponsorship

GOAL: To build commitment to water valuation at the highest level of the organization.

In step one, organizations will:

- · Build commitment for water management at the corporate level
- Understand why building this commitment is important
- · See examples of Sponsorship in practice

This step is intended for:

- Executives
- · Executive-level management

In order to be successful, companies must ensure that valuing water becomes a part of everyday operation at all levels. The overarching task of *Sponsorship* is to build a commitment to water management at the highest level within a company. This commitment will help a company succeed in implementing this water valuation tool by ensuring support for associated projects. It also indicates that the company recognizes water risk management as one of its environmental goals.

A company should start by identifying **principles** of the company in terms of water. Water principles must be accessible to all people within the company. That means that they

should be written in easy-to-understand language and readily available. It would be help-ful to update the principles to reflect changing business needs.

The second step is to outline a **water policy** for the company. A water policy is a corporate organizational guidance document governing day-to-day behavior reflecting the water principles that provide a governing vision and a sense of the company's values.

# Sample Corporate Water Principles

BOX 3

Principle 1. Fresh water is a finite and vulnerable resource, essential to sustain life, development, and the environment. PharmaCo is dedicated to putting patients first. To uphold this dedication, we recognize that our practices should not interfere with maintaining this resource.

Principle 2. PharmaCo should build relationships with local water stakeholders at all levels to ensure inclusive practices and cooperative resource management.

Principle 3. Water has an economic value in all its competing uses but should be recognized as having social as well as an economic value. As part of assessing the value of water, PharmaCo pledges to also consider the social elements of water.

Principle 4. PharmaCo pledges to become water-aware in all stages of pharmaceutical production process.

The principles and policy will provide the foundation for a water management program, instituted at the corporate level. This water management program will include:

- Clear corporate definitions
- · Company-wide commitments
- A dedication of time and resources
- · Comprehensive understanding of water-related business risk
- Accountability structures
- Quantitative reduction targets
- And measurable strategic goals
- · With a commitment to continuous reevaluation and improvement

Developing and supporting this water management program at the executive level will help water to be appropriately addressed across the corporation. While operations-level managers have often realized the need to address locally-specific water issues, smart companies recognize the need for buy-in, commitment, and support from all levels of an organization. Clear expectations, commitments, and allocation of human and financial capital will allow staff to use the water management program to inform:

- Natural resource use
- · Business decision-making
- · Analysis of potential cost savings
- · Project financing, cost structures, and accounting practices
- Relationships with suppliers and partners (Box 5)

# BOX 4 Sample Corporate Water Policy

This policy expresses PharmaCo's commitment to water conservation and our vision to become the industry leader in water resource management. Water conservation and management will be achieved in concert with Value III, which affirms PharmaCo's commitment to protect and preserve the environment.

#### Values

- I. An integrated strategy for optimization of water use and efficiency, developed and implemented globally, is a necessary PharmaCo business tool.
- II. Efficient water use will add business value and enhance profitability. Business benefits that result from water optimization are both financial, including reduced operating costs, and non-financial, including reduction of energy use, improved relationships with stake holders, improvements to corporate reputation, and a more sustainable future.
- III. Natural resources such as water have intrinsic societal value. PharmaCo is committed to developing an understanding of how we use water and will seek innovations and employ best practices to continuously reduce our use of water and to protect environmental resources.
- IV.It is the responsibility of every employee to optimize the use of water in his or her job activities.
- V. The objectives of this policy will be supported by measures to assess water management performance, establish water use reduction goals and public reporting of PharmaCo's water performance.

#### Roles and Responsibilities

- I. The PharmaCo Executive Committee is the sponsor of the objectives and values of this policy and will establish global performance goals for reductions in water use and cost.
- II. All divisions are responsible for implementation of the objectives and values articulated in this policy.
- III. The Water Task Force (WTF) is responsible for and will coordinate corporation-wide initiatives to achieve the objectives of this policy including developing an integrated global strategy for optimization of water use and water resource management. WTF will also measure and communicate progress toward achieving corporate water use and cost reduction goals.

#### Case Study: Intel Corporation

Intel Corporation has carefully managed local water issues at its individual manufacturing facilities. However, the company also knew it needed broad-based corporate support to gain the benefits of a unified strategy rather than piecemeal localized responses. Intel developed its Corporate Industrial Water Management Group, incorporating internal experts from all levels of operations and management. This group develops company strategies, best management practices, and methods of measuring and communicating data, all focused on managing the company's water resources. These organization-wide efforts have allowed Intel to set comprehensive goals, develop corporate principles, design new technology, raise awareness internally and externally, and improve relations with local communities, all while lowering overall water intensity. This would not have been possible without executive-level support and commitment.<sup>56</sup>

# Managing the Supply Chain 57,58

BOX 5

The Pharmaceutical Supply Chain Initiative (PSCI) is a consortium of several leading pharmaceutical companies with the goal of "supporting suppliers in upholding industry expectations regarding labor, health and safety, environment, ethics and management systems." The mission of the PSCI is to "improve economic, environmental, and social outcomes for those involved in and affected by the pharmaceutical supply chain." Although the PSCI considers some environmental issues in supplier principles, it does not directly address water. Corporate supporters may want to develop an additional element to specify expectations regarding water use.

The following is a sample contractor ethics policy intended to be part of any supply chain environmental agreement:

Suppliers that service this corporation are expected to be conservative with water use, especially in geographic areas where scarcity is of concern. Suppliers are expected to, at minimum, abide by local rules and regulations regarding water use and disposal, and, wherever possible, perform at a greater level than required by law. Suppliers will conduct a water footprint analysis and commit to a numerical water reductions target every 5 years. This figure will be released to the contracting pharmaceutical company along with information on water use best management practices. Additionally, suppliers are expected to assess their relative risk to water supply disruptions and report this information to the contracting organization. Community water issues and water-related health issues will be reported to the contracting organization. In areas where these issues are severe, a supplier will be asked to provide effort in finding solutions.

This policy will have a two-fold effect of proactively managing supply chain water risk for pharmaceutical companies as well as strengthening reputation and image for both parties. The supplier will also benefit from these initiatives by attracting other corporate customers who are implementing sustainability practices. For example, Wal-Mart's green supply-chain directives have led to replacement of lagging suppliers with new suppliers willing to comply with Wal-Mart's environmental mandates. Supporters of supply chain environmental initiatives have the opportunity to take a leadership role in outlining responsible water-use expectations for suppliers.

Once the foundation and principles of this water management program have been designed, other supporting features can be incorporated. These may include **feedback mechanisms**, such as internal reporting to adjust goals and increase the rigor of the water management program. The water program could also be tied closely to a company's energy strategy, for which many programs and structures may already be in place.

Before the tool can be implemented, managers should select three or four sites to pilot the decision-making tool. Although it is important to value water across the company, changing a business' relationship with water takes time and resources. Collecting and analyzing information on the success of implementation at a few areas to start will allow a company to ensure the success of the water valuation tool.

To help identify these sites and begin implementing this tool, executive level management must ensure that each site conducts a thorough **water balance**. It is important to have accurate site-level information on the amount of water used for each level of purity. Collecting this information will allow a company to analyze the relative costs of using and purifying water in their processing. This company-wide water balance activity will highlight sites with the highest costs or the largest water use. This will allow executive level managers to identify locations that can be prioritized for the implementation of this decision-making framework.

There are a number of methods for conducting a company-wide water balance. The World Business Council for Sustainable Development (WBCSD) has developed a method for companies to analyze their global water footprint (Appendix B.3). The WBCSD Global Water Tool allows synthesis of information to quantitatively assess watershed-level vulnerabilities. The Global water tool could be extremely helpful in identifying sites for priorization.

Sponsorship must take place at the executive level before the next five steps of this water valuation tool can be applied successfully. Proactive companies recognize that, like energy, water availability into the future is uncertain and yet presents opportunities for business operation. Creating a fundamental atmosphere within the company that addresses water issues lays a strong foundation for water valuation. Building this institutional capacity and developing incentives is essential for enabling cohesive, organization-wide water resource leadership, making sponsorship the clear starting point of this water valuation tool.

#### SPONSORSHIP CHECKLIST:

Create a corporate water policy and distribute/make available company-wide
Outline corporate water principles and distribute/make available company-wide
Develop a water management program
Make this document available to employees
Conduct a water balance
Create feedback mechanisms
Designate sites for pilot projects

# 2.2.2 Step 2: Learn

GOAL: To understand water use and water-related risk at the site level.

In step two, organizations will:

- · Analyze water use at the site level
- Think about the water-related business risks outlined in Section 2.1 at the site level

This step is intended for:

· Site-level environmental management

*Learn* is the second step in the water valuation tool and is designed to help companies analyze water use, water needs, and the local water resources of a site. While *Sponsorship* primarily takes place at the executive level, *Learn* is intended for use at operational-level. Within a company, each site will have varying stresses on the local water systems resulting from the unique geography of the location, as well as the specifics of the company's needs.

The first part of the *Learn* step, the **Site Profile**, will summarize pertinent water data. This summary provides information that will:

- · Establish a baseline from which to measure improvement
- · Drive open-ended discussion and brainstorming to identify the key risks for each site

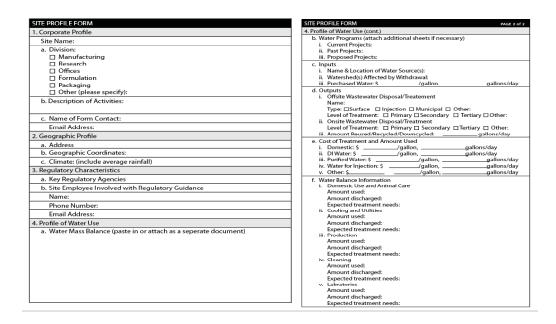
The purpose of the Site Profile Form is to provide water managers with centralized information about the site's water use. Site-level upper management can designate an employee, the water valuation coordinator, as the individual responsible for the data collection. This person should be well-versed in site water use and local regulations.

The water valuation coordinator should gather a cross-organizational team comprised of environmental specialists, production engineers, laboratory researchers, equipment operators, custodial managers, and facilities managers.

Once the data is gathered and the Site Profile Form is complete, it should be forwarded on to site managers as well as to a newly-formed water valuation committee so that it can be readily available when addressing risks and opportunities at the site level in later stages of this decision-making framework.

A blank Site Profile Form (Fig. 18) is included in Appendix B.1.

#### FIG. 18 Site Profile Forms



The second part, **Risk Exploration**, will utilize information gathered in the Site Profile to facilitate risk identification through a series of thought questions. These risks (as described in Section 2.1) are:

- Changing Business Demands (CBD)
- Supply Chain (SC)
- Stakeholder Issues (SI)
- Source Water Quality (SWQ)
- Regulatory Environment (RE)
- Water Availability and Climate Change (WAC)

The Risk Exploration process is intended to aid water managers in understanding the biggest risks facing a site and allow new perspectives and attitudes about water to drive innovative water management strategies. Once these risks are identified, this new knowledge will be incorporated into the third step of this decision-making framework, *Plan* (Section 2.2.3).

The Risk Exploration is a series of thought questions designed to get managers thinking about water use at the site and in the surrounding community (Appendix B.2). After each question is a suggestion of relevant business risks identified in the question's answer.

This Risk Exploration process will be a brainstorming session facilitated by the water valuation coordinator. The water valuation committee should be encouraged to develop some of its own additional questions and thoughts related to risk.

The Risk Exploration activity is included in Appendix B.2. It includes several questions related to the following topics:

- · This site's activities, location, and role in the company
- · This site's location
- This site's community and your local workforce
- · This site's relationship with regulators and the applicable laws and policies
- Past water conservation/recycling/treatment programs
- Planning and implementing new water conservation, recycling, treatment and management programs
- · The site's water needs
- The water needs of suppliers and partners
- · This site's wastewater disposal needs
- This site's water balance diagram

In order to be a water leader, managers need to think about water in new ways. Once the water valuation committee has reviewed the Site Profile to learn about the site's water use and brainstormed via the Risk Exploration activity, new outlooks and knowledge gained should be applied to the following questions:

- What was surprising about reviewing the Site Profile?
- · What was surprising about completing the Risk Exploration activity?
- What other information is relevant to water risk for this site, based on the knowledge of the water valuation committee?
- What does the committee see as the biggest risks facing this site?

The water valuation coordinator should write a short (two page) summary document highlighting risks and opportunities discovered through this exercise. This will serve as a record for the next steps of the decision-making framework. This should also be submitted to executive level environmental management to inform leadership of specific issues facing the pilot site.

The Site Profile and Risk Exploration activities provide the foundation for developing water management strategies and projects, the next step of the water valuation tool, *Plan*.

#### LEARN CHECKLIST:

	Designate a site water valuation coordinator
	Appoint members to the water valuation committee
	Fill out the Site Profile worksheet
	Conduct the Risk Exploration exercise
	Write up a two-page summary of the Risk Exploration exercise
П	Submit the summary to executive-level environmental managemen

# 2.2.3 Step 3: Plan

GOAL: Develop unique strategies for the site and executive levels of a company.

In step three, organizations will:

- Develop company-wide strategies designed to address water valuation across the organization
- Develop site-level strategies designed to address water valuation at the watershed level

This step is intended for:

- Site-level management
- · Executive level environmental management

The goal of the *Plan* section is to take the water-related business risks identified in the *Learn* section, and transform these risks into business opportunities. New information and perspectives generated in the *Sponsorship* and *Learn* phases will facilitate the development of innovative executive-level and site-specific strategies to sustainably manage water.

Below are descriptions of *Plan* activities that will need to be carried out at either the executive or site level.

#### Executive Level

Executive level strategies in the *Plan* section will build from the water management program developed during the *Sponsorship* phase. These programs and strategies can help build awareness of and further commitment to the corporation's water management program created in *Sponsorship*. These actions, while not as broad in scope as those in *Sponsorship*, do not apply to any one site and therefore can be implemented across the company by top-down approaches.

Several questions can help determine which areas of the water policy and principles will be the focus of initial company-wide efforts. These issues should be addressed by a committee of individuals (herein referred to as the water task force) from many departments within the executive level of the company. On the task force, it will be important to have representation from an environmental specialist, a marketing expert, a corporate responsibility representative, as well as a finance expert.

This task force should consider the following questions:

- What aspects of the new water policy should be prioritized across the organization?
- Considering the water balance, what risks are common among most locations? Could these risks be better addressed using a executive level strategy?
- Based on the water valuation committee's report on site-specific water-related business

- risks, which sites are at highest risk and should therefore be prioritized? Company-wide results from the WBCSD tool could also be useful here. (Appendix B.3),
- What are the water task force's initial ideas for projects to reduce risks or enhance opportunities?

The task force should now brainstorm ideas and compile them into a matrix organized by the six risk categories (see Appendix B.4). The water task force should work to develop strategies that will champion the company's water policy and principles. The task force should look for strategies that address multiple risks or create additional business opportunities. Some example strategies are presented in Table 1. The examples are organized by risk category (Section 2.1).

# Example Strategies for Executive Level Management

TABLE 1

Plan for risk	Example strategies & starting points
Changing Business Demands (CBD)	Create a Water Task Force that meets monthly and includes employees from multiple levels of the company
Regulatory Environment (RE)	Monitor employee activities via an internal information clearinghouse such as the Knowledge Sharing Database (Section 2.2.5)  Be aware of the possibility of water privatization
	Consider setting higher water-reduction goals for sites that are at higher risk to water scarcity in the future
Stakeholder Issues (SI)	Have a "Water Day" for employee water-related informational activities
	Educational outreach in the community: have a representative give presentations at local K-12 schools about the importance of water
	Partner with national non-governmental organizations for water-related outreach activities and resources
	Sit on the boards of national water organizations

#### Table 1 (continued)

Plan for risk	Example strategies & starting points
Source Water Quality (SWQ)	Participate in global corporate initiatives related to water, e.g. the CEO Water Mandate, part of the UN Global Compact
Supply Chain (SC)	Get involved in corporate promotion and reputation- building events regarding water sustainability
	Explore accounting structures that incorporate environmental impacts (Appendix B.5)
Water Availability and Climate Change (WAC)	For sites that are vulnerable to flood or drought, insist that all sites develop an emergency plan that includes:  -what to do in an emergency -what to do in case of government shutdown -what to do if water source is polluted

Now that the team has come up with some strategies, consider the following questions:

- What resources and expertise within the company could help with these strategies?
   Outside of the company?
- What are the barriers to implementation?
- · Do these strategies help address multiple risks or create opportunity?

#### Site Level

At the site level, strategies developed in *Plan* will focus on the water-related business risks unique to the region and the manufacturing processes on-site. Each site's water valuation committee and coordinator will be essential in building these strategies and project ideas. The information gathered in *Learn* will be key to the development of these approaches.

The site-level section of *Plan* will help to utilize new perspectives and knowledge about the company's water use. It is important that the water valuation committee perform both the *Learn* and the *Plan* steps. In relation to the output from the Risk Exploration activity, the committee should think about the following questions:

- Which risk category/categories is the committee most concerned about?
- · Which risk category/categories does the committee feel need to be addressed first?
- Are there any opportunities for water reductions in this site's operations made obvious by the Learn analysis?

- Are there any aspects of manufacturing processes at this site where water could be more efficiently utilized?
- Are there any aspects of the manufacturing processes at this site that may be a barrier in implementing water reductions strategies?
- What are the committee's initial ideas for projects to reduce risks or enhance opportunities?

The water valuation committee can now utilize all the information gathered in the Learn section to develop site-specific strategies to address business risk. The committee should brainstorm ideas and compile them into a matrix organized by the six risk categories (see Appendix B.4). The group should be especially aware of strategies that address multiple risks or create additional business opportunities. These strategies can be particularly useful and cost effective. Some example strategies are presented in Table 2. The examples are organized by risk category (Section 2.1).

# Example Strategies for Site-Level Management

Plan for risk

Example strategies & starting points

Create an employee incentive program that awards innovative water conservation ideas and activities

Utilize water-reducing technologies such as low-flow toilets and showers, or drip irrigation

Have employees participate on the boards of local water organizations

Discuss ways to retro-fit the company to adapt to changing regulations

Stakeholder Issues (S1)

Fill in the Stakeholder Wheel

TABLE 2

# Table 2 (continued)

Plan for risk	Example strategies & starting points
Stakeholder Issues (SI) (continued)	Identify all users of the local watershed
	Create an educational program for employees about the local cultural relationship to water
	Educational outreach in the community. Have a representative give presentations at local K-12 schools about the importance of water
	Partner with local non-governmental organizations for water-related outreach activities and resources
Source Water Quality (SWQ)	Assess local source water quality and whether there have been any pollution events in the last decade
	Look for opportunities to improve ecosystem services at the source
	Collect water for use on site, for example, by building a storm-water retention pond
Supply Chain (SC)	Do a survey of company suppliers' environmental records
эрріу спаш (эс)	Try to purchase from suppliers that may improve company reputation
Water Availability and Climate Change (WAC)	In case of extreme events, develop a plan for employee interruptions that may arise
	Have employees calculate water footprints
	Look for new ideas in an internal information clear- inghouse such as the Knowledge Sharing Database (Section 2.2.5)

Now that the team has come up with some strategies, consider the following questions:

- What resources and expertise within the company could help with these strategies? Outside of the company?
- What are the barriers to implementation?
- Do these strategies help address multiple risks or create opportunity?

# Bringing It All Together

The executive level water task force, as well as each site's water valuation committee, should choose three or four of the most promising strategies to be developed in *Act*, the next step in this decision-making framework. Recommendations and observations from the *Plan* step should be summarized and communicated to environmental management.

This *Plan* section is intended for a company to develop its own unique strategies that are specific to the local environment and production processes. Additionally, this will enhance the efficiency of the water management program at the executive level. Together these actions will facilitate the company-wide commitment for sustainable water management developed in the *Sponsorship* stage of this tool.

#### PLAN CHECKLIST:

Designate members of the executive level water task force
Fill in the executive level Plan Matrix (Appendix B.4)
Develop 3-4 executive level strategies
Fill in the site-level Plan Matrix (Appendix B.4)
Develop 3-4 site-level strategies
Summarize and report all strategies to environmental management

# 2.2.4 Step 4 : Act

GOAL: To implement concepts and projects related to water valuation.

In step four, organizations will:

· Implement strategies developed in the Plan section

This step is intended for:

- · Site-level management
- · Executive level management

Once the three or four most promising strategies have been selected in the *Plan* step, these must be developed into proposals for *Act*ion. The proposal and approval process will require careful planning and organization of resources, following the same administrative

procedures as any other company projects. Although proposals will be submitted in the same way as other requests for capital, the corporate commitment developed in *Sponsor-ship* will help ensure the approval of these new strategies.

A company can initially focus on projects that are easier or less capital-intensive. Such projects will have the benefit of saving the company money in the short term while building a portfolio of success. This can enhance commitment within the company to ensure support of more challenging projects in the future.

Below are descriptions of Act activities that will need to be carried out at the executive and site level.

# Executive Implementation:

- · Prioritize sites with the largest vulnerabilities to risk or opportunities to cost savings
- Designate an executive water valuation coordinator to serve as a point of contact for each site's water valuation coordinator. This person will collect and examine Learn output and other documentation from the water valuation committee
- Carefully track proposals throughout the executive level project planning and funding stages
- Encourage executives to continue commitment to and support for site-level initiatives

## Site Implementation:

- It is important to build commitment at the site-level. Chosen strategies for water man
  agement should be communicated to employees at all levels using promotional posters,
  discussion points at departmental meetings, site-wide emails, and related events.
- · Water sustainability approaches should be marketed site-wide.
- Projects in their early stages should be input into the Knowledge Sharing database (Section 2.2.5).
- The water valuation coordinator should track current projects and performance as well as manage communications with other levels of the company.
- Develop a contact list of experts and resources that can assist with the projects

The *Act* part of the tool will likely be the most challenging and time-consuming, but also the most rewarding. As project funding staff become more comfortable with these types of proposals and more familiar with the company's corporate commitment to water, the approval process will become easier. After completing this step, a company will be well on its way to being a leader in water resource management, reaping the benefits of enhanced opportunity and financial savings by avoiding business risk.

#### **ACT CHECKLIST:**

	Designate an executive water valuation coordinator
	Implement executive level strategies developed in the Plan section
	Implement site-level strategies developed in the Plan section
П	Develop a site-level contact list for project assistance

# 2.2.5 Step 5 : Share

GOAL: To communicate results of strategy implementation with the entire company.

In step five, organizations will:

· Share knowledge about implemented water-valuation projects

This step is intended for:

Employees at all levels

As this decision-making framework begins to produce measurable results, it will be useful to share these successes and failures company-wide. The *Share* step accomplishes this by enhancing communication between multiple management levels and different geographic locations. *Share* is facilitated by a user-friendly database accessible from the company's intranet. This database assists managers, employees, and partners in systematically capturing and organizing their water-related knowledge and experiences. Additionally, this database could serve as a central location for quantitative, site-level data. With this system, knowledge is easily available internally and enhances linkages between individuals and groups working to address similar challenges in different parts of the organization and world.

#### Benefits:

- Inspiration This database will provide a place to go for ideas and resources, saving employees time and money.
- Informal Advice Internal employees are well-trained and understand the workings of the company best. Therefore, in-house advice can be highly useful when approaching a problem.
- Technical Assistance Users can reference the database for technical information and assistance.
- Upper Management Communication Users can address upper management with salient ideas. Upper management can also utilize the database to monitor company activities relevant to the executive water management program.
- Formal and Informal Learning Events Users have a common calendar to organize and learn about events, both formal and informal.
- Evaluate and Assess Users and managers can review projects and water data to evaluate the success of water management activities.
- Self-promotion At the completion of a project, users have a space to record innovation.
   These ideas can then be harvested for patent applications and public relations efforts.

#### Case Study: United Nations Environment Programme<sup>59</sup>

Best Practices and Success Stories Global Network (BSGN) is the United Nations Environmental Programme's knowledge sharing database that seeks to enhance the visibility of environmentally sound practices and about the successful implementation of environmental

initiatives. This network shares information and promotes replication of successful practices. Utilizing this database also allows UNEP to showcase the impacts of its work and the work of its collaborators, promoting sustainable development, environmental protection, and poverty alleviation.

The knowledge-sharing database will serve as an internal platform for cross-organizational communication at both the site and executive level. It will also facilitate propagation of water policies and principles and encourage operations managers to continually seek improvement in water resource management.

What follows is an example database created to share information on new or past water projects. This database was created using Microsoft InfoPath, although other programs could be used.

# FIG. 19 Knowledge Sharing Form



Example Database: How to Share Knowledge

I. First query by Facility Location or Facility Type or Water Use Activity.

II. Select "Which best describes your shared input?" from the choices Reduces Risk, Enhances Opportunity, or Presents a New Technology. Reduces Risk is an idea that helps to prevent a risk from harming the company's bottom line. If Reduces Risk is chosen, the user will be taken to select from the six risk categories (Changing Business Demands, Regulatory Environment, Source Water Quality, Stakeholder Issues, Supply Chain, Water Availability and Climate Change). More than one can be selected by holding ctrl button. Enhances Opportunity is an idea that may help the company save money, especially over a shorter time period. Presents a New Technology is an idea that presents a new technology, either employee-developed or something possible for purchase.

III. Select "Do you (check all that apply)?" from the choices: Want to present this idea to other employees, EHS, and/or upper management; Want to share what is currently in progress; Want to share results with other employees, EHS, and/or upper management; Want to present an idea for possible patent; or No preference/simply want to share.

IV. Users can also reference the Water Events Calendar, in order to attend upcoming company events.

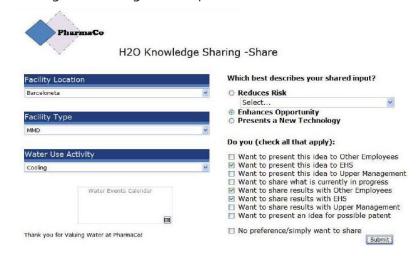
V. Submit

# Example

This information in the figure below was input by Marc Pharmac, the water valuation coordinator in Barceloneta, Puerto Rico:

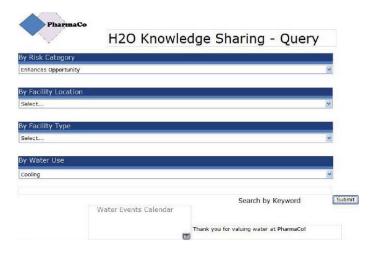
# Sharing Knowledge Example

FIG. 20



# Searching the Knowledge Sharing Database

FIG. 21



Example Database: How to Search the Knowledge Sharing Database

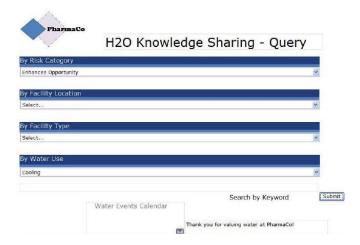
I. Query By Risk Category, By Facility Location, By Facility Type, and/or By Water Use. Or the user may Search by Keyword.

II. Users can also reference the Water Events Calendar, in order to attend upcoming company events.

# Example

This query was conducted by employee Mark Pharmac, who wanted to search for information that would enhance opportunities related to cooling. He could have also searched by facility location and/or type.

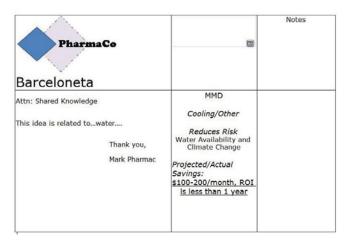
# FIG. 22 Searching the Knowledge Sharing Database



# Example

This page was created by employee Mark Pharmac, who wanted to share knowledge for a project in Manufacturing, that Reduces Risk (Source Water Quality), with a Projected Savings of \$100-\$200/month. The output returns a description of the activity and a projected cost savings.

# FIG. 23 Output from Knowledge Sharing Database Search



In addition to the knowledge-sharing database, an annual meeting at each site could help further water-related interpersonal communication and strategy-building. This annual meeting, or "Session H2O" should:

- Be run by the plant manager, not environmental management If the meeting is run by the plant manager, it is clear that water savings are important to the entire facility.
- Award top ideas and show that water conservation pays Set up an award system for conservation ideas and performance, including ceremonies, catered lunches, etc.
- Communicate new ideas This meeting can be used to discuss ideas and strategies that
  are new to the company.
- Provide training for new equipment or strategies This meeting can be a platform for training.
- Report progress and results This meeting is a place to discuss the status of different water-related activities and whether or not improvement is needed.

The activities of each site's meeting should be summarized and communicated to executive management via a one to two page memo.

## Case Study: GE and "Session Energy"60

At GE's "Session E," managers are praised for outstanding performance, exchange best practices with peers, and receive feedback on less-successful practices that did not work as well. At the Session, the plant manager makes the presentations, not environmental management. This "Session E" provides information and support to make site managers better equipped to create their own "world-class" energy-efficient plant.

Both the database and the "Session H2O" provide methods for cross-organizational networking. Knowledge Sharing is a way to optimize communication and reduce implementation barriers.

#### SHARE CHECKLIST:

☐ Create a knowledge-sharing database
☐ Input results from Act into the database
☐ Schedule a Session H20

# 2.2.6 Step 6: Re-evaluate

GOAL: To examine the success of programs continuously, make improvements to the decision-making process, and set expanded water-related goals.

In step six, organizations will:

- · Re-evaluate the implementation of this water valuation tool.
- Identify ways to improve on the processes developed.
- Ensure success for future iterations of the program to continue developing strategies that support the valuation of water company-wide.
- · Set new water-related goals for the entire company

This step is intended for:

- · Executives
- · Executive level management
- · Site-level management

Becoming a leader in water resource management requires a constant commitment to improvement. *Re-Evaluate* is the last step in the water valuation tool. It represents the importance of ensuring this decision-making framework is an iterative process. Revisiting all steps in this water valuation tool allows for evaluation of past performance and the creation of a implementation program that will be tailored to fit an individual company's needs. Additionally, this step can allow companies to identify successful programs and potential process improvements. Just as important is the task of learning from past mistakes so that failures are not repeated again in future projects. Companies must continue to raise the bar by expanding pilot projects and improving policies and programs In addition, companies should set higher quantitative goals based on the metrics chosen in *Sponsorship*.

#### **RE-EVALUATE CHECKLIST:**

Discuss the progress of program implementation
Make modifications to the worksheets, forms, and/or knowledge sharing database
as necessary to ensure success of future programs
Set higher quantitative goals for water reductions

# 3

# CASE STUDY: THE PHARMACEUTICAL INDUSTRY IN PUERTO RICO

The pharmaceutical industry plays a key role in the Puerto Rican economy, and has for the past several years. Over 100 companies have research and development, manufacturing, formulation, and packaging operations in the commonwealth. Bio-technology, pharmaceuticals, and medical devices are among the areas of focus for these operations.

Pharmaceutical companies benefit from Puerto Rico's abundant natural resources, motivated workforce, and significant government financial incentives. A high-quality infrastructure for communication, transportation, and supporting industries encouraged initial development in the late 1950s and helps maintain a strong level of industry involvement today.

- The pharmaceutical industry provides 30,000 jobs in Puerto Rico
- $\cdot$   $\;$  These jobs account for 26% of total manufacturing jobs
- The pharmaceutical industry provides 24% of the GDP in Puerto Rico
- Pharmaceutical products represent 60% of all exports from the commonwealth
- The value of existing pharmaceutical industry infrastructure totals over \$60 billion US

The data above provide evidence of the large impact this industry has on Puerto Rico.

This industry also contributes to growth in a number of other related manufacturing and service industries, which collectively employ over 100,000 Puerto Ricans. The long-standing presence of the industry has social impacts as well. Pharmaceutical production workers receive some of the highest pay in the commonwealth, and the industry is directly involved in education by supporting a multitude of students in engineering and other technological and scientific fields. Significant investment by the industry in Puerto Rican universities has yielded over 9,600 new scientists annually. The government has created a welcoming business environment for major corporations by implementing tax

incentives such as low rates for corporations, credits, exemptions, and deductions. These deductions can be earned for a wide variety of expenditures including property, payroll expenses, Research & Development (R&D) costs, and employment programs. 61,62

Barceloneta, PR stands out among manufacturing communities worldwide. This region hosts one of the largest aggregations of pharmaceutical facilities in the world, due in part to the size and quality of underground aquifers. This case study provides an example of how to use the decision-making framework. A hypothetical site has been created based on real information about the pharmaceutical industry in Barceloneta. This facility belongs to a hypothetical US company named PharmaCo. The following case study is intended to be representative of the context and water relationships of many actual facilities in Barceloneta, based on previous field work and research.

#### Sponsorship:

Several members of the PharmaCo executive team had suggested the need for a comprehensive water use plan. The executive team thought that building a reputation as a company committed to water management would also show how dedicated it was to protecting the health of both current and potential customers. This new approach would allow PharmaCo to become a leader in water management, potentially realizing a competitive advantage. PharmaCo's executives had read research linking water to energy. Although the company was aggressively working to reduce energy use and associated business risks, little had been done about water.

After careful thought and planning, an executive committee mandated that PharmaCo would be water-positive in 50% of its locations and reduce overall corporate water use by 10% from a baseline over the next five years. Additionally, in areas determined to have high water risk, PharmaCo sites would achieve a 15% reduction over the same time period.

#### Q: What does it mean to be "water positive"?

A: Being "water positive" is an approach to 'offset' an organization's water footprint by investing human and financial capital in water reductions projects in the local community. An organization reaches a 'positive' status when they offset more water than it uses on site.

Key executives developed a written set of water policies based on the company's core values. These are listed in Section 2.2.1. Additionally, these executives defined key terms and units of measurement and set aside \$250,000 of the corporate operational budget to be used to encourage and support projects at each site. The executives then decided to choose three plants, including the one in Barceloneta, PR, to pilot this decision-making framework. The team requested that department supervisors at these plants designate a water valuation coordinator from current staff and work with employees in adding water-related issues to their job descriptions. As part of this policy, a water task force was created to further develop and implement this policy and program laid out by the executives. This water task force is comprised of several middle-management employees versed in

water issues. In order to stay committed to this program, executives decided to reevaluate the process in six months.

The chief financial officer also asked the finance division to designate three staff members for further training in environmental accounting (Appendix B.5) and benefit-cost analysis. The chief operations officer worked with supply chain supervisors to develop a "Partner and Supplier Code of Ethics" to ensure that companies doing business with PharmaCo were also aware of water-related business risk (Section 2.2.1).

The executive team felt that the water valuation tool should be piloted at a few plants to observe and improve the process. The pilot program chose three sites that used significant amounts of water or were in areas of stressed water supply.

- The Barceloneta, Puerto Rico facility was chosen to achieve a 15% reduction by 2013.
- The Berlin, Germany facility was chosen to achieve a 10% reduction and attain "water-positive" status by 2013.
- The Australia facility was chosen to achieve a 15% reduction by 2013.

Based on the progress at these sites, PharmaCo will choose to implement the decision-making process company-wide.

#### Learn:

The head of Environmental Health and Safety (EHS) for PharmaCo's Barceloneta facility designated an employee, EHS environmental engineer Juan Lopez, as the water valuation coordinator for the site. Juan was already involved in water-related activities such as water quality monitoring, so he and his supervisor officially updated his work duties to include responsibility for utilizing the decision-making framework on-site. Juan began this process by filling out the profile form with data from other EHS documentation (Appendix C.1).

Juan then began to build a water valuation committee to conduct the Risk Evaluation activity. He sent a site-wide email to query interest in water issues at the plant. His final committee included some co-workers form EHS, the plant manger, the plant engineer, the custodial manger, the utilities manger, a chemist, a lab manger, and two production workers. This committee met for four hours on two consecutive mornings, addressing the questions provided in the Risk Exploration activity.

Finally, the group identified the areas of biggest risk based on their conversations from the Risk Exploration activity. Juan took notes as the others were talking, answering the questions, and filling out the site's stakeholder wheel (Appendix C.2). After the water valuation committee meetings, Juan drafted a memo (Appendix C.3) with recommendations and conclusions to be shared with site-level management and corporate-level EHS.

#### Plan:

The water valuation committee, led by Juan Lopez, utilized the results from the Learn section to come up with innovative water management strategies for the Barceloneta site. Conducting the Risk Exploration activity helped the group hone in on specific risks

that needed urgent attention. The committee sat down for approximately five hours and developed some excellent and implementable strategies (Table 3). To direct the meeting, the brainstorming session started off by answering the questions in the Plan section of the water valuation tool (Section 2.2.3).

- Which risk category/categories are you most concerned about?
   Water Availability and Climate Change, Source Water Quality, Regulatory Environment
- Which risk category/categories do you feel need to be addressed first?
   All 3 risks need to be addressed in tandem. However, it is likely that addressing one risk will indirectly address some others.
- Are there any opportunities for water reductions in your site's operations made obvious by the Learn analysis?
  - Domestic water as well as water used for cooling would be two areas where some reductions could occur.
- Are there any aspects of manufacturing processes at your site where you feel water could be more efficiently utilized?
   It may be difficult to change how water is currently used in some processes, but it is feasible that as new processes come on board here at Barceloneta, we can be significantly more water conscious.
- Are there any aspects of the manufacturing processes at your site that you feel may be a
  barrier in implementing water reductions strategies?
   The transition to producing more biological pharmaceuticals here at Barceloneta will
  ultimately demand more water, and this will be hard to overcome.
- What are your initial ideas for projects to reduce risks or enhance opportunities? Please brainstorm these ideas in the plan matrix below.

TABLE 3 Site-Level Strategy Development

Risk	Site-Wide Strategy Development
Changing Business Demands (CBD)	Enact a new site-wide policy that whenever a new production process is introduced at the site, a full water audit is performed to assess the 'embodied water' in the product.
	Put together a 1-hour training program for current employees that discusses issues with the changing business environment including globalization and the industry shift to biologicals. The focus of this training will be how these changes will affect future water resources and use.

# Site-Level Strategy Development(continued)

Risk	Site-Wide Strategy Development
Regulatory Environment (RE)	Facilitate a conference with local regulatory agencies and other pharmaceutical companies to have an open forum for discussing current water issues. Suggest that our company hosts bi-annual meetings for regulators and pharmaceutical companies to continue discussions.
	Consider developing a contract with local regulators, to lock in a price for water (extraction or purchase) for a set time period, as long as PharmaCo Barceloneta reduces overall water footprint by 15% over 5 years. This approach or a similar one will reduce the uncertainty regarding Puerto Rico water prices into the future, as they have tripled in the last few years.
Stakeholder Issues (SI)	Enact a new site-wide policy where every 4 months, employees are able to take a half-day (paid) to go volunteer in water-related activities (example, participating in a local stream clean up event).
	Designate 2-3 employees for K-12 outreach work. For these selected employees, it will be part of their jobs to 4 times per month go to a local school and conduct a 2 hour long educational, science and water-conservation program.
Source Water Quality (SWQ)	Conduct an assessment of the local water supply to identify some future potential off-site contamination sources. Have an emergency plan in place to respond quickly to any source water contamination.
	Call upon local experts to see what some potential approaches may be to addressing salt-water intrusion in the aquifer. Present findings and solicit ideas at the local pharmaceutical confer

# Site-Level Strategy Development (continued)

Risk	Site-Wide Strategy Development
Source Water Quality (SWQ) (continued)	ence, as discussed in this matrix under "Regulatory Environment."
Supply Chain (SC)	Enact a policy that focuses on using local suppliers, especially for key inputs. This will reduce uncertainty regarding suppliers and their water resource availability.
	Develop a "water supply chain" audit for the 2-3 most profitable production outputs. This will provide a foundation to assess what would happen if one of their supplier's water supplies were interrupted, and how this may impact production and profits.
Water Availability and Climate Change (WAC)	Twice per year, water use data should be input into the PharmaCo "Global Water Tool" created by the WBCSD, specifically updating the Barceloneta numbers to always have a clear idea of water stress and supply.
	Design a set of purchasing standards so that any new equipment using water is among the most water-efficient available. These standards will almost resemble an "energy star" label but for water. Suggest that this standard be used corporate wide, and even industry wide. As part of this program, have a yearly competition at each site for employee suggestions on how to further reduce water use.

- Do these strategies help address multiple risks or create opportunity?
   Many of these strategies address a specific risk, and indirectly help to think about other risks.
- What are the barriers to implementation?
   The main barriers to implementation are human capital and financial resources. Some of these strategies may be costly, and savings not visible immediately. It will be difficult to

'sell' projects that have high indirect cost savings and low direct cost savings. The indirect cost savings are generally difficult to measure.

What resources and expertise within the company could help with these strategies?
 Outside of the company?

There are several employees who have some advanced knowledge in water-resources engineering. It would also be possible to hire interns focusing on sustainability and resource conservation to develop some of these strategies. Partnerships with academic institutions and other pharmaceutical companies could develop these strategies further.

The initial steps taken at the corporate level taken in the Sponsorship section were necessary to take a cohesive vision for corporate water management. These steps were essential in enabling site-level strategic planning; however, there are many other strategies that uphold the water principles and policies developed in empower that will allow positive water valuation to percolate through all levels of the organization.

The water task force brainstormed several strategies that it wants to be put in place company-wide to achieve its numeric goals for water valuation. These will be instituted initially at the three sites piloting the decision-making framework. These strategies are outlined below (Table 4).

# Company-Wide Strategy Development

TABLE 4

Risk	Company-Wide Strategy Development
Changing Business Demands (CBD)	A yearly meeting will be held at PharmaCo corporate headquarters. Site managers will attend and the focus will be how the changing business environment and industry will affect global operations and natural resource use.
Regulatory Environment (RE)	Every site manager is required to have Environmental, Health and Safety representatives talk with local regulators and learn about what kinds of water-related regulations can be expected in the future, especially water price.
Stakeholder Issues (SI)	In order to raise awareness for our employees regarding water issues, a Water Day will be held company-wide. There will be speakers coming in to educate employees. Complimentary lunch will be provided to all employees. During this time, employees will be able to participate in a 'waterfootprint' exercise to learn about water use both

### Company-Wide Strategy Development (continued)

Risk	Company-Wide Strategy Development
Stakeholder Issues (SI) (continued)	at PharmaCo and at home. A presentation will also be given that educates employees on the link between public health and clean water, focusing on our role as a health care company.
Source Water Quality (SWQ)	Any new PharmaCo manufacturing facility must undergo a source water quality analysis to see what issues there may be with the water source as well as potential future contamination sources.
Supply Chain (SC)	In choosing new suppliers, in addition to price of inputs, a supplier must release information regarding water use and reliability of water supply. Suppliers who are not willing to provide this information will not be considered.
Water Availability and Climate Change (WAC)	All sites must conduct a water balance and assign costs to different purities of water. Additionally, each site must put together emergency management plans that address storms, droughts and flooding.

The results of the Barceloneta strategy development session were reported to PharmaCo's corporate water task force. At this point they are very pleased with the progress being made in Barceloneta, as well as pleased with their own progress in coming up with executive level Plan strategies. At both the site and executive level, three to four strategies were chosen to be developed into proposals for further action.

#### Act:

By moving through the decision-making framework, PharmaCo was then equipped with several water-saving strategies. With help from the water valuation committee, Juan Lopez developed funding proposals for these three to four new strategies, which included information regarding the potential for:

- Saving money
- · Avoiding risks and weakening vulnerability
- · Reducing the impact of new or changed regulations
- Improving facility reputation within the community
- Receiving positive press coverage

The water valuation committee first promoted projects that were less capital-intensive or easier to implement; projects that would help save PharmaCo money as well as build a portfolio of success.

In order to assess progress efficiently, PharmaCo assigned Juan, the water valuation coordinator, the job of tracking current projects and performance as well as managing communications with other levels of the company. As part of addressing the Regulatory Environment risk, Barceloneta began hosting a conference to facilitate dialog between the local regulatory agencies and pharmaceutical companies. Unfortunately, the conference was not well-attended by the neighboring industries, and local regulators did not seem open to the idea of joint decision-making. Juan later decided not to continue with this strategy.

Another project piloted to address the Water Availability and Climate Change risk involved the creation of a water standard for all new equipment purchased. This standard was applied to the new retention pond and cooling towers that Barceloneta needed to install. The facility had been using brine water in an open-loop system to cool the reactors, which was an inefficient system that wasted water and energy. They decided to switch to a high-efficiency coolant, Syltherm.<sup>63</sup> Although the process was a bit more expensive to install, Juan calculated that the energy and water savings would pay for the added cost in a little over three years.

#### **Knowledge Sharing:**

The knowledge-sharing database was tested by the three sites piloting the water valuation tool. Each site used the database to share ideas, failures, successes, and progress updates with interested employees at all three locations. The database also allowed PharmaCo executive management access to a written record of projects and implementation timelines.

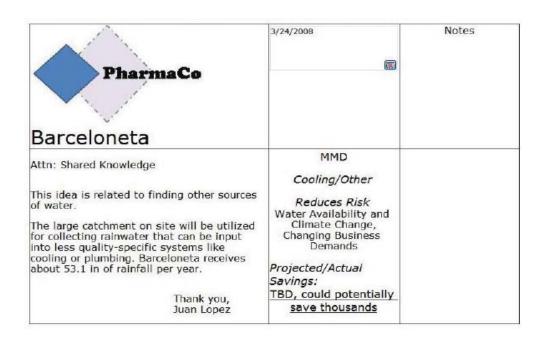
Below are two sample shared ideas from Barceloneta (Figs. 24 and 25):

- · Replacement of water for cooling with the Syltherm cooling liquid
- · Stormwater collection facilities

#### FIG. 24 Example of Shared Knowledge-Cooling System



# FIG. 25 Example of Shared Kknowledge-Rainwater Collection System



As a result of this shared knowledge, PharmaCo Australia, another facility piloting the water valuation tool, became interested in the storm water pond that Barceloneta had developed. An EHS staffer contacted Juan to gain more information as well as detailed plans on the project so that they could develop a similar water reduction strategy.

#### Re-Evaluate:

The water valuation committee was pleased with the results of the first round of the water valuation tool. They identified several strategies to implement, and the projects are being met with positive feedback throughout the site. Finding funding for the various projects has posed a challenge, but committee members used case studies and water-related business risk to show the benefits of early action for sustainable water management. This worked well as an explanation for why capital should be expended on these projects. Additionally, local regulatory agencies made a contract with PharmaCo Barceloneta that if they reduced their water footprint by 15% in 5 years, showing yearly reductions of at least 3%, the agency would not raise aquifer use charges for a 10-year period.

Within the first six months of strategy implementation, Barceloneta was able to reduce water use by 1%. While this was a good first effort, it is clear that more projects and employee involvement is needed to get closer to their water reduction goal.

February 5th, 2008 was host to PharmaCo's first Water Day. Since water management is in its pilot phase within the company, only two other sites participated in the activity. Employees showed marked enthusiasm in learning about world water issues, and PharmaCo's role as a healthcare company. They praised the organization's early efforts, and also felt being a water leader would provide a strategic business advantage going into the future.

The Barceloneta water valuation committee meets every six months for a two-hour meeting on how the site is progressing towards its goals. Juan Lopez is responsible for gathering the data and calculating water reductions for the period.

During the first 6-month meeting, the water valuation committee noticed that PharmaCo in Berlin had implemented a water-offset program. This program offered farmers training and materials to reduce water used in irrigation. The amount of water offset by farmers counted towards the water credits implemented in PharmaCo's water positive approach. The Barceloneta water valuation committee thought this was an innovative strategy, and is developing a similar project in its own region.

Both worker productivity and profitability increased for the time period, signifying a commitment to PharmaCo's new water strategy. PharmaCo's executive water task force team decided to have PharmaCo Barceloneta speak at the next global site-managers meeting to introduce, discuss, and promote the water valuation tool to the rest of the organization. Overall, all employees of the pilot plants were pleased with the results of the implemented projects and were excited about transitioning the program to other facilities company-wide.

# 4

# CONCLUSION AND FUTURE RECOMMENDATIONS

The condition of water resources around the globe are at risk from expanding demand and decreased availability. Companies can also find themselves facing water-related business risk due to changing business demands, stakeholder issues, source water quality, supply chain, regulatory environment, and water availability and climate change.

Proactive corporations will develop new perspectives and explore opportunities for water management.

#### This document showed:

- How a corporation can avoid business risks related to water use
- How corporations can think about valuing water, given the low cost of this re source today
- How corporations can make decisions about water and plan for an uncertain future
- How a corporation can gain competitive advantage and take a leadership role in changing the way industry values water

By using the included **water valuation tool** as a decision-making framework, pharmaceutical companies can think about risk, create value, and stand out as a leader among other companies. In following the steps of *Sponsorship*, *Learn*, *Plan*, *Act*, *Share*, and *Re-Evaluate*, organizations can build a commitment to water management, learn about water use across the company, plan, develop and implement water management strategies and programs, share water-related information, and continuously improve site-level and company-wide water management.

This water valuation tool provides the structure for pharmaceutical companies to approach water issues internally and self-sufficiently. Becoming proficient in this decision-making process will make progress easier to achieve and will provide the foundation for organizations to become leaders in sustainable water management.

#### SOME POTENTIAL NEXT STEPS INCLUDE:

- Share knowledge with other companies. Quantitative data for the case studies in this document are not currently publicly available. Gathering data regarding water and cost savings from other organizations will help build a strong business case. for implementation of a water valuation approach in the pharmaceutical industry.
- Perform a comprehensive financial benefit-cost analysis for the implementation of this framework.
- Collect and report water-use statistics and related information. A complete data set is key to building a more quantitative analysis of water-related business risk and its financial implications.
- Develop marketing that describes activities related to implementation of this tool, for inclusion in sustainability reports and other publications.
- Examine the potential financial benefits of developing opportunities that arise from risk mitigation.

The included water valuation tool provides the basic framework for developing better water management strategies. A continuous commitment to improvement and the ability to customize this tool to the needs of each organization, provide the capacity for gaining competitive advantage and becoming a leader in water valuation.

"When a well-run business applies its vast resources, expertise, and management talent to the problems that it understands and in which it has a stake, it can have a greater impact on social good than any other institution or philanthropic organization." <sup>64</sup>

—Harvard Business Review

# APPENDIX A WATER-RELATED BUSINESS RISK

## A.1: A Pharmaceutical Industry Comparison of Corporate Reporting on Water

The Pacific Institute, an independent, nonpartisan think tank studying issues at the intersection of development, environment, and resource security, published a document entitled "Corporate Reporting on Water: A Review of Eleven Global Industries." This document reviewed the corporate responsibility reports from 139 of the largest companies in the eleven most water-intensive industrial sectors. Specific to the pharmaceutical and biotech sector, this report analyzes the water programs of 13 of the top financially performing companies.

The 11 Most Water Intensive Industrial Sectors

Rank Sector 1 **Apparel** 2 Automotive 3 Beverage Biotech/Pharmaceutical Chemical 6 **Forest Products Food Manufacturing** 8 High-technology / Electronics Metal / Mining 10 Refining 11 Utility

TABLE 6 The 13 Top-Performing Pharmaceutical/Biotech Organizations

Rank	Organization
1	Pfizer
2	Johnson & Johnson
3	Bayer
4	GlaxoSmithKline
5	Sanofi-Aventis
6	Novartis
7	Roche
8	AstraZeneca
9	Abbott
10	Merch & Co.
11	Wyeth
12	Bristol-Myers Squibb
13	AkzoNobel

The analysis points out several key issues with reporting by these companies that relates directly to how they manage and value water. For example, many company reports lack context; they provide their overall water footprint but do not reference an industry average for comparison or discuss strategies to reduce water consumption. There is also a significant lack of information on companies' water-related risks. Corporate Social Responsibility (CSR) reports typically do not publish reduction targets or management strategies; few companies consider supply-chain water use in their management strategies; regional water vulnerabilities are often under-reported; and companies infrequently report their use of recycled water. These issues are all important for companies to address and publicly report.

The following quote from the Pacific Institute report succinctly states issues facing industrial water resources:

Water is a crucial resource for nearly all industrial activities. Yet decreasing water availability, declining water quality and growing water demands from non-industrial water users are creating new challenges to businesses that have traditionally taken clean and reliable water for granted. Around the world, corporations are now facing diverse water risks, including changing allotments, more stringent water-quality regulations, growing community interest and control over local resources, and increased public scrutiny of water-related activities. 65

The pharmaceutical/biotech sector has the most comprehensive approaches to water reporting of the eleven water-intensive industrial sectors surveyed. Below is a summary of the analysis the Pacific Institute did for this sector.

#### Summary of Findings of Pharmaceutical/Biotech Sector:

- · Only 2 of the 13 companies discussed local water supplies
- None of the companies report suppliers' water management practices
- Only 1 company mentioned stakeholder engagement practices
- 9 companies have established water policies
- 12 companies have independent water sections in their reports to describe performance
- 6 companies have numerically specified water reductions targets
- 5 companies mention that they implement water-specific best available technologies
- 4 companies mention factoring water risks into their business decisions
- 11 companies have formed strategic partnerships with stakeholder groups, and 4 of these describe efforts specifically in the area of water management
- Only 1 company commits to continuous improvement in water management<sup>66</sup>

Assessing the pharmaceutical and biotech industries' water-reporting metrics is important to understand the diverse initiatives in manufacturing operations.

# APPENDIX B WATER VALUATION TOOL

## B.1: Example Site Profile Form

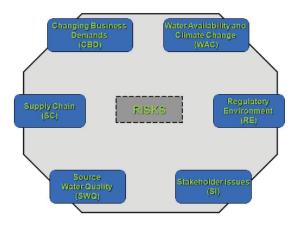
SITE PROFILE FORM  1. Corporate Profile  Site Name:  a. Division:    Manufacturing   Research   Offices   Formulation   Packaging   Other (please specify):  b. Description of Activities:  c. Name of Form Contact:     Email Address:  2. Geographic Profile  a. Address b. Geographic Coordinates:     c. Climate: (include average rainfall)  3. Regulatory Characteristics a. Key Regulatory Agencies b. Site Employee Involved with Regulatory Guidance Name: Phone Number: Email Address:  4. Profile of Water Use a. Water Mass Balance (paste in or attach as a seperate document)	
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Phone Number: Email Address: 4. Profile of Water Use	b. Site Employee Involved with Regulatory Guidance
Email Address: 4. Profile of Water Use	Name:
4. Profile of Water Use	Phone Number:
	Email Address:
a. Water Mass Balance (paste in or attach as a seperate document)	4. Profile of Water Use
	a. Water Mass Balance (paste in or attach as a seperate document)

SITE PRO	FILE FORM			PAGE 2 of 2
4. Profile	of Water Use (cont.)			
	ter Programs (attach a	dditional she	ets if necess	sary)
	Current Projects:			
	Past Projects:			
III.	Proposed Projects:			
c. Inp				
	Name & Location of W	•	•	
	Watershed(s) Affected	•		
		/	gallon, <u> </u>	gallons/day
d. Ou	•	1.00		
	Offsite Wastewater Dis	sposal/Treate	ment	
	Name:	:		Other
	Type: □Surface □ In Level of Treatment: □			
	Onsite Wastewater Dis	•	•	in Tertiary Li Other:
	Level of Treatment:			□Tertiary □ Other
	Amount Reused/Recy	,	•	•
	st of Treatment and An		<u> </u>	ganons, ady
	Domestic: \$			gallons/day
	DI Water: \$			
iii	Purified Water \$	/ ganon, _ /	gallon	gallons/day
iv.	Water for Injection: \$		gallon, gallon.	gallons/day
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	Domestic Use and Ani			
	Amount used:			
	Amount discharged:			
	Expected treatment no	eeds:		
ii.	Cooling and Utilities			
	Amount used:			
	Amount discharged:			
	Expected treatment no	eeds:		
	Production			
	Amount used:			
	Amount discharged:			
	Expected treatment no	eeds:		
	Cleaning			
	Amount used:			
	Amount discharged:	oods:		
	Expected treatment no Labratories	eeus.		
	Amount used:			
	Amount discharged:			
	Expected treatment no	eeds:		

## B.2: Risk Exploration Activity

## Part 1 : Site-Specific information

The Risk Wheel FIG. 26



Think about this site's activities, location, and role in the company:

## 1. Corporate Profile

Question	Business Risk
	Dusiness MSK
How long has this site been in operation?	
What are the most water-intensive manufacturing or laboratory processes performed on site?	WAC
Are current processes/uses going to be continued into the future?	CBD
What aspects of NEW processes are more or less water intensive than current processes?	WAC, CBD
What process or facility changes do you see in the future?	WAC, CBD
Who are your water-intensive neighbors, including other manufacturers, utilities, and communities? With whom do you share the input and output watersheds?	WAC, SI
What do you know about your neighbors' processes or water usage? What water benchmarks do they use?	WAC
What has been in the local or regional news regarding local water resources?	WAC, SWQ

## Corporate Profile (continued)

Question	Business Risk
What has been in the local or regional news regarding your company? What has been in the news about other water-intensive manufacturing companies, local utilities, agriculture, communities, and non-profit groups?	SI, CBD, SC

Think about this site's location:

## TABLE 8 2. Geographic Profile

Question	Business Risk
How many times have employees, facilities, or water sources been impacted	WAC
by storms, droughts, or floods? How did this affect your production capacity?	
How many 100-year floods/droughts have occurred in the past 20 years? How	
many 50-year floods/droughts in past 20 years? <sup>+</sup>	WAC
How would a sea-level rise affect your facility?	
	WAC, SWQ
What is your drought policy?	
	WAC
Is this location in a water-stressed region? Is it projected to be in a water-	
stressed region?*	WAC

<sup>†</sup> These terms represent the probability of a severe flood with a 1 in 100 or 1 in 50 chance of occurring in any given year.<sup>67</sup>

Think about this site's community and your local workforce:

## Geographic Profile (continued)

Question	Business Risk
What are the major religious groups in this area? What are their implicit beliefs on water?	SI

The definition of "water-stressed" is a supply of 500m3/person/yr. To evaluate this, use the WBSCD tool. Input site-specific data into the WCBSD tool to see the relative water stress of that site. Also review maps from United Nations Development Programme, and the World Resources Institute map for country-level resource availability.

Question	Business Risk
What percentage of the community has access to clean water?	SI, CBD
Do 100% of your employees have access to clean water at home?	SI, CBD
How does your site attract and retain employees?	SI, CBD
What efforts are made to ensure employees are heard and their needs are met?	SI, CBD
What do your employees say they like best about working at your site?	SI, CBD

Think about this site's relationship with regulators and the applicable laws and policies:

## 3. Regulatory Characteristics

Question	Business Risk
How strong are your relationships with regulatory agencies?	RE, SI
What are some potential conflicts in your relationships with regulatory agen-	RE, SI
cies?	NE, 3I
What opportunities do you have to help design new policies or programs?	RE, SI
What is your influence on regulatory agencies?	RE, SI
Which regulations do you see changing in the future? How? When? What new regulations do you anticipate?	RE, SI, WAC, CBD
How has your company had to adjust operations due to regulation in the last 20 yrs?	RE, SI
What are the anticipated political shifts locally, regionally, nationally? How will leadership changes potentially affect regulation?	RE, SI
What regulatory issues have local (250-mile radius) corporations seen? How might these issues ripple towards your site?	RE, SI
Have any of your commercial or agricultural neighbors experienced restricted water use/availability or lost license to operate?	RE, SI

## Regulatory Characteristics (continued)

Question	Business Risk
How do local and regional regulations impact production when in a drought or flood situation?	RE, WAC
What other parties outside of the company dictate water availability or water use decisions?	RE, SI

Think about past water conservation/recycling/treatment programs:

#### 4. Profile of Water Use

#### A: Water Programs

- i. Why did some proposed projects fail?
- ii. What were the roadblocks?
- iii. What worked really well with past projects?
- iv. Who participated?
- v. Were these participants recognized?

Think about planning and implementing new water conservation/ recycling/ treatment/ management programs:

## TABLE 10 4. Profile Of Water Use - A: Water Programs

Business Risk
SI

## 4. Profile of Water Use - A: Water Programs (continued)

Question	Business Risk
Question	DUSINESS KISK
Who are your partners? (NGOs, community groups, research institutions, industry groups)	SI
What are some potential in-house and external partnerships?	SI
Which local groups currently receive financial support form your company?	SI
What partnerships would you like to see formed? To which organizations would you like to see your company giving time or resources?	SI
What are your competitors doing to manage stakeholder relations?	SI
What are your own ideas for innovative water programs?	SI

Think about the site's water needs:

## 4. Profile Of Water Use - B : Inputs

Question	Business Risk
Do you expect price to change in the near future? Why?	WAC, RE
Do you expect to be using more or less of any water purity type?	WAC, SC, CBD
What other factors, aside from water supply price increases, will make	SWQ, SC
producing higher purities of water more expensive?	
Do you see any opportunities for cost reduction when using various purities?	SC
Has the quality of the source water changed over time? If so, what do you	
think are the causes?	SWQ
Is your site's water source subject to specific contaminations such as saltwater	
intrusion?	SWQ
In what watershed-level stakeholder engagement activities are your site cur-	SI SIMO
rently involved?	SI, SWQ

## 4. Profile Of Water Use - B : Inputs (continued)

Question	Business Risk
What are some past or current community issues and conflicts associated with your shared source water and watersheds?	SI, SWQ
What would happen at your site if the water price doubled?	WAC, RE
What would a 50% reduction in water use require?	WAC, RE, SI

Think about the water needs of suppliers and partners:

## 4. Profile Of Water Use - B : Inputs (Continued)

Question	Business Risk
Where are your suppliers located?	SC
How would your supplier fill out this questionnaire? How are they affected by regulation, drought, floods, climate change, stakeholder groups, etc?	SC

Think about this site's wastewater disposal needs:

## TABLE 12 4. Profile Of Water Use - C : Outputs

Question	Business Risk
Will new products or activities change quality or quantity of wastewater output in the future?	CBD, RE
Do you expect local or site wastewater issues to affect source water supply?	SWQ, WAC
Do you see your relationship with your site's local wastewater treatment plant changing?	SI, RE

Think about this site's water balance diagram:

#### 4. Profile Of Water Use - D: Water Balance

TABLE 13

Question	Business Risk
What is the biggest use by quantity?	WAC
What simple changes could be made in the site's water inputs or outputs that	WAC
would reduce use, costs, and therefore, risks?	

#### B.3: WBCSD Global Water Tool

"To manage your water globally, you need to know the water situation locally."

The World Business Council for Sustainable Development (WBCSD) has developed a method for companies to analyze their global water footprints in terms of their global operations and supply chains. Using the WBCSD Global Water Tool allows companies to synthesize information from a corporate-wide water balance to quantitatively assess watershed-level vulnerabilities.

The tool allows organizations to think about key questions, such as:

- How many of your sites are in extremely water-scarce areas? Which sites are at greatest risk? How will that look in the future?
- How many of your employees live in countries that lack access to improved water and sanitation?
- How many of your suppliers are in water scarce areas now? How many will be in 2025?

#### According to the WBCSD, the tool:

- Compares your company's water uses (including staff presence, industrial use, and supply chain) with validated water and sanitation availability information – on a country and watershed basis.
- Allows calculation of water consumption & efficiency.
- Creates key water GRI (Global Reporting Initiative) Indicators, inventories, risk and performance metrics and geographic mapping.<sup>68</sup>

The tool functions in two parts. The first is an MS Excel workbook that necessitates input of a water inventory, and delivers output in terms of GRI Indicators. GRI Indicators "total water withdrawals" (EN8), "water recycled/reused" (EN10), and "total water discharge" (EN21), are calculated for each site, country, region and in total.<sup>69</sup> The results are output in easy-to-read charts that clearly relay company-wide water risk at different sites.

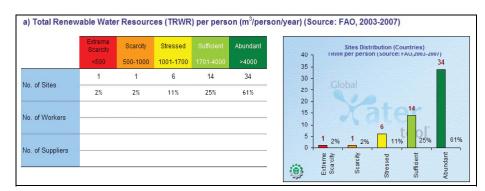
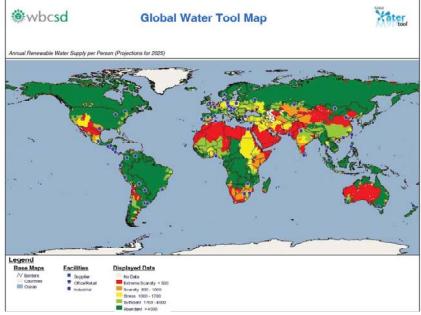


Fig. 27 Example Output from the Global Water Tool<sup>70</sup>

(this figure is an example, and not representative of any specific organization's water use)

The second part of the tool is an online mapping function that includes site locations and external water maps, as well as a Google Earth interface that allows spatial viewing.

Fig. 28 Example Map Output from the Global Water Tool<sup>71</sup>



 $(this\ figure\ is\ an\ example,\ and\ not\ representative\ of\ any\ specific\ organization's\ water\ use)$ 

This tool was released by the WBCSD in August of 2007, during World Water Week. Many WBCSD Global Water Tool Advisory Board Members have tested this tool and found it beneficial in helping understand company-wide water availability. It has allowed these organizations to prioritize water reduction efforts by region. This WBSCD water availability assessment can be useful during the Sponsorship phase of the included water valuation tool for help in site prioritization.

# B.4: Risk Matrices for Executive and Site-level Strategy Development

Risk ↓ Action	Changing Business Demands	Regulatory Environment	Stakeholder Issues	Source Water Quality	Supply Chain	Water Availability and Climate Change
Company- wide Strategy Development						

Risk ↓ Action	Changing Business Demands	Regulatory Environment	Stakeholder Issues	Source Water Quality	Supply Chain	Water Availability and Climate Change
Site-wide Strategy Development						

## B.5: Overview of Environmental Accounting

#### **Environmental Accounting**

Environmental accounting is built on the idea that natural resources are not free goods. It encourages organizations to treat resources as finite assets, promoting appropriate and efficient allocation. This accounting practice incorporates environmental cost and benefit information into business decisions.

In standard management accounting, internal costs are private costs borne by a facility for materials and labor. External or societal costs are the costs to society stemming from a facility's activities. Many companies consider environmental costs 'overhead' or indirect and therefore are not associated with day-to-day operations, and their true magnitude may not be realized by analysts and managers. Contingent and image/relationship costs are not included in traditional accounting approaches. Due to this accounting structure, many times the full value of 'green projects' is not recognized. It is important to note, however, that many of these costs are difficult to measure.

Green accounting approaches build in these additional costs to products and processes, as a way to put a value on the environmental impacts associated with a resource. By breaking environmental costs out of overhead, managers will have a much better idea of the true cost of producing a product. This practice can also provide a more accurate method of financial assessment when an organization is deciding whether to go ahead with a project designed to save resources and benefit the environment.<sup>73</sup>

The benefits of environmental accounting span from direct to indirect and include:

- · More informed decision-making
- · Uncovering opportunities
- Improved pricing of products
- · Assistance with internal and external reporting
- Increased competitive advantage
- Improved reputation
- · Staff retention and attraction
- Generation of social benefits<sup>74</sup>

# APPENDIX C BARCELONETA, PR. CASE STUDY

## C.1: Completed Site Profile Form

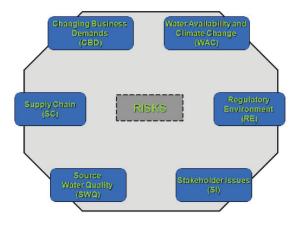
1. Corporate Profile  Site Name: Pharmaco, Inc.  a. Division:  Manufacturing  Research Offices Formulation Packaging Other (please specify):  b. Description of Activities:  c. Name of Form Contact: Juan Lopez Email Address: juan.lopez@pharmaco.com  2. Geographic Profile a. Address: 123 Pharma Way. Barceloneta, PR b. Geographic Coordinates: 18* 27' 2" N lat 66* 32' 19" W long c. Climate (include average rainfall): Hurricane season spans June to November  3. Regulatory Characteristics
a. Division:  ☐ Manufacturing  ☑ Research ☐ Offices ☑ Formulation ☐ Packaging ☐ Other (please specify):  b. Description of Activities:  c. Name of Form Contact: Juan Lopez Email Address: juan.lopez@pharmaco.com  2. Geographic Profile  a. Address: 123 Pharma Way. Barceloneta, PR  b. Geographic Coordinates: 18° 27' 2" N lat 66° 32' 19" W long c. Climate (include average rainfall): Hurricane season spans June to November  3. Regulatory Characteristics
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Email Address: juan.lopez@pharmaco.com  2. Geographic Profile  a. Address: 123 Pharma Way. Barceloneta, PR  b. Geographic Coordinates: 18° 27' 2" N lat 66° 32' 19" W long  c. Climate (include average rainfall): Hurricane season spans June to November  3. Regulatory Characteristics
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c. Climate (include average rainfall): <i>Hurricane season spans June to November</i> 3. Regulatory Characteristics
3. Regulatory Characteristics
<u> </u>
a. Key Regulatory Agencies: EPA Region 2
b. Site Employee Involved with Regulatory Guidance
Name: Susan Feliciano
Phone Number: 885-395-2857
Email Address: susan.feliciano@pharmaco.com
4. Profile of Water Use
a. Water Mass Balance (paste in or attach as a seperate document)
20 million gallons Evaporation or other losses
1
500 million gallons  Fram PRASA  To BRWWTP
from PRASA
300 million gallons from groundwater 200 million gallons reuse

SITE	PRO	DFILE FORM PAGE 2 of 2
4. Pro	ofile	e of Water Use (cont.)
b.	Wa	ater Programs (attach additional sheets if necessary)
		Current Projects: installing an energy-efficient cooling tower
		Past Projects: installed new RO filtering system (now 300gpm, 7/8/04)
	iii.	Proposed Projects: new 500,000 gal storm water retention pond
C.	Ini	outs
		Name & Location of Water Source(s): Karst aquifer and PRASA
		Watershed(s) Affected by Withdrawal: none
	iii.	Purchased Water: \$ 3.20 /kgallon gallons/day
d.	Οι	utputs
		Offsite Wastewater Disposal/Treatement
		Name: Barceloneta Regional Waste Water Treatment Plant
		Type: ☐ Surface ☐ Injection ☐ Municipal ☐ Other:
		Level of Treatment: ☐ Primary ☒ Secondary ☐ Tertiary ☐ Other:
	ii.	Onsite Wastewater Disposal/Treatment
		Level of Treatment: ☐ Primary ☒ Secondary ☐ Tertiary ☐ Other:
	iii.	Amount Reused/Recycled/Downcycled: gallons/day
e.	Co	st of Treatment and Amount Used
	i.	Domestic: \$/gallon,gallons/day
		DI Water: \$ <u>7.50</u> /gallon, <u>1.5 mill</u> gallons/day
		Purified Water: \$/gallon,
	iv.	Water for Injection: \$ 14.90 /gallon,
	٧.	Other:
f.	Wa	ater Balance Information
	i.	Domestic Use and Animal Care
		Amount used: 5,000 gpd
		Amount discharged: 5,000 gpd
		Expected treatment needs: 2e treatment at BRWW Treatment plant
	ii.	Cooling and Utilities
		Amount used: 50 million gpd
		Amount discharged: 30 million gpd
		Expected treatment needs: 3e treatment needed before USE in cooling
	iii.	Production
		Amount used: 500 million gpd
		Amount discharged: 500 million gpd
	•	Expected treatment needs: treated to various levels before use, 3e after
	IV.	Cleaning
		Amount used: 100 million gpd
		Amount discharged: 100 million gpd
	.,	Expected treatment needs: 3e treatment before and after
	٧.	Labratories  Amount used: 15 million at 3
		Amount discharged: 15 million and
		Amount discharged: ~1.5 million gpd  Expected treatment needs: treated to various levels before use, 3e after
		LADELIEU HEALITEIT HEEUS. Treatea to various levels petore use. Se atter

## C.2: Risk Exploration Activity with Stakeholder Wheel

## Part 1 : Site-Specific information

The Risk Wheel FIG. 26



Think about this site's activities, location, and role in the company:

#### 1. Corporate Profile

Question and Crown Answer	Descionana Diale
Question and Group Answer	Business Risk
How long has this site been in operation?	
35 years	
What are the most water-intensive manufacturing or laboratory processes performed on site?	WAC
Bulk chemical production, water for cooling, water for insulin production (making WFI, cleaning, fermentation, formulation)	
Are current processes/uses going to be continued into the future?	CBD
Less bulk chemical production, increasing insulin production, injectable cancer treatment chemicals	
What aspects of NEW processes are more or less water intensive than current processes?	WAC, CBD
We will be using more and more water for injectables (biologicals)	

What process or facility changes do you see in the future?

WAC, CBD

Concern about the lifespan of cooling towers-two need replaced in the next 7 years. Should explore better cooling techniques. Also will be decommissioning several bulk chemical reactors

Who are your water-intensive neighbors, including other manufacturers, utilities, and communities? With whom do you share the input and output watersheds?

WAC, SI

At least 10+ other pharma companies, small scale and large scale agriculture, the town of Barceloneta, all share groundwater aquifer

What do you know about your neighbors' processes or water usage? What water benchmarks do they use?

WAC

Assume similar levels of water use by other pharma companies. We know that BioPharmaTech makes vaccines so they probably use a lot of water. We should find out how much the city uses. Irrigation systems of local farmers should be explored. Explore benchmarks and goals of nearby companies.

What has been in the local or regional news regarding local water resources?

WAC, SWQ

Barceloneta has pure, high-quality groundwater. We don't pre-treat the water much. Salt-water intrusion is becoming an issue, as are flooding, storms, and hurricane intensity. Hurricane Dean and others last summer caused flooding and damage. Also we have to use more mechanical pumping due to lack in pressure of Artesian wells. Also, seeing some problems with water quality b/c of contamination of non-confined aquifer.

What has been in the local or regional news regarding your company? What has been in the news about other water-intensive manufacturing companies, local utilities, agriculture, communities, and non-profit groups?

SI, CBD, SC

People question whether pharmaceutical companies should be allowed to use as much water as we do. Fertilizer run-off from farmers creating dead zones in streams and rivers, increasing nitrogen pollution. Organic solvents in the aquifers from manufacturing plants. landfill leaching into groundwater. Puerto Rico Aqueduct & Sewer Authority (PRASA) just sold 1.5B tax-exempt bonds to improve infrastructure. Filtering capacity issues. A lot of communities live off the PRASA supply and have issues getting clean water for drinking and domestic use.

WAC

How many times have employees, facilities, or water sources been impacted by storms, droughts, or floods? How did this affect your production capacity?

Production halted during hurricane in 2000 and 2003. Flooding required employees to spend more time at home. Stormwater was a big problem on the site. Landslides and

Think about this site's location:

#### 2. Geographic Profile

TABLE 8

Question and Group Answer	Business Risk
rivers overflowing their banks  How many 100-year floods/droughts have occurred in the past 20 years? How many 50-year floods/droughts in past 20 years?†	WAC
Severe flooding caused by hurricanes.	
How would a sea-level rise affect your facility?	WAC, SWQ
Risk of saltwater intrusion and more flooding, coastal erosion for stormwater manage- ment b/c Barceloneta is near the beach.	
What is your drought policy?	
Not really a concern, last drought was 71-74 and 93-94 (caused water supply problems)	WAC
Is this location in a water-stressed region? Is it projected to be in a water-stressed region?‡	WAC
In 2000, based on WRI maps, PR is bordering on water-stressed (yellow) meaning supply per person is 500–1000m3/yr.	

 $<sup>\</sup>dagger$  These terms represent the probability of a severe flood with a 1 in 100 or 1 in 50 chance of occurring in any given year. 75

Think about this site's community and your local workforce:

What are the major religious groups in this area? What are their implicit beliefs SI on water?

Catholic and other Christian. Believe in stewardship but no specific/strong beliefs about water. Also some afro-Caribbean religions (like Santeria). Need to find out about how big of an influence Santeria practitioners are and what they believe about water.

The definition of "water-stressed" is a supply of 500m3/person/yr. To evaluate this, use the WBSCD tool. Input site-specific data into the WCBSD tool to see the relative water stress of that site. Also review maps from UNDP, and the WRI map for country-level resource availability.

#### What percentage of the community has access to clean water?

Varies regionally, need more info about this from Dept. of health.

#### Do 100% of your employees have access to clean water at home?

SI, CBD

Talk with HR? Need more info about this. We have heard through the grapevine that some employees live in the hilly regions and use a small-scale non-PRASA community-run systems. We don't know how good a quality this provides.

SI, CBD

#### How does your site attract and retain employees?

We are in competition with our neighbors to attract new, good employees. We offer scholarships and competitive health benefits

#### What efforts are made to ensure employees are heard and their needs are met?

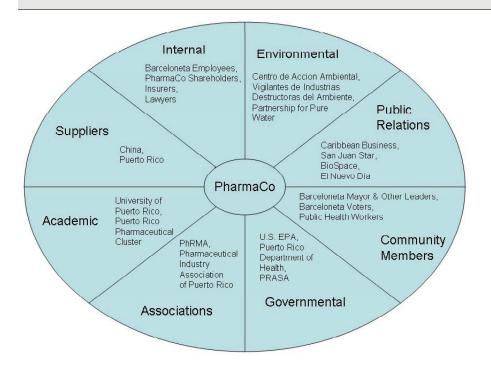
SI,CBD

We have monthly meetings in each department. We have suggestion boxes available. We do biannual employee satisfaction surveys.

SI,CBD

#### What do your employees say they like best about working at your site?

We've heard that our benefits are better than others and that we employ a lot of young people. SI,CBD



Think about this site's relationship with regulators and the applicable laws and policies:

## 3. Regulatory Characteristics

Question and Group Answer	Business Risk
How strong are your relationships with regulatory agencies?	RE, SI
	NL, Ji
We work closely with The Department of Health. However, we are not so much in touch with USEPA region 2.	
What are some potential conflicts in your relationships with regulatory agencies?	RE, SI
PRASA has been calling on us about water withdrawal. NOAA has been wanting us to be more careful about saltwater intrusion.	
What opportunities do you have to help design new policies or programs?	RE, SI
PRASA has been investing in new infrastructure and might want our input on where & how to spend the money.	
What is your influence on regulatory agencies?	RE, SI
No real influence as an individual, but significant influence when in collaboration with other industries.	
Which regulations do you see changing in the future? How? When? What new regulations do you anticipate?	RE, SI, WAC, CBD
In the past we have been given leniency on compliance, to Federal clean water act and safe drinking water act- but that will not last forever.	
How has your company had to adjust operations due to regulation in the last 20 yrs?	RE, SI
We had to upgrade our treatment techniques as well as build a new cooling tower in order to come into compliance.	er
What are the anticipated political shifts locally, regionally, nationally? How will leadership changes potentially affect regulation?	RE, SI
None	

What regulatory issues have local (250-mile radius) corporations seen? How might these issues ripple towards your site?

We should explore this more. Possibly an intern can research this.

Have any of your commercial or agricultural neighbors experienced restricted water use/availability or lost license to operate?

Not recently, but we have heard about this happening in India with Coca-Cola. We could explore this more.

How do local and regional regulations impact production when in a drought or flood situation?

In 93-94 drought we faced water supply restrictions from PRASA.

What other parties outside of the company dictate water availability or water use decisions?

Think about past water conservation/recycling/treatment programs:

#### 4. Profile Of Water Use

#### A: Water Programs

i. Why did some proposed projects fail?

Mostly because they were too expensive

PRASA is influential, as is the Municipal government.

- ii. What were the roadblocks?
  \$\$\$, water issues are not visible enough. More quantitative info is needed.
- iii. What worked really well with past projects?

  Cooperation between engineering and EHS
- iv. Who participated? Engineering, EHS
- v. Were these participants recognized? Sort of...but not in front of their peers.

Think about planning and implementing new water conservation/ recycling/ treatment/ management programs:

## 4. Profile of Water Use - A : Water Programs

What are some resources—expertise, capital, or leadership—that can be accessed?	SI
Some new employees in the facilities engineering department have university coursework in water systems planning. We might be able to find other employees interested in water ustainability. We should find out with a survey in specific departments. EHS also has ontacts with the department of health who might be able to partner with us or help us with regulations.	
What water benchmarks have been established by neighboring local companies?	SI
We actually have little idea what other companies are doing in terms of water. We beard that BioPharmTech has promised a 10% global reduction of water use by 2025. Also, at its facility in Fajardo, Puerto Rico, Pfizer set the goal of reusing 100 percent of its wastewater and now reuses about 20,500 gallons per day of treated water in three cooling towers. This means that there is zero discharge from the facility's wastewater reatment plant, whereas before wastewater was sent to the local public treatment colant and then to the Fajardo River. New ultra-filtration and reverse osmosis units were being installed to improve the quality of the water. In addition, boilers were improved so that they could recover water from the steam they created. 75	
Which watchdog NGOs are following your company and your site's activities, particularly in your community?	
Centro de Accion Ambiental, VIDA (Vigilantes de Industrias Destructoras del Ambiente) <sup>76</sup>	SI
s your site or local area getting attention from academic institutions?	
We don't know much about this in relation to water but get positive attention for sup- corting education and employment of graduates.	SI
Has your company received suggestions from NGOs or academics regarding mproving water stewardship?	
VO	SI

AFFEINDIA C

Who are your partners? (NGOs, community groups, research institutions, indus-SI try groups) Pharmaceutical Industry Association of Puerto Rico (environ. health and safety committee) What are some potential in-house and external partnerships? SI Partnership for Pure Water, support education programs, support the arts in PR Which local groups currently receive financial support form your company? This is to be reviewed SI What partnerships would you like to see formed? To which organizations would you like to see your company giving time or resources? SI Interamerican University of Puerto Rico – San German Campus Center for Education, Conservation and Research (CECIA-UIPR) CECIA-UIPR provided training, education and support for community leaders on improving the operation and administration of small drinking water systems. The program focused on twenty communities in two municipalities, Patillas and Caguas. CECIA-UIPR also provided support to develop water infrastructure and increase regulatory compliance in other small systems throughout Puerto Rico. This has led to significantly improved drinking water and protected public health in Puerto Rico's most isolated communities. The former Partnership for Pure Water (PPW) allowed many industry water users to give back to the local community with financial resources and expertise. This project has been disbanded, but maybe we can think about reinstating something similar. Want closer partnership with government agencies. Closer partnerships with local k-13 schools What are your competitors doing to manage stakeholder relations? SI They are actively involved in engaging local water groups. What are your own ideas for innovative water programs? SI We could calculate our water footprints.

Think about the site's water needs:

## 4. Profile of Water Use - B : Inputs

Question and Group Answer	Business Risk
Do you expect price to change in the near future? Why?	WAC, RE
The price recently tripled, so we do not expect it to go up again in the future.	
Do you expect to be using more or less of any water purity type?	WAC, SC, CBD
More WFI because we are expending into biopharm.	
What other factors, aside from water supply price increases, will make producing higher purities of water more expensive?	SWQ, SC
If saltwater intrusion or groundwater over draft continues, the cost of accessing and treating water will go up.	
Do you see any opportunities for cost reduction when using various purities?	SC
Recycling programs for WFI treatment systems. Upgrading cooling tower. Using other cooling methods for buildings.	
Has the quality of the source water changed over time? If so, what do you think are the causes?	SWQ
Yes, Barceloneta has historically been known for having high-quality aquifer water.  Due to overuse, runoff as well as salt water intrusion, source water quality is declining	
Is your site's water source subject to specific contaminations such as saltwater intrusion?	SWQ
Yes, saltwater intrusion and contaminants that weren't treated when wastewater is put into improper injection wells.	
In what watershed-level stakeholder engagement activities are your site currently involved?	SI, SWQ
None yet!	

What are some past or current community issues and conflicts associated with SI, SWQ your shared source water and watersheds?

The water needs of small communities, small agricultural wells. Pollution in surface

What would happen at your site if the water price doubled? WAC, RE

Need to explore this further.

What would a 50% reduction in water use require? WAC, RE

Need to explore this further.

Think about the water needs of suppliers and partners:

## 4. Profile of Water Use - B : Inputs (Suppliers)

Question and Group Answer	Business Risk
Where are your suppliers located?	SC
Puerto Rico and China.	
How would your supplier fill out this questionnaire? How are they affected by regulation, drought, floods, climate change, stakeholder groups, etc?	SC
Our local suppliers will experience the same effects that we do. China will be facing changing regulations and probably more droughts, but these supplies are still much less expensive	

Think about this site's wastewater disposal needs:

#### TABLE 12 4. Profile of Water Use - C : Outputs

Question and Group Answer	Business Risk
Will new products or activities change quality or quantity of wastewater output	CBD, RE
in the future?	
We will have more waste from using our new Reverse Osmosis system for generating	
WFI	

Do you expect local or site wastewater issues to affect source water supply? SWQ, WAC

Surface water quality is decreasing because of runoff from agricultural fields (heavy nitrogen levels are causing hypoxic zones in rivers, lakes and streams in Puerto Rico). Chemical spills can affect groundwater quality by percolation. Our team heard about the Cidra superfund site created in 2004; some municipal sources had been contaminated, and drinking water supply was cut off to almost 9,000 people. 15 wells were affected.<sup>77</sup>

Do you see your relationship with your site's local wastewater treatment plant changing?

SI, RE

Our plant treats wastewater on site, so no.

Think about this site's water balance diagram:

## 4. Profile of Water Use - d : water balance

In order to be a water leader, managers need to think about water in new ways and approach problems with open minds. Now that you have reviewed the Site Profile, learned about the site's water use, and brainstormed with your team, apply your new outlook and knowledge to the following questions:

What surprised you about completing the Site Profile?

We use more water for domestic use than we previously thought.

What surprised you about completing the Risk Exploration activity?

How susceptible we are to saltwater intrusion, how many people use the same aquifer as us, the susceptibility of the region of Barceloneta to the negative effects of climate change such as sea level rise and increased frequency and intensity of water related events.

What other information is relevant to water risk for this site, based on your personal knowledge?

We're concerned about water privatization and whether PRASA will be able to provide infrastructure and supply reliably. Also, we realize how important the pharmaceutical companies are in this area b/c if each one used as much water as we did, it would have a significant impact on the community.

Look back over your answers to these questions. How do you feel about the following risks after this group exercise?

- · Water Availability and Climate Change
- Changing Business Demands
- Supply Chain
- Source Water Quality
- Regulatory Environment
- Stakeholder Issues

Write a short (two page) summary document highlighting risks and opportunities discovered through this exercise. This should be submitted to corporate-level environmental management. This will serve to inform executive leadership of specific issues facing your site.

# MEMO PharmaCo, Inc.

To: CEO Constance Jones & Members of the Executive Committee:

From: Juan Lopez, & Members of the Barceloneta Water Valuation Committee

CC: Martin Brady Date: 05/12/2008

Re: Risk Exploration for water-related business risk

The Barceloneta water valuation committee is pleased to submit the following report summarizing the findings from the April 13th meeting.

Our facility has been in operation for 35 years in an area that is heavily dominated by pharmaceutical manufacturing. As our business moves into the 21st century, we anticipate having to address the following water-related risks:

#### Source Water Quality

 Although the groundwater we use is of extremely high quality, companies in the area are extremely concerned about salt water intrusion given our coastal location.

#### Stakeholder Issues

- In the neighborhood, there are:
  - · at least 10 other pharmaceutical companies,
  - · a number of small and large-scale farming operations,
  - · the city of Barceloneta
- We know very little about our neighboring pharmaceutical companies.
  - BioPharmaTech makes vaccines, so they must utilize a large portion of the same aquifer on which we rely.
  - We have discovered that executives have set a 10% global reduction in water use goal by 2025.
- We are in competition with our neighbors to attract new and qualified employees. We offer scholarships and competitive health benefits.
- Most of the local communities live off the PRASA supply and others have experienced problems getting clean water for drinking and domestic use.
- Employees who live in the mountainous regions rely on small-scale non-PRASA community-run systems. We do not know how good a quality this provides.
- Some local residents have been questioning whether the pharmaceutical companies should be allowed to use as much water.

#### **Regulatory Environment**

· We do not have a very good relationship with the local regulators. We work closely with

The Department of Health, however, we do not have much contact with US EPA Region 2.

- PRASA has been threatening to increase our water rates and aquifer charges.
- NOAA has asked us to be more careful about salt water intrusion.
- We have no real influence as an individual organization, but could have a more significant impact if we were in collaboration with other industries in the region.
- In the past, regulators have been lenient about compliance with the Federal clean water act and safe drinking water act. This leniency will not last forever.
- We were recently required to upgrade our treatment techniques. We will soon have to build a new cooling tower in order to come into compliance with new regulations.

#### **Changing Business Demand**

- We anticipate an increase in the production of biopharmaceuticals, which will significantly increase our use of high-purity water.
- We will need a new cooling tower in the next 7 years.
- We will be decommissioning several bulk chemical reactors over the next few years.
- PRASA just sold \$1.5 billion (USD) in tax-exempt bonds to improve infrastructure. They might want our input on where & how to spend the money.

#### Water Availability and Climate Change

- Any change in the availability of water will affect production at this facility. This change will
  also affect neighboring residents and industrial facilities.
- Currently, the plant is in a moderately water-stressed area.

#### Supply Chain

- Increase in the production of biopharmaceuticals will increase our reliance on WFI-related technologies and resources.
- Suppliers in Puerto Rico and China produce the materials we rely on: cardboard boxes and plastics for packaging, raw materials for production, and other materials needed for the manufacturing process.
- Companies in PR also use water and will be affected by risks similar to those outlined above.
- Companies in China face additional risks, mainly from changing regulations, source water
  quality, and climate risks. We must be aware of these risks, as they will affect price and our
  ability to access these products.

We would like to thank you for the opportunity to participate in this process. We look forward to the continuation of the development and implementation of ideas for reaching our executive-level and site-wide water stewardship goals. We are excited to continue this process by utilizing the water valuation tool presented in the University of Michigan report.

#### Thank You,

Juan Lopez,

& Members of the Water Valuation Committee

## NOTES

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