



Sustainable
Hospitality
Alliance

in collaboration with



Water Risk Assessment

November 2013

Responsible hospitality for a better world

This report was published in 2013 when Sustainable Hospitality Alliance was known as International Tourism Partnership (ITP), part of Business in the Community (BITC).



EXECUTIVE SUMMARY

This study has been conducted by the Stockholm International Water Institute (SIWI) for the International Tourism Partnership (ITP). The purpose of the study has been to investigate if and how freshwater can become a constraint to the hotel industry in specific regions in terms of maintaining current operations as well as future growth. Freshwater is becoming a scarce resource in many parts of the world due to overconsumption, pollution, climate change impacts as well as poor management of the resource.

Analyses at the sub-national level of Dubai, Shanghai, Beijing, Rio de Janeiro and India's Golden Triangle found that many of these regions are under threat due to many of these factors and that it might implicate the hotel industry. Particularly in the case of Dubai, excessive consumption of groundwater and increasing pressure on desalination facilities could in a worst case scenario lead to severe water shortages in the near future. China, with selected target areas face multi-faceted risks including water shortage and increasing pollution that can seriously affect the attractiveness from a visitor point of view as well as possible price hikes due to increased costs of water treatment. In the case of Shanghai and Beijing climate change impacts heightens the risk for flooding disasters, potentially threatening water infrastructure as well as hotel facilities.

In India's Golden triangle over-extraction and climate change impacts risks limiting available fresh water resources. Emerging legislation is also expected to put increased demands on private sector water users. In parts of Brazil changed run-off patterns could cause bottlenecks in both energy and food supply affecting the hotel industry. Substandard conditions related to drinking water in favelas around Rio can affect availability of hotel staff due to health complications.

As a general mitigation measure, a heightened awareness and preparedness level from the hotel industry is crucial. A strategic thinking around fresh water including risk analyses for existing and intended sites is recommended. Investments in water saving technology is another strategic measure that can be useful in order to limit water waste and over consumption. Training of staff and other members of the industry in smart water usage and other pre-emptive measures is another simple way for the industry to play its part in preserving fresh water resources.

General questions about the report:
www.tourismpartnership.org

Questions on report content:
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CONTENT

Introduction	4	India's Golden Triangle	15
Limitation	4	Water quantity and quality challenges	16
Methodology	4	Response measures	16
Sources	4	Complications related to water and climate change	16
Understanding linkages	4	Response measures	16
Structure	4	Complications related to social aspects of water	16
		Response measures	16
Dubai and the United Arab Emirates (UAE)	5	Water legislation characteristics	17
Water quantity challenges	6		
Water quality challenges	7	Rio de Janeiro – Brazil	18
Response measures	7	Water quantity and quality challenges	18
Complications related to water and climate change	8	Response measures	19
Response measures	8	Complications related to water and climate change	19
Complications related to social aspects of water	8	Response measures	19
Water legislation characteristics	8	Complications related to social aspects of water	19
		Response measures	19
Shanghai – China	9	Water legislation characteristics	20
Water quantity challenges	10		
Response measures	10	Concluding remarks – ways forward for the hotel industry	20
Water quality challenges	10		
Response measures	10	ITP Water Risk Assessment Team	21
Complications related to water and climate change	10		
Response measures	11	References	22
Water legislation characteristics	11		
Beijing – China	13		
Water quantity challenges	13		
Response measures	14		
Water quality challenges	14		
Complications related to water and climate change	14		
Response measures	14		
Water legislation characteristics in Beijing	14		



INTRODUCTION

Nearly one in five people live in areas of physical water scarcity – places where the development of water resources is “approaching or has exceeded sustainable limits” and “more than 75 per cent of river flows are withdrawn for agriculture, industry, and domestic purposes”. By 2030, the world might face a 40 per cent global shortfall of accessible, reliable water supply for economic development. The private sector is a major water user and is dependent on water for production and service delivery. The hotel industry is no exception: water plays a major part in everyday operations and will impact potential growth in many parts of the world.

This assessment has been conducted in order to highlight potential water related risks faced by the tourism and hotel industry. It provides a brief overview of a range of possible impacts the industry could suffer due to shifts in the availability and quality of water resources. The assessment also suggests possible mitigation measures that can be taken to avoid negative impacts, and points out potential areas where additional costs can be expected. Focus is on selected regions/nations around the world, namely: Rio de Janeiro, Brazil; Beijing and Shanghai, China; the Golden Triangle, India and Dubai, The United Arab Emirates. Each case presents a snapshot of emerging water risks in different settings.

Limitation

This assessment should be viewed as a brief overview to capture some of the emerging water related challenges and trends faced by the hotel industry. The assessment is not designed as an in-depth study of different aspects as this is not part of its scope and resources. Therefore the study is designed to provide indications of risks, impacts, costs and other circumstances of interest, enabling further analyses of more specific character. It is important to note that the overarching risks identified need to be analysed in a case-by-case manner due to the site specific characteristics of the research topic (this is explained in more detail in the conclusions).

Methodology

The assessment has primarily been produced through literature review and desktop research of a wide range of existing information sources. Sources include scientific reports, journals and papers as well as various news articles and expert interviews. Information has subsequently been evaluated and analysed. Strategic input from experts with specific expertise and local knowledge has been incorporated when needed and possible.

The evaluation of risk has been made as part of the literature review. Constant repetition from credible sources stating a severity of a particular situation in combination with data (such as data on national extraction rates, pollution levels and climate change impacts etc.) has enabled the authors to make assumptions on the severity of a problem and the assumed likelihood that it can/will happen.

Sources

This assessment report should be considered an “intelligence report” rather than a traditional scientific report. Information on freshwater resources linked to the hotel industry is very limited. Thus, the use of sources is somewhat different. In order to get “real time” information on development on the ground and find evidence of impacts linked to the hotel industry, different kinds of media have been used in combination with more standardised scientific literature. Information used from these sources has been quality checked and as a principle is only used if the same information can be backed up by a number of different sources.

Understanding linkages

Some risks reported on might seem less connected to freshwater. It is however important to apply a systemic thinking to issues and an understanding of the connections of various resources and assets. Inland water systems and coastal zones are intimately linked and the management of the former has direct impacts on the latter, both affecting the business environment for hotel development. Climate change, for instance, does not only directly threaten fresh water availability but also the infrastructure that supplies the resource. Another example comes from coastal pollution, which in many cases is induced by behaviours in freshwater systems upstream. Making these connections is important in order to understand why awareness of connected risks is as important to report on as what can be perceived as being more direct risks.

Structure

The assessment report structure is designed to enable easy uptake of information. Information is presented in bullets with core messages shown in bold and followed with suggestions of possible steps to deal with identified issues at the end of each section. Matrixes that summarise key risks, impacts and responses are also provided as an overview of the essential information. In addition to the literature included in the reference list, further reading sources can be provided on demand.

DUBAI AND THE UNITED ARAB EMIRATES (UAE)

Key messages

- Dubai and the UAE are quickly heading towards severe-freshwater deficits; and only costly options to secure water supply remain.
- Waste water systems are under-developed, inducing beach pollution.
- Coastlines and areas of high economic activity are threatened by sea level rise.
- To reduce water related risks, it is recommended to:
 - Conduct strategic impact analyses to determine on-site implications of water supply and sewage treatment deficiencies in various project stages as well as mitigation of possible beach pollution.
 - Assess and cater for budget needed for likely cost increases in water supply services.
 - evaluate long term risks of likely climate change impacts, such as sea-level rise, and required mitigation measures.

Risk matrix – Dubai/UAE

RISK	LIKELIHOOD	IMPACTS	MITIGATION/RESPONSE MEASURES
Acute freshwater shortage/depletion	High	<ul style="list-style-type: none"> • Increased used of costly desalinisation solutions • Price hikes on water supply • Restrictions on certain types of water and energy use 	<ul style="list-style-type: none"> • Implement strategies/technologies for substantial water saving and reuse • Increase expected budget for water fees • Assess and pinpoint water intensive activities that can be cut from standard operations (types of gardening eg. landscaping)
Increased pollution risks due to substandard sewage systems	Intermediate	<ul style="list-style-type: none"> • Reduced attractiveness/value of hotel location • Health risks 	<ul style="list-style-type: none"> • Enhance assessment to determine pollution risks • Develop response mechanisms to potential freshwater impacts and minimise damage if beach pollution occurs
Problems related to sea level rise due to climate change effects	Intermediate	<ul style="list-style-type: none"> • Loss of property and infrastructure, risks to fresh water supply systems and sources • Increased costs for mitigation measures and/or restoration efforts • Reduced attractiveness of location, reduced number of visitors 	<ul style="list-style-type: none"> • Make climate change impacts assessment a regular part of pre-project evaluation strategies • Work actively with concerned institutions to get informed on existing institutional response strategies and develop own response measures to minimise negative impacts

Key to tables in this report

RISK LEVEL (LIKELIHOOD+ IMPACT MAGNITUDE)	LIKELIHOOD	IMPACT MAGNITUDE
Low	Low	Limited impact: Will not to a large degree impact life and property or induce cost increases or alter means of operations considerably
Intermediate	Intermediate	Moderate impact: Likely to some degree impact life and property or induce cost increases or alter means of operations considerably
High	High	Major impact: Likely to greatly affect life and property and induce cost spikes or substantially alter means of operations considerably

Water quantity challenges

- **Population and water scarcity are both growing.** Dubai is the second largest of the emirates but has the largest population; 2 104 895 out of a total 7,9 million (variations in population estimates are frequent). When adding the constant visitor level to the population data, Dubai's population is estimated at over 3 million (World Bank, 2013). The UAE has the 9th highest population growth rate, 3,06 per cent, and the fifth highest net migration rate in the world with almost 17 migrants/1,000 people (CIA, 2013).
- **The average annual rainfall is between 78-100mm (USA~700mm, Tunisia~200mm).** There are no perennial streams in the country and in 2010 the freshwater supply amounted to 0,2 km³/year while withdrawal stood at 2,3 km³/year which was the equivalent of a deficit of almost 500 m³/year per capita. In the UAE the primary water sources are groundwater (51 per cent), desalinated sea water (40 per cent and treated waste water (9 per cent) (Szabo, 2011).
- **The UAE has one of the highest water consumption rates in the world with every citizen consuming twice as much as the global average (Global Water Intelligence, 2011).** The consumption/availability ratio suggests that the UAE is depleting non-renewable groundwater (fossil water) reserves at an alarming rate. On average, the groundwater level has decreased by 1 metre every year for the last 20 years (Al-Omar, 2012). At current rates, groundwater resources could be depleted within 50 years (The National, 2012). Water demand is expected to double until 2030, with urban areas taking largest share. Current plans to address the gap between available groundwater and future demand focus on the costly options of using desalinated water and recycled water resources.
- **UAE/Dubai is increasingly dependent on expensive water supply systems that need financial and energy security to be operational.** The UAE lacks the long term energy security needed to operate current supply systems in the long term. Presently the UAE needs to find alternative energy sources to secure operations. Water supply systems are often powered by fossil fuels (for desalination stations and recycling plants) that have always been an abundant resource in the UAE. In 2008 the UAE became a net importer of gas from having being a net exporter. Oil assets come with great opportunity costs if used locally for water treatment and will add to the overall financial vulnerability of the water sector. Developing alternatives, such as nuclear power, to get the needed electricity is many years away if that option was chosen.
- **Back up capacities in the water supply systems is very limited in the UAE/Dubai; on average there is only water supply for four days should any serious interruptions occur (NY Times, 2010).**
- **The hotel industry is a top water and energy consumer in UAE/Dubai¹ (energy requires substantial volumes of water in production) and Dubai's five star hotels consume up to 250 per cent more water and 225 per cent more energy than European top hotels.** Dubai's Hotels average 650 to 1,250 litres of water per guest and consume 2,750-3,250 KW of power per square foot. By comparison, European hotels using 350 litres and 1,000 KW per square foot (Farnek Avireal, 2007).
- **As a top water consumer the hotel industry should expect to be a focus area for possible new decisions and/or legislation related to water conservation.** The awareness of the water situation in UAE/Dubai is high and growing consistently. In recent years this has catalysed actions to increase water tariffs and water efficiency.
- **Dubai Municipality has set an ambitious agenda to cut water and electricity consumption by 30 per cent by 2030.** This translates to a 20 per cent reduction 2012-2017 (Dubai Supreme Council of Energy, 2013).
- **The Dubai water and electricity utility (DEWA) has increased water and electricity tariffs.** Effective from January 2011, DEWA reformed its tariff system for water and electricity to motivate less consumption. This meant an instant price hike of 15 per cent. Depending on the effectiveness of these measures and the state of the global economy (variations in fuel/energy markets), it is possible that similar measures will happen in the near future.
- **Strict water reporting and usage requirements are placed on project developers in Dubai.** According to new rules established in 2010, DEWA requires all potential developers to submit water demand estimates spanning inception, completion and full occupancy stages of a project. Projects deemed to have specifically high water demand must submit water requirements at least five years before scheduled project completion. According to DEWA's demand assessment guide, hotels are considered the biggest water users per capita for project development (Dubai Electricity and Water Authority, 2010).
- **Certain project development activities cannot expect water supply from the national utility.** Among these is construction, those including irrigation and landscaping

¹ Several sources point to the hotel industry as a top water consumer in the UAE/Dubai. Information should however be understood in proper context. Though indicators point towards a comparable excessive water use among hotels in the UAE/Dubai, Dubai lacks many of the water intensive industries found in many other countries and in that regard the statement should be interpreted from a national perspective as the hotel industry constitutes a major water user in UAE/Dubai in the absence of other industries that would normally consume more water.

as well as district cooling water supply. Alternative supply measures should therefore be considered in new development (Ibid).

- **Possible cost increases in the mid to long term: Despite promises from DEWA that tariffs will not increase; it is very unlikely that water tariffs can be kept at current rates under current conditions where demand is increasing and consumption needs to decrease.** Project developers will likely see increased costs of supplying potable water to projects that are not covered by DEWA's supply policy as general water availability goes down in Dubai.

Response measures

- **Invest to save for the present and future.** Investing in water and energy saving/reuse technology should be prioritised as a long term measure for supply security and cost effectiveness.
- **Seek site- specific actions to reduce water consumption.** The high water consumption rate in some Dubai hotels should be investigated on a site specific basis in order to pinpoint cost effective measures and enabling behaviors to reduce water use. Assessments should identify essential water uses and “fringe activities” (such as types of landscaping, water use for aesthetic purposes), and show priority areas to reduce water consumption with minimal reductions in the quality of guest experience. It is also recommended to examine water use in various supply chains to identify peaks in water consumption to see if consumption patterns can be altered to place less stress on water sources.
- **Prepare for price hikes.** Set aside financial buffers to mitigate potential price hikes possibly imposed by water and energy utility in near to mid-term future scenarios.
- **Evaluate water supply options and needs from the utility and other sources during project planning.** Determine the requirements, costs and possibilities to supply water intended for purposes not included by the water utility at pre-feasibility stages of any new project development. This is preferably done by engaging in dialogue with DEWA at earliest possible opportunity.

Water quality challenges

- **Desalination (desal) in the UAE/Dubai is an absolutely crucial function to sustain current water supply but has several negative environmental impacts.** Some prominent effects are:
 - Impacts on the marine environment from concentrated brine solution (prime residue from desal plants) and other chemicals that is compounded in proximity of the plants.

- Increased salinity levels in the Arabian Gulf due to brine pollution emitted from desal plants around the Gulf.
- The Gulf countries could under current trends potentially reach the threshold for “peak salt”² – the point where desal is economically unfeasible as a source of freshwater (the potential timing for this is not thoroughly established).
- Higher water temperatures in the immediate area around the plant as a result of warmer discharge water impacts water quality.

The aquatic environment around the Arabian Gulf is a key resource for residents and attraction for visitors that is under threat (The National, 2009). The Arabian Gulf is a semi enclosed shallow water body with long retention times. Consequently it takes long time before water is “replaced” in the Gulf and the evaporation rate is very high. Urban and industrial pollution (in part due to illegal offloading of waste in storm water systems) combined with maritime pollution from shipping as well as add-on effects from the numerous desal plants creates a foundation for a looming environmental crisis. In recent years stretches of the most popular beaches, host to a concentration of hotels in Dubai, have been forced to shut down temporarily (The Telegraph, 2009).

- **The sewage and wastewater infrastructure of Dubai is under developed.** This adds significantly to the pollution problem and creates risks to commercial activities. In 2009 there was only one sewage treatment plant serving a population of what was then 1.3 million. Though expansions have been made in recent years, several major structures are not connected to the main sewage system (such as the Burj Kalifa). These buildings have to rely on a system of trucks moving sewage to treatment facilities (or sometimes dumped illegally). Obviously this system is sensitive to disruptions and it is common that trucks pile up and that it can take as much as 24 hours to reach the assigned dumping site. There is no specific information on the extent to which hotels are exposed in particular, but they may be vulnerable to disruptions and should assess this risk.

Response measures

- **Assess treatment capacity during development planning.** The presence or lack of reliable sewage and wastewater treatment should be thoroughly assessed before planning potential projects. Assessments need to cover: the ability to connect to the central system, expected population density in a selected development area; and the future expansion of the waste water treatment system.
- **Create a strategy to secure sewage and dispose waste water disposal for individual units.** The current system is in many parts underdeveloped unreliable and bottle necks could

² Desalination produces “brine” – a salt based solution – as a bi-product of the process. Normally brine is dumped back in the water source and often increases the concentration of salt in the water near the plant. The Arabian Gulf is a relatively shallow and closed water body with long retention times. Most countries around the Gulf are dumping brine from their desal plants in the Gulf. Combined with less freshwater replenishment do to inland damming of rivers, the salt/pollution levels are increasing fast. In time the salt levels of the Gulf could become so high that it is not economically feasible to desalinate, and it cannot serve as a satisfactory source of freshwater. This is referred to as “peak salt”.

be a consequence of inefficient treatment and transportation systems. Dialogue with Dubai Municipality as the responsible authority is a recommended step in order to understand exact conditions related to intended establishment of new facilities and sewage/waste water treatment possibilities.

- **Establish control functions to prevent illegal dumping³ from hired contractors that perform sewage transportation.** The problem has a direct feedback loop to the hotel industry and others with increased risks of intrusion of polluted water in to freshwater systems, polluted beach areas and health risks to visitors.

Complications related to water and climate change

- **The IPCC predicts a 1°-2° Celsius temperature rise in the period 2050 and a considerable decrease in precipitation, possibly 20 per cent less, during the same period.** This implies that the severity of water shortage problems in the UAE is likely to intensify (Ministry of Energy United Arab Emirates, 2006).
- **Extraction of available ground water resources is predicted to become even more complicated and costly in the future.** Efficiency in groundwater pumping has an inverted relationship to pumping depths. Unsustainable extraction rates will lead to higher costs and environmental damage.
- **The UAE is also at great risk from predicted sea level rise due to climate change.** Rising sea levels will pose a direct threat to UAE/Dubai's capital/investment intensive coastal areas. In terms of project development the risks related to sea level rise will put further emphasis on the location of projects, protection of infrastructure and adaptive capabilities against salt water intrusion and other potential impacts (Ibid).
- **The attractive coastal zones of the UAE and Dubai are exposed to increased risk due to sea level rise.** In addition to increased flood risks in coastal areas threatening infrastructure and other assets in zones of massive project development initiatives. This also suggests a heightened risk of salt water intrusion in freshwater systems and risks to water supply systems. The coastal areas are home to sensitive ecosystems that partially make up the attractiveness from a tourism stand point. Examples of these are extensive mangrove areas and coral reefs. They are particularly sensitive to changes in external conditions. Temperature increases of sea water as well as sea level rise are impacts that could severely threaten the existence of these ecosystems and ultimately the appeal the region holds for visitors.

- **Changes in temperature threaten current water supply systems.** Systems and technologies for power production and desal are designed for specific water and ambient temperatures. Increases in temperature in the UAE would severely challenge current plant designs' capabilities. Even slight temperature increases can risk decreasing plant efficiencies substantially with the likely consequence that operations will be more costly.

Response measures

- **Add climate risk assessment to development planning procedures.** Risks posed by climate change, with sea level rise as one potential impact, should be considered in any planning for future development. Additional factors that need to be assessed include: risk of salt water intrusion to existing freshwater supplies, possible infrastructural damage affecting freshwater supply systems, damage to beach front property and security to visitors.
- **Consult water and climate experts to develop site-specific plans.** Strategies and mitigation measures could be constructed in collaboration with water specialists, hotel units/chains and the local entities charged with the responsibilities for mapping climate change impacts; in UAE/Dubai this is most likely the Ministry of Energy and the Ministry of Environment and Water.

Water legislation characteristics

- **Legislation regulating water use, conservation and pollution in the UAE/Dubai is not comprehensive but revisions of existing water regulations are currently taking place.** Laws regulating misuse and conservation of water (more or less standard pieces of legislation in most countries) have been absent. New legislation supposedly effective since 2012 was designed to deal with these matters (Gulf News, 2010). There is however no evidence of this legislation having been adopted (FAO, 2013). Presently there are only a few established laws that stipulate, to some extent, terms for water usage in the UAE and project development incorporating different aspects of water use: Law No. 6 of 2006 regulating the digging of groundwater wells; Federal Law No. 24 of 1999 on the environment protection and development; and Resolution No. 37 of 2001 issuing the Environmental Impact Assessment Regulation for installations (Ibid). In general; water regulations mandate that water authorities should ensure sustainable water and energy consumption. DEWA, the water and energy supply authority of Dubai, stipulates these responsibilities in vague terms on their various outlets without detailing strategies for how this is to be achieved therefore it is difficult to ascertain the level of implementation and follow through. DEWA follows ISO 14001, the international standards on environmental management (DEWA, 2013).

³ The problem of illegal dumping has in many sources been reported to be decreasing substantially over the last years however.

SHANGHAI – CHINA

Key messages

- Flooding and extreme weather pose the most intense and direct threats to the hotel industry in Shanghai, particularly in flood prone tourism zones.
- Water scarcity and pollution events pose potential risks to the overall city economy, and could have seasonal repercussions on the tourism industry.
- Efficient water use and treatment will be a cost saving measure as the fees charged for use and treatment will increase steadily over the coming decade.
- Helping customers lower their water footprint will have an important impact on the local environment, and will have positive impacts on the reputation of the company. The cost of water is increasing rapidly, and all industries will need to hit new water use and pollution reduction targets.

Risk matrix – Shanghai/China

RISK	LIKELIHOOD	IMPACTS	MITIGATION/RESPONSE MEASURES
Typhoon and flood disaster	High	<ul style="list-style-type: none"> • Damages to facilities (direct costs) • City/local level economic losses, lower number of visitors • Destruction to tourism sites, lower number of visitors 	<ul style="list-style-type: none"> • Flood risk evaluation during site selection • Purchase disaster insurance • Emergency planning and training for staff • Facility planning (to minimise expensive/important equipment on ground floors) • Create emergency fund
Increased fees for water supply and treatment	High	Increased fees for water use and treatment	<ul style="list-style-type: none"> • Increase expected budget for water fees • Invest in water saving equipment (toilets, showers, laundry and pools) • Water saving landscaping
Serious pollution events of local water supplies in Shanghai	Intermediate	<ul style="list-style-type: none"> • Reduced number of visitors at city/local level • Temporary increased costs to access water for hotel use 	<ul style="list-style-type: none"> • Environmental risk assessments and plans of local water sources • Collaboration with upstream actors to protect important water sources (for recreational tourism)

Water quantity challenges

- **There is concern that at current growth trends, demand for clean fresh water may exceed the city's supply capacity within the decade.** The current capacity of the city's water supply is about 16,000 m³ per day, which is able to cover the demand of 26 million people. However, once the population reaches 30 million the demand would rise to 18 million tons per day, exceeding the current capacity, according to Xu Xuehong, Deputy Director of the Taihu Lake Water Resources Protection Bureau in Shanghai (Shanghai Daily, 2012).
- **Shanghai is a "pollution induced water shortage city".** Almost all surface water in Shanghai has been polluted to different degrees and most local sources – including the Huangpu River and Taihu Lake – do not meet drinking water quality standards, which increases the city's dependence on water from the Yangzi River (Shanghai Water Authority, 2013).

Response measures

Invest in water saving. Hotels should prepare to increase their expected budget for water fees, and invest in water saving equipment (in toilets, showers, laundry and pools) and water smart landscaping to minimise water use as much as possible without impacting visitor experience.

Water quality challenges

- All of Shanghai's water sources are under great environmental stress. While Shanghai's geographical location provides an abundance of water, high demand and pressure on those resources cause challenges for both water quantity and quality. Water quality is a large problem in the Huangpu River, which is the largest source of drinking water. As a port city, much of Shanghai's most popular tourist destinations and areas with the highest density of hotels are located near to water. Losses in water quality, or serious pollution events, in those water systems could negatively impact tourism.

The greatest pollution problem is salt. According to Finlayson et al (2012), the number one threat to Shanghai's water security is the likely increase in the frequency and duration of salt water pollution in its freshwater water sources. Reduced flows due to water diversion projects and sea level rise are the primary drivers for salt intrusion.

- **Shanghai is increasing its dependence on water from the Yangzi outside of its borders because local sources in the Huangpu River are largely too polluted for safe use.** Water from the Yangzi is also being diverted to address shortages in the North, which in turn can lead to salinity pollution in Shanghai's water sources if the return flow becomes too sparse. This makes the city vulnerable to pollution and shortages caused by upstream activities along the river, which includes industrial, agriculture and power production, all of which are also dependent on the Yangzi runoff.
- **Extreme pollution events, including algal blooms and eutrophication, could disrupt local water supply in Shanghai, which could in turn impact domestic and international tourism.** The lakes and rivers in the Yangtze delta region continue to battle against increased eutrophication. In 2007, a large-scale outbreak of algae bloom in Tai Lake led to a week-long termination of water supply to over two million people in Wuxi, which neighbors Shanghai. Such events could have short term impacts on the economy and create management challenges to serve visitors in the city.
- **Restoration of water quality will open new tourism opportunities.** In the 1990's, industrial pollution in Suzhou creek turned the water rancid and black. A ten year restoration project has revitalised the creek and the urban lands along it into popular parts of the city. This creates new potential zones for development of the hotel industry.

Response measures

- **Assess both environmental risks and opportunities.** Environmental risk assessments should be conducted for new developments to understand the potential impacts that the hotel will have on local water sources and vice versa. The opportunities to improve the natural environment should also be assessed in areas with potential for additional tourism development.
- **Create strict policies and train appropriate staff in waste prevention, disposal and management.** In addition, purchase green certified cleaning agents and minimise chemical use to the greatest extent possible.
- **Collaborate with upstream actors to protect important water sources (for recreational tourism).** Industry, agriculture, and domestic users can all contribute to pollution loads on water sources and lower the attractiveness of a hotel or tourism area. Investigate options to engage polluters, or potential polluters, to protect those water sources.

Complications related to water and climate change

- **Shanghai ranks as one the most flood risk prone cities on earth, something that should be carefully considered when planning and designing new buildings and development.** Nationally, China loses more than 1 per cent of annual GDP to floods and is growing more vulnerable (Han & Kaspersen, 2011). Floods will continue to be a major difficulty for Shanghai and for China at a national level. Shanghai's location, naturally low elevation, flat topography and ground subsidence make it vulnerable to floods, particularly heavy rains and typhoons; both of which are likely to intensify and occur more frequently if global warming continues.
- **Climate change may increase risk of flooding, which in turn may lead to salt-water intrusion and eutrophication and threaten water quantity and quality.** Projected rates of warming would increase surface water temperature and intensify eutrophication of water bodies, while expected increases in heavy rains and sea level rise will exacerbate salt water intrusion in local water supplies.
- **Water-logging is a serious concern in many areas of Shanghai, particularly in sections of Pudong New Area.** Land use change has led to an increased depth of surface runoff, which makes areas without sufficient drainage systems in place vulnerable to water-logging. Heqing Town, Huaxia tourism area, Chuansha Town, Tangzhen Town and Jichang in the Pudong New Area are all at high risk to water-logging during times of extreme heavy rainfall (Quan et al 2010). This should be considered in multiple ways by the hotel industry.

Response measures

- **Plan for floods.** It is highly likely that hotels will be located in floodplains or regions facing some degree of flood risk, so it is critical to assess those risks and prepare responses to them. Actions that can be taken include: flood risk evaluation during site selection; purchase of disaster insurance; emergency planning and training for staff; facility planning (to minimize expensive/important equipment on ground floors) and the creation emergency fund for disaster response (Tsai, C. & Chen, C. 2011).
- **Site smartly.** When siting new and designing new buildings, steps should be taken to minimise the vulnerability to and impacts of water logging for facilities; and, where feasible, assessments should also be made to understand the impacts of land use change that follow new developments.

Water legislation characteristics

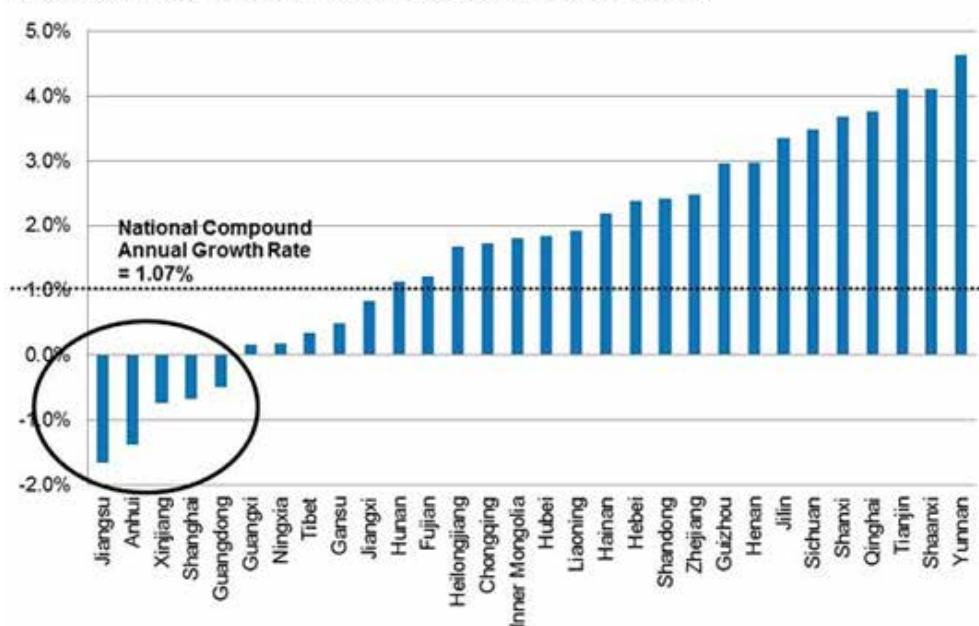
- **The city is investing heavily in major infrastructure improvements, and will require more from industrial actors to limit pollution and consumption.** Shanghai invests 3 per cent of GDP in environmental action plans, including for water. Over the next five years, the city will invest up to RMB 100 billion (USD 16 billion) to improve its

water utilities, including water supply systems, an anti-flood system & riverbank administration (Shanghai Water Authority, 2012).

- **Shanghai will set up a new water resource management system by 2014 that will include the strictest ever standard on water saving and treatment in the city.** The new systems will include more scientific water resource allocation across the city and a central platform to monitor and control the water use efficiency of local companies. New legislation will introduce stricter regulation, higher prices for use and treatment and firm quotas on water use for all industry, including the hotel sector. According to Zhang Jiayi, Director of the Shanghai Water Authority, many major industries will be forced to use 30 per cent less water compared to 2010 (Shanghai Daily, Oct. 17, 2012).

- **The cost of water is increasing rapidly, and all industries will need to hit new water use and pollution reduction targets.** At the national level, water use and treatment costs are far too low to the user, particularly for industries. From 2006-2010, water usage increased 1.6 per cent annually, but new mandates will require that this trend is reversed and total water usage decreases on an annual basis. The Shanghai municipal government is committed to being a “water saving city” and enacting “the strictest water management” regulations by 2014 (Shanghai Water Authority, 2012)⁴. The city is building upon its commitments to improving the efficient use of water per unit of economic activity by demanding that all actors reduce overall water use and pollution while maintaining economic growth. New regulations will bring much higher prices and new quotas to limit water use, particularly for business and profitable uses of water resources, aimed to encourage conservation (China Water Risk, 2013).

Provincial Water Quota Growth/Reduction: CAGR 2010-2015



Source: China Water Risk Analysis, State Council “Most Stringent Water Management System Methods”

Shanghai is one of five provinces that will have to lower water usage according to new regulations for “Most Stringent Water Management System Methods” put forth in 2013.

⁴ Chen Yuanming, deputy director of Shanghai Water Authority told reporters on World Water Day 2012 that “Shanghai will be among the first group of four major cities in the nation to realise tougher water management policies in an effort to control its total water consumption, and improve water usage efficiencies as well as waste water treatment processing” (source: www.cleanbiz.asia/news/shanghai-sets-tough-water-management-policies#.UVK9wYalFrM)

BEIJING – CHINA

Key messages

- Beijing suffers from chronic water scarcity and high levels of pollution, which both impact and are impacted by the tourism sector.
- New legislation will introduce stricter regulation, higher prices for use and treatment and firm quotas on water use for all industry, including the hotel sector.
- Flood risk is major concern as land use change has made the city more vulnerable to floods during the summer.
- More than fifteen million visitors come to Beijing each year, and have a significant impact on local water resources.
- Water shortages pose a major threat to the economy of Beijing and China and would likely have indirect repercussions on the tourism industry

Risk matrix – Beijing/China

RISK	LIKELIHOOD	IMPACTS	MITIGATION/RESPONSE MEASURES
Flooding disaster	High	<ul style="list-style-type: none"> • Damages to facilities (direct costs) • City/local level economic losses, lower number of visitors • Destruction to tourism sites, lower number of visitors 	<ul style="list-style-type: none"> • Flood risk evaluation during site selection • Purchase disaster insurance • Emergency planning and training for staff • Facility planning (i.e placing equipment on higher floors) • Emergency funds
Increased fees for water supply and treatment	High	Increased fees for water use and treatment	<ul style="list-style-type: none"> • Increase expected budget for water fees • Invest in water saving equipment (toilets, showers, laundry and pools) • Water saving landscaping
Serious pollution events of local water supplies in Shanghai	Intermediate	<ul style="list-style-type: none"> • Reduced number of visitors at city/local level • Temporary increased costs to access water for hotel use 	<ul style="list-style-type: none"> • Environmental risk assessments and plans of local water sources • Collaboration with upstream actors to protect important water sources (for recreational tourism)
Water shortages due to drought	High	<ul style="list-style-type: none"> • Potential disruptions in energy supply • Stricter quotas on water use for hotels • Impacts on local economy trickle down to tourism 	<ul style="list-style-type: none"> • Invest in water saving equipment (toilets, showers, laundry and pools) • Take additional water saving measures

Water quantity challenges

- **More than fifteen million visitors come to Beijing each year and have a significant impact on local water resources.** While water shortages are not very likely to pose direct risks to the hotel sector, helping customers lower their water footprint will have an important impact on the local environment, particularly in Beijing where water scarcity levels are very high, and for the reputation of the company.
- **Demand for water exceeds the city's supply and will continue to do even after the South North Water Transfer project begins sending water to the capital in 2014.** The

city runs a major water deficit: in 2011 supply was estimated to be more than 500 million cubic meters short of demand. Water shortages in Beijing are an issue of national priority, and Beijing is both buying and diverting water from other provinces. In 2011, the Beijing government spent over RMB 20 million to buy water from other provinces. In 2014, the South-North water diversion project will send one billion cubic meters of water to Beijing annually, but supply is still projected to be well-short of demand (Circle of Blue, 2011).

- **Growing demand for energy will require much more water and will increase competition for water resources.** Even as efficiency increases and use decreases in many sectors, the rising demand for water for energy production will offset those gains. Water shortages, caused by drought or other causes, can potentially lead to energy shortages which will directly impact the urban economy and the hotel industry.

Response measures

- **Prioritise investment in water and energy saving.** Efficient water use will be required by all in the sector, and will also be a cost saving measure as the fees charged for use and treatment will increase steadily over the coming decade (NDRC, 2012). Hotels should prepare to increase their expected budget for water and energy fees, and invest in water saving equipment (in toilets, showers, laundry and pools) and water smart landscaping to minimise water use as much as possible without impacting visitor experience. Recycling grey water and rainwater harvesting where possible. Energy efficiency investments (in lighting, heating, water heating, smart switches, etc.) and training to staff can also save energy, money and water.⁵
- **Engage the visitor to save water.** While water shortages are not very likely to pose direct risks to the hotel sector, helping customers lower their water footprint will have an important impact on the local environment, particularly in Beijing where water scarcity levels are very high, and for the reputation of the company. Chinese consumers are among the most “green” oriented in the world, and water saving is a heavily promoted concept both by the government and within civil society.

Water quality challenges

- **Extreme pollution events could disrupt local water supply, which could in turn impact domestic and international tourism.** In 2009, an estimated 45 per cent of the water monitored from the rivers coming into Beijing were classified with Grade V pollution, and not fit for human use (Ma, 2011). At the national level, 40 per cent of the major rivers have Grade V pollution levels. Major pollution events are difficult to prevent despite stricter government policy and attention to the issue, and could impact visitors desire to visit the city over periods of time.
- **The city is investing heavily in major infrastructure improvements and water protection, and will require more from industrial actors to limit pollution and consumption.** Huge investments are being made at the city and national level on natural water protection. In 2011, China spent more than USD 7.46 billion for ecological compensation, much more than any other country (China

Daily, 2013).

- **Assess both environmental risks and opportunities.** Environmental risk assessments should be conducted for new developments to understand the potential impacts that the hotel will have on local water sources and vice versa. The opportunities to improve or maintain the natural environment should also be assessed in areas with potential for additional tourism/hotel development (for example around the Miyun).
- **Create strict policies and train appropriate staff in waste and wastewater disposal and management.** In addition, purchases green certified cleaning agents and minimise chemical use to the greatest extent possible.

Complications related to water and climate change

- **Flood risk is now a major concern as rapid land use change has made the city more vulnerable.** Nationally, China loses more than 1 per cent of annual GDP to floods and is growing more vulnerable (Ministry of Water Resources, China, 2013). Major flood events have hit Beijing in consecutive years and cost hundreds of millions of dollars in damages and lost income. Floods will continue to be a major difficulty for Beijing and for China at a national level, so efforts should be made to mitigate risk and potential damages.
- **Beijing is vulnerable to the impacts of water shortages that can follow droughts, which may become more common and severe under climate change.** With the scarcity of available water resources, droughts will impact all sectors of the economy. Beijing may be also susceptible to power outages if water is insufficient for coal production in neighboring regions. Domestic tourism to Beijing may also be impacted by the repercussions of droughts on the economy in other regions.

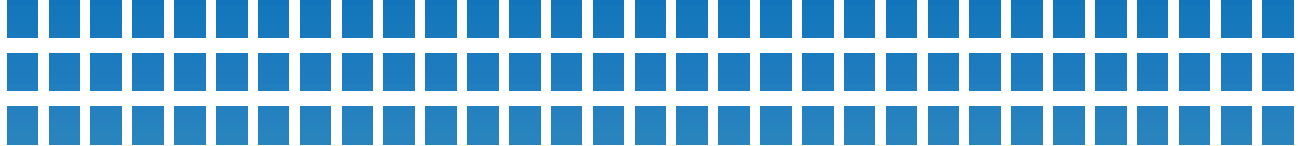
Response measures

- **Plan for floods and droughts.** Actions that can be taken include to address flood risk include: evaluation during site selection; purchase of disaster insurance; emergency planning and training for staff; facility planning (to minimise expensive/important equipment on ground floors) and the creation emergency fund for disaster response (Tsai, C. & Chen, C. 2011). Extra precautions should also be taken against power outages.

Water legislation characteristics in Beijing

- **Water legislation regulating water use, conservation and pollution in Beijing is comprehensive and a priority among local decision makers.** New legislation introduced in 2013 (“Water Resources Fee” promulgated by the National

⁵ A list of over 30 different measures to take recommended by the Shanghai Water Authority can be found here: www.shanghaiwater.gov.cn/swEng/useful/useful_FAQ/faq_detail4.jsp?type=3&location=1



Development Resource Council (NDRC), Ministry of Finance (MoF) & Ministry of Water Resources) will create stricter regulation, higher prices for use and treatment and firm quotas on water use for all industry (China Water Risk 2013, State Council 2013).⁶ Beijing has set targets for 2015 to increased fees for surface and groundwater to RMB 1.6/m³ and RMB 4.0/m³ respectively, an increase of 20 per cent and 30 per cent over current levels and will take additional measures to increased reuse, set quotas, and encourage conservation of water resources (ibid).

- **Enforcement of environmental laws and regulations is the primary problem in most of China.** Weak institutions and overlapping authorities have led to poor enforcement of laws and fines for polluting industries and serious environmental degradation across China, despite increasingly strict laws on water. The government has pledged that environmental regulations will be more rigorously implemented, and has greatly empowered the Ministry of Environmental Protection over the past half-decade. Respected environmental observers predict that “improved enforcement is coming” (China Water Risk, 2013).

⁶ The legislation document from the State Council can be found here (in Chinese): www.gov.cn/zwgg/2013-01/06/content_2305762.htm

INDIA'S GOLDEN TRIANGLE

Key messages

- Pollution from the Delhi metropolitan area is degrading the status of water bodies in the Golden Triangle region and damaging tourist attractions.
- Over-extraction of groundwater and high occurrence of flooding can pose threats to supply and quality of fresh-water sources.
- As competing demands for local resources escalate, investment in water saving technology becomes more important and practical.
- Risk assessment around selected hotel sites can guide actions to reduce vulnerability to water shortages.
- Where possible, seek opportunities to collaborate with local authorities to protect environmental and water quality.

Risk matrix – India

RISK	LIKELIHOOD	IMPACTS	MITIGATION/RESPONSE MEASURES
Over-extraction of groundwater	Intermediate	<ul style="list-style-type: none"> • Unreliable supply of water causing higher price Power outages due to water supply shortages 	<ul style="list-style-type: none"> • Invest in water saving technologies • Produce risk assessments on groundwater resources around the hotel premises • Cooperate with relevant authorities to manage groundwater sources • Determine availability of alternative sources to ensure water supplies to the hotel
Water shortage and damages from floods	High	<ul style="list-style-type: none"> • Risk to vital infrastructure straining fresh water supplies. • Damage to tourism sites, decreased number of visitors 	<ul style="list-style-type: none"> • Plan for floods, i.e. ensure emergency water and power supply and emergency training for staff • Conduct flood risk assessment of sites
Increased public health risks due to substandard water and sanitation situation	Low	<ul style="list-style-type: none"> • Increased sickness and absence in staff, e.g. emerging risk of Dengue fever • Decrease in visitors to the region due to public health warnings 	<ul style="list-style-type: none"> • Co-operate with authorities to improve the public health situation • Participate in public health improvement projects
Reputational risk due to actual or perceived degrading water systems	Intermediate	<ul style="list-style-type: none"> • Loss of domestic and international visitors • Substantial loss of income/reestablishment costs 	<ul style="list-style-type: none"> • Work proactively/engage with local communities to support sustainable water use initiatives • Create strict policies and train appropriate staff in waste and waste-water disposal and management • Assess and enable water saving operation systems



Water quantity and quality challenges

- **The Golden Triangle is located in a region with a high occurrence of water shortages and unreliable water supply.** The baseline water stress of the region is extremely high which indicates the available flow is not sufficient to sustain the current withdrawal level (Aqueduct, 2013). In many places in India including the target region, groundwater is at high risk of depletion as a result of decades of over-extraction (Rodell et al, 2009). Fears of widespread public unrest caused by water shortage have been reported in Delhi in the last year (BBC, 2012).
- **Demand on existing supplies is growing quickly.** India is a nation facing a wide range of water related difficulties, not least in the Golden Triangle area. By 2020, water demand in India is expected to grow by 20 per cent (KPMG, 2010) and water scarcity may impact food and energy production, with possible shortages and price hikes as consequence.
- **Water is underpriced and undervalued... for now.** Government subsidies for agriculture hide the acuteness of the water shortage situation in India. The government provides subsidies for irrigation, which in many places is used with low efficiency (Kuar and Sharma, 2012). The true costs of water use are largely masked by the subsidies.
- **Visitors in India consume approximately 150m³ of water per day, which is 7 times higher than the average Indian domestic water user (based on Gössling et al, 2012).**

Response measures

- **Invest in water saving methods and technology. Investing in water saving technology can save costs and buffer against shortages.** An analysis on investment in technology and training can be conducted to assess the economic viability of such measures.
- **Make strategies for potentially reduced groundwater availability.** India is quickly depleting its groundwater sources. Strategies should be made for the eventuality that water availability will decrease and regulations on water use will stiffen. This should entail water source options assessments in the locality of specific hotel sites. It is also advised to buffer against increased water tariffs and prepare action plans to meet stricter water use requirements or new governmental policies. For example, Delhi raised water tariff in 2009 including sewer maintenance charge for both the domestic and industrial users for the first time. In addition, the water tariff increased by 20 per cent again in 2012 (Delhi Jal Board 2009 & 2012).

Complications related to water and climate change

- **Climate change may increase the risk of water shortages and damage to water supply infrastructure in the region.** Climate change may affect rainfall patterns. Decreasing annual mean rainfall has been observed in Northeast India (Cruz et al, 2007: 472). Damage caused by intense cyclones has also risen significantly (GCOS, 2005; Lal, 2001).

Response measures

- **Evaluate vulnerability to climate events. Investigate the status of water supply infrastructure in connection to the hotel.** Monitoring the safety of the infrastructures against extreme climate events can prevent water shortages and damage.
- **Prepare for less predictable rain.** Changes to rainfall patterns will have an impact on water availability and quality

Complications related to social aspects of water

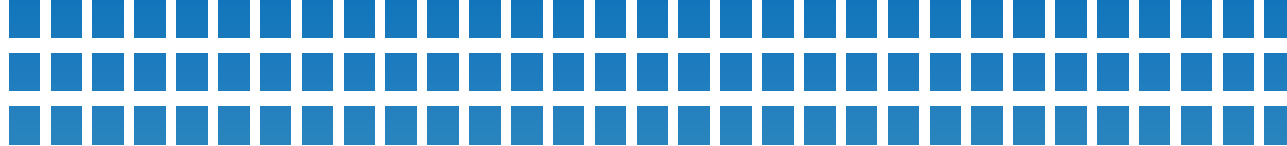
- **Social and economic inequity remains high in the region.** Though India has seen economic improvements over the last years, huge divides between rich and poor still persist. Large urban slums are particularly vulnerable and lack access to water supply and sanitation. Corruption is widespread and very present in the water sector. In addition, India has produced many examples of where social discontent has turned in to violent conflict, sometimes aimed at specific targets such as a private sector entity. Any actor establishing itself in India needs to consider the possibilities of conflicts quickly escalating, especially when concerning highly sensitive topics such as water resources (Hall & Lobina, 2012).

Response measures

- **Engage with local communities to support sustainable water use initiatives.** Work proactively to inform the public on how the hotel works efficiently to minimise water consumption.
- **Create strict policies and train appropriate staff in best practice regarding water use waste and wastewater disposal and management.**
- **Engage in local community activities to support water efficiency in specific water sheds where hotels are located.** This is not only good PR, it helps work to preserve a common resource for the benefit of all parties.

Water legislation characteristics

- **India's National Water Policy (1987) addresses the overall objectives of water management in the country, emphasising the role of ground water management.** Following this, the Central Ministry of Water Resources drafted a Model Bill to regulate and control the exploitation of groundwater and has circulated it to the States and Union Territories.
- **Unlike managing water supply and sewage discharge that are subjects dealt in the federal or municipal government, the groundwater in Delhi is considered a state level subject.** The Delhi Water Board has been established under section 3 of the Delhi Water Board Act, 1998 (Delhi Act No.4 of 1998) to discharge the functions of water supply, sewerage and sewage disposal and drainage within the National Capital Territory of Delhi and for matters connected therewith.

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- **According to the guidelines for classification/re-classification of hotels issued by the Hospitality Development and Promotion Board (HDPB), the Ministry of Tourism in India specifies that new hotel constructions are to include “eco-friendly practices”.** This includes plans to establish (a) sewage treatment plant (b) rain water harvesting. These requirements became official from September 2010. Besides water quality concerns associated with the hotel industry, water conservation plans are also required for new hotel applications to the Ministry (Ministry of Tourism, 2012: 41-42).
 - **In December 2012, India drafted a new water policy that for the first time clearly states targets for reduction of water use by industrial and commercial entities.**⁷ The policy also states that industrial and commercial actors should prioritise water reuse. The policy also suggests a volume based tariff system for uses beyond basic human needs. Consequently, it is likely that future demands for water saving will be put on the hotel industry and that the industry might experience higher water tariffs as part of the suggested volume based system.

⁷ Government of India (2012) NATIONAL WATER POLICY www.downtoearth.org.in/dte/userfiles/images/DraftNWP2012.pdf

RIO DE JANEIRO – BRAZIL

Key messages

- High seasonal water variability and flood events in the city cause water shortages.
- Coastal pollution poses a threat to the city's most precious tourism asset, pristine beaches.
- Social inequality and urban poverty lessens Rio de Janeiro's appeal as a tourism destination.
- Climate change may lead to increased natural disasters and sea level rise, which can impact fresh water supplies and the city's general attractiveness to visitors.
- The hotel industry can contribute to build physical and human capacity against floods and coastal pollution.

Risk matrix –Rio de Janeiro/Brazil

RISK	LIKELIHOOD	IMPACTS	MITIGATION/RESPONSE MEASURES
High seasonal water variability and frequent flood occurrence	High	<ul style="list-style-type: none"> • Low water availability during floods • Damages to hotels by mudslides caused by floods • Reduced number of visitors to hotels 	<ul style="list-style-type: none"> • Improving emergency response capacity • Building physical structures against damage caused by mudslides
Coastal pollution due to poor waste water management; Environmental problems caused by urban slums	Intermediate	Reduced number of visitors due to polluted beaches	<ul style="list-style-type: none"> • Properly treating waste water from hotel facilities • Cooperating with relevant authorities on pollution control • Supporting local activities on beach cleaning and awareness raising
Climate change impacts such as more frequent flood occurrences and possible sea level rise; saltwater intrusion to fresh water sources	High	<ul style="list-style-type: none"> • Physical damages or loss of hotel premises • Higher insurance costs • Degraded freshwater sources 	Monitor international or national assessments on long-term effects of climate change to determine threats to hotels with connected freshwater supply and infrastructure

Water quantity and quality challenges

- **Primary challenges in Rio de Janeiro are related to water quality, not the quantity of the resource.** Despite a relative abundance of water resources in the region, major challenges remain to maintain and provide a clean water environment.
- **One in five residents lack access to sanitation and this degrades water quality.** Water supply and sanitation in Rio de Janeiro have significantly improved during the last decade. Water supply in particular has greatly improved. In 2010, 98 per cent of the population had access to improved drinking water sources. Access to sanitation was at 79 per cent the same year (WHO and UNICEF, 2010).
- **Wastewater treatment is a major problem, adding to pollution of water resources.** In 2008, only 50.2 per cent of Brazilian population were connected to waste pipes (UNEP, 2011).
- **Coastal pollution is caused by poor wastewater management.** Dark pollutant stains known as “black tongues” periodically appear on Rio's beaches, and strips of white and yellow foam have started to appear on the beaches in Rio de Janeiro (The Guardian, 2012).
- **Pollution of coastal areas threatens the most prominent tourism assets of the city.** Public health risks are posed by beach pollution (ABC News, 2010). There is low awareness of these health risks and proper seawater monitoring systems are largely absent (Rio Times, 2012).



Response measures

- **Participate in public programmes on water pollution control and waste management.** Wastewater treatment is critical to a clean environment and vital to the hotel industry; hotels should look in to opportunities to support government authorities in order to ensure safe wastewater disposal and treatment.
- **Engage with local communities to raise hotel's profile in socially and environmentally responsible management initiatives.** The hotel industry can contribute to improve coastal pollution management by engaging with the local community. Providing support to public campaigns or local initiatives to preserve environmental health of beaches and other areas can contribute to sustainable development of the region and better conditions for the hotel industry.

Complications related to water and climate change

- **Less predictable rainfall may lead to more droughts and floods.** Though water-rich in general, regional disparities may still cause periods of water shortage. Seasonal changes can also bring heightened risks of natural hazards such as floods and mudslides posing threats to life and property alike. Floods, which are already a serious problem, may increase in Rio. Changing rainfall patterns will mean more droughts in some areas as well, such as in the north eastern region of the country.
- **Rainfall variability will impact on agricultural production, aggravating the risk of food shortages, possibly straining current supply chains.** In such a scenario, it can be expected that costs to secure supplies to the industry increases.
- **Decreases in rainfall will affect hydropower generation, and the general power security in the country.** According to the International Energy Association, hydropower provides more than 80 per cent of the electricity Brazil generates. This means power outages could follow if water shortages arise.
- **Coastal areas, where the bulk of the population and economic activities are concentrated, will be vulnerable to rising sea levels.** Sea-level rise imposes a direct threat to Brazil's most precious tourism attractions. Intergovernmental Panel on Climate Change (IPCC) presents scenarios of higher sea levels, which would profoundly affect island populations and urban coastal settlements. According to Marengo et al (2007), the prospect of a higher sea level would affect 25 per cent of the Brazilian population, 42 million people, who inhabit coastal cities and towns.
- **Sea level variations and associated storm surges could destroy parts of the urban shore front and infrastructure along the coastal line (Magrin, 2007: 586).** The five principal coastal metropolises – Belém, Fortaleza, Recife, Salvador, Rio de Janeiro – are especially vulnerable.

- According to the 2007 Brazilian Institute of Geography and Statistics (IBGE) census, 24 million people are concentrated in these cities.

Response measures

- **Climate change threat assessment. Hotels in coastal regions should evaluate the threat of sea level rise.** Risks of saltwater intrusion into fresh water sources and other natural hazards potential impacts on infrastructure should be included in this analysis. It can also be supported by establishing dialogue with responsible authorities on possible response measures.

Complications related to social aspects of water

- **About 1,000 favelas (slum areas/illegal settlements) surround Rio de Janeiro and are home to over 20 per cent of residents of the city.** Water and sanitation services are in general lacking in these areas and the population usually has to rely on homemade supply and sewer systems. Electricity is often provided illegally through connections to the main grid. The lack of basic services including water supply and sanitation has created an environment where criminality and corruption thrives, making Rio de Janeiro one of the most dangerous cities in the world lessening the tourism appeal of the city.
- **The hotel industry is a major employer of residents of the favelas.** Consequently the industry also suffers as an outcome of poor water and sanitation conditions in favelas. Social inequalities can threaten the hotel industry in the shape of poor health brought on by substandard water quality for urban poor or low income families that can often be found in different levels as hotel staff. Poor conditions translate to more sick days among hotel staff and consequently economic losses.

Response measures

- **The situation with substandard fresh water supplies in favelas offers an opportunity for the hotel industry to engage in strategic and for the industry beneficial public relations campaigns.** By allocating resources to mitigate the situation the industry would both gain positive recognition while at the same time providing habitants/hotel staff with better living conditions ultimately saving costs in terms of lost work days due to unhealthy employees.

Water legislation characteristics

- **Privatisation of water supply and sanitation and wastewater treatment services is increasing (Lobina and Hall, 2007).** In many places, the privatisation process has taken place without the provision of a suitably robust regulatory system to cater to the transition. As a result, assignment of responsibilities and authority are unclear and have led to disputes related to water provision. Privatisation of water services under similar circumstances may induce increase in water charges related to operational costs.

- Water supply tariffs in Brazil have steadily been on the increase in recent years. Sabesp, the largest water utility in Brazil and South America, currently seeks a substantial increase in water use tariffs. Rising supply costs has been a trend in recent years relating to both private and public suppliers. This is supposedly a market correction, as cost

levels have been unsustainably low to cover the large investments made in infrastructure and attempts to broaden access to services (Bloomberg, 2013). The general trend of increased water tariffs in Brazil is likely to continue as current investments in supply infrastructure is undergoing in the country.

CONCLUDING REMARKS – WAYS FORWARD FOR THE HOTEL INDUSTRY

Water is quickly becoming a limiting factor in many branches of the private sector. As a considerably water dependent industry, the hotel industry is not an exception, as demonstrated by this assessment. The industry runs the risk of experiencing a range of negative impacts that will affect its ability to survive and/or grow in different regions if water challenges are not met upfront. This assessment has provided a broad oversight to provide a first glimpse of some of the possible challenges that can emerge. The challenges will look different depending on regional and local specifics in chosen sites for sectoral development.

It is important to consider that the assessment of the threats, impacts and mitigation measures for the hotel industry must be site specific. While it is crucial to understand the wider water challenges as part of this process, specific assessments are needed for every new project and on existing sites. This allows for the creation of response strategies to the actual risks and conditions faced by a hotel where it is located.

Some strategic actions that can be taken by actors in the hotel industry to confront water risks are listed below:

- Produce risk assessments for each new/intended and existing project in order to assess the water implications facing that particular site, now and in the near future.
- Develop efficient accounting tools tailored to the industry in order to efficiently measure water utilization and related impacts in various forms. This could be done in cooperation with water specialists and based on existing water accounting systems such the Water Foot Print assessment approach and/or Life Cycle Analyses.
- Once risks have been identified, response mechanisms need to be established. These can range from effective risk reduction measures related to climate change impacts/natural hazards, to work to ensure continued access to sustainable water supplies from utilities or other means.
- Strategic options assessment plans to reduce unsustainable, on-site, water resources use also needs to be established for each entity. These need be created based on information about the specific project area to ensure they can be as effective as possible. They should, among other things, include options assessments for:
 - Water saving and reuse (what areas of direct water use can be reduced, replaced or abandoned to save water and where can water reuse be effective?).
 - Operation efficiency (how can various operational schemes appliances/equipment be altered through small adjustments to address both direct and indirect water usage use (such as energy consumption)?)
 - Technology choices (if new technology needs to be invested in to cater to the above, what are the cost-effective choices?)
- Develop policy strategies to engage with the local community.
- Many private sector entities engage in with the community in different ways or support local causes as a PR measure or philanthropic gesture. However, without a real understanding of the water problems that persist in a particular basin, these efforts may be pointless as they respond to the wrong problems, or ones that should be of lower priority. Efforts need to be based on assessments of the local water resource conditions, and done in communication with local community representatives. This analysis should cover both the impacts of the company's own operations as well as those from other activities in the basin.
- Collaborate with other water users to share best practice and work together to identify solutions to common problems.



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