GAINING PERSPECTIVE: ADDRESSING THE ROLE OF LOCAL PERCEPTIONS OF WATER QUALITY AND THE ASSOCIATED HEALTH RISKS IN REDUCING VULNERABILITY TO WATER INSECURITY: THE CASE OF THE GAMBIA

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A Thesis Submitted to
Saint Mary's University, Halifax, Nova Scotia
in Partial Fulfilment of the Requirements for
the Degree of Bachelor of Arts (Honours).

Written for International Development Studies 4500
May, 2013, Halifax, Nova Scotia

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Date: May 2013

ABSTRACT

GAINING PERSPECTIVE: ADDRESSING THE ROLE OF LOCAL PERCEPTIONS OF WATER QUALITY AND THE ASSOCIATED HEALTH RISKS IN REDUCING VULNERABILITY TO WATER INSECURITY: THE CASE OF THE GAMBIA

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Water quality is a crucial element in ensuring a water-secure world. In many developing countries, poor quality or contaminated drinking water is a major source of water related illness, which leads to millions of preventable deaths each year. Perceptions play an important role in decision-making behaviour and as such are key determinants of consumption. The perception of drinking water quality and of water-related health risks can therefore be an important factor in disease contraction and transmission. This research examined the role of local perceptions of water quality and the associated health risks in reducing vulnerability to water insecurity. A documentary search of the existing data was done to obtain secondary sources of information pertaining to the research topic—with a special focus on The Gambia, West Africa. A qualitative approach to primary data collection was facilitated by the interview technique, which took place in fourteen different communities, located in two separate regions of the country—one primarily urban and the other rural. At present, due to financial and logistical constraints there is no efficient means of large-scale water quality monitoring, which hinders water security in The Gambia. Disparities in wealth, access to financial resources, location, traditional practices and seasonal variation were noted as impediments to water security. It was concluded that a lack of resources, knowledge and awareness were important factors with respect to water-related health issues. Thus, a need for an efficient means of large-scale water quality monitoring as well as a water-related education program was determined. Perception analysis was recommended as an important tool to be used in locally adapted water resource management, as it could help to bridge the divide between decision-makers and the public. This would facilitate the accurate assessment of water security as well as the necessary management techniques to be implemented.

May 2013

ACKNOWLEDGMENTS

It is with immense gratitude that I acknowledge the help, support and guidance of the numerous individuals, without whom the completion of this thesis would have remained just a castle in the sky. I would like to thank, first and foremost, my thesis advisor, Dr. Cathy Conrad, for her encouragement, enthusiasm and continued ability to turn dreams into reality. Working under her has been a genuinely inspiring experience, which has enabled me to gain a variety of hands-on knowledge that would have otherwise been impossible. I am truly grateful for the incredible opportunities that she has provided.

Next, I would like to thank my honours seminar professor and faculty advisor, Dr. Anthony O'Malley, for his knowledge, expertise and patience throughout the thesis writing process. His obvious passion for development and persistent intensity with which he teaches has significantly enhanced my own interest in this field of study and I now look forward to many future pursuits in this area.

To my seminar classmates, I consider it an honour to have worked alongside such an enthusiastic and inspired group of people.

To my friends, I would like to thank all of you for your continued patience and support throughout the thesis writing process. Thanks for providing me with the necessary distractions and for reminding me how to be *insightful.*

To my parents, I take great pride in being able to acknowledge your contributions to the realization of this thesis. I am truly grateful to have parents who let me forge my own path, all the while providing me with continued encouragement and advice

throughout each change in direction. I am enormously thankful for your constant love and support.

To Amy Berry, thanks for letting me vent and for sharing my pain. This thesis would not have been possible without you!

Finally, I owe my deepest gratitude to Oliver Woods, whose enduring love, patience and understanding guided me through this learning process. Thanks for drying my tears and bringing me back down to reality when I needed it. I couldn't have done it without you.

Halifax, Nova Scotia
May 2013

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CHAPTER ONE

Water Security and the Relevance of Quality

1.0 Introduction

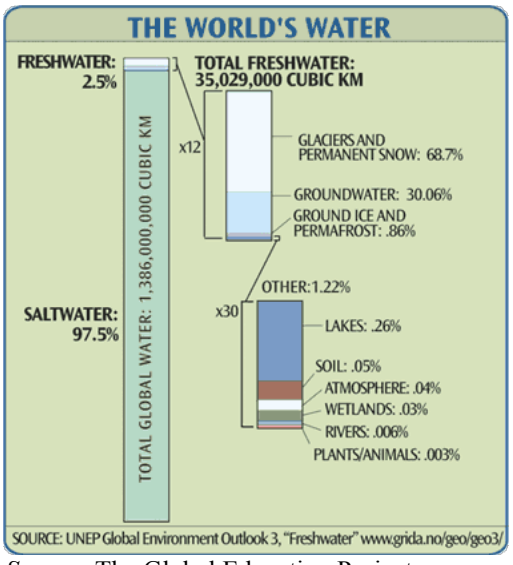
Jiyo, ndox, mumal, ndiyam, mal, melik, ayar, wata, eau—water[1]. Throughout the ages, humans have required the same four basic needs to ensure their survival: air to breath, water to drink, food to eat and protection from the elements in the form of shelter or clothing, depending on the particular climate. With the exception of air, water is the most indispensable to the continuation of life, as without it a person would die within a few days. Water is a vital element in the human body; it constitutes more than two thirds of a person's body weight and is the cardinal substance that allows all life on Earth to flourish. However, even though the importance of water is paramount, much of the world's population suffers from a lack of sufficient fresh water to meet their daily needs.

Water is essential to life. It adheres to no boundaries and the need for it knows no discrimination across borders, nations or continents. Water is also a finite substance. As its nickname suggests, the *Blue Planet* boasts an abundance of water and much like the ratio in the human body, approximately two thirds of the Earth's surface consists of water

[1] Each of the following are translations for the word 'water' in various languages spoken in The Gambia: jiyo (Mandinka), ndox (Wolof), mumal (Diola or Jola), ndiyam (Fulani or Fula; Pulaar), mal (Maninkakan or Mankanya), melik (Mandjaque or Manjaca), ayar (Malay), wata (Aku), eau (French), and water (English) (Access Gambia, 2012; ASJP).

(Cech, 2005, p. xix). However, of that water, only about 2.5 percent is freshwater. Furthermore, less than 1 percent of this freshwater (0.01 percent of all water on earth) is useable to humans, as much of the Earth's freshwater is tied up in the form of permanent ice or snow, in deep groundwater aquifers, or out of reach for much of the world's populations (UNEP, 2002a, p. 150). Due to the universal need and finiteness of this substance, the issue of water security is pertinent to the field of international development.

Figure 1.1 The World's Water (Earth: A Graphic Look at the State of the World)



Source: The Global Education Project

The United Nations (UN) Millennium Development Goals (MDGs)—which will be discussed in further detail in the subsequent chapters—were used as a reference to gauge the relevance of water security to the current development problematic. This development topic can be found under the seventh MDG, which puts forward the

umbrella goal of ensuring environmental sustainability. More precisely, the issue of water security can found under the third subsection, MDG Target 7c.

According to the European Report on Development, water security can be defined as "the availability of, and access to, water sufficient in quantity and quality to meet the health, livelihoods, ecosystem and production needs of populations, coupled with an acceptable level of water-related risk" (2012, p. 5). As is apparent from this definition, access and availability as well as quantity and quality are all major elements of water security. However, these issues are further magnified by problems of improper sanitation and hygiene, which can lead to various waterborne diseases. Because of the major health risks associated with poor quality water, it is evident that water security is highly dependent upon the quality of water supplied.

In order to decrease the level of health risks associated with poor quality water it is first necessary to assess the perceptions of such risk, as perception plays a major role in determining decision-making and behaviour (Pennings & Grossman, 2008, p. 436-437). Once an understanding of these perceptions is obtained, this information can be used to mitigate vulnerability by being implemented into local water and risk management programs as well as education efforts. Adequate water quality management is a vital aspect in ensuring a water-secure world. Therefore, an understanding of local perceptions with regards to water quality and the associated health risks will essentially allow decision makers to assess the situation more clearly and manage water resources more efficiently. It will also abate the communication gap between decision makers and the local public.

1.1 Thesis Statement

The intent of the present research was to show that a more thorough knowledge of local perceptions regarding water quality and the associated health risks could be an important tool for water education initiatives and for the improvement of local water resource management. More precisely, the purpose of this thesis was to examine the role of local perceptions of water quality and the associated health risks in reducing vulnerability to water insecurity. The thought process behind this objective was that the incorporation of local perception analysis into water resource management techniques could lessen the vulnerability to water insecurity. The Gambia, West Africa was used as a case study. As is the case in many developing countries, The Gambia currently experiences many threats to water security regarding the quality of available drinking water in the country.

Figure 1.2 Map of The Gambia

Source: Will Flanagan, 2013a

1.2 Methodology

The research used for the purpose of this thesis relied on both secondary as well as primary sources. A documentary search of the existing data was done to obtain secondary sources of information pertaining to the research topic—with a special focus on The Gambia. Particular attention was paid to the research methods used by other researchers found in the aforementioned literature, which ultimately shaped the choice of research methods and techniques used for primary data collection.

A qualitative approach to primary data collection was facilitated by the interview technique, which took place in various communities across The Gambia, including: Kotu, Kartong, Banjul, Bakau, Sukuta, Ebo Town, Bantantu, Bansang and Fulabantang. Semi-

structured interviews with open-ended questions were used so that participants were uninhibited in their expressions and were given the opportunity to express themselves fully in their own words. Furthermore, group interviews of various sizes were used as a means of collecting oral evidence to gain an understanding of the local perception of water quality and the related health risks, as one-on-one interviews seemed unusual or unnatural. Data collection was facilitated through the collaboration with an established in-country non-governmental organization called the Nova Scotia-Gambia Association (NSGA). The NSGA currently deals with water and health related issues in schools and communities across The Gambia. This collaboration proved to be extremely beneficial in soliciting information as well as guidance and assistance in carrying out the interviews.

The local perception of water quality and related health risks was a foundational element of the research, which was obtained through personal interaction and communication. Therefore, the interview technique was an appropriate method of data collection, which provided a solid basis for gathering essential information. This technique, along with the information obtained from secondary sources, allowed for an assessment of the impact of local perception on a community's vulnerability to water insecurity. That being said, certain challenges resulting from this technique were also anticipated. For example, although some people may have felt less inhibited and more open to sharing in a group setting, it is possible that the less confident, the poorer and the powerless could have been muffled by more outspoken participants. Therefore, ensuring equal participation was challenging. Furthermore, the language barrier could have rendered a loss in trust or understanding but this was combatted through the use of a local translator who facilitated comprehension and added credibility to the research project.

Above all the respect of confidentiality is vital to the success of a study; therefore, Saint Mary's University Research Ethics Board (REB) approval was obtained prior to commencing any research activities involving human participants. Also REB guidelines were followed throughout and after completion of the conducted research. Further elaboration on methodology can be found in Chapter Three.

1.3 Chapter Outline

The structure of this thesis is as follows: Chapter Two examines the general features of the issues and debates surrounding the environment, water security, risk perceptions as well as the relationship between water quality and health. Chapter Three compares and contrasts the empirical data obtained from both primary and secondary sources pertaining to local perceptions of water quality and the associated health risks in The Gambia. Chapter Four analyzes and discusses the significance of the data to the central issues of the research topic such as the role of local perceptions of water quality and associated health risks in reducing vulnerability to water insecurity through water quality management. Finally, Chapter Five presents conclusions and recommendations with regards to the findings, followed by a bibliography and appendices.

CHAPTER TWO

Water, Health and Resource Management

2.0 Environment and Development

As of the second half of the 20th century the world has bared witness to an exponentially growing affinity with development. Development is multidimensional and encompasses many aspects of human life including the social, political, economic and environmental spheres of society. As a result many initiatives and institutions have been created to facilitate development across the globe. One such institution that has been very influential in establishing precise goals and timelines for the world's contemporary development projects is the United Nations (UN). Dubbed the UN 'Millennium Development Goals' (MDGs), these goals outline eight distinct areas in need of development internationally and are further broken down into various targets, which define more specific aspects of each goal. Although each MDG and its respective targets are fundamental to the achievement of well-rounded global development, preliminary basic needs must first be established in order to ensure the successful deployment of consequent development initiatives.

As water is a basic need for human survival, ensuring the security of this resource is a prerequisite for all areas of development. Found under the seventh MDG, which seeks

to ensure environmental sustainability, is target 7c, which aims to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation (United Nations, 2011, p. 53). The UN has also explicitly recognized (in Resolution 64/292) water and sanitation as a human right as well as "acknowledged that clean drinking water and sanitation are essential to the realisation of all human rights" (General Assembly, 2010).

According to the World Health Organization (WHO) and UNICEF's Joint Monitoring Program (JMP) for Water Supply and Sanitation, the definition of an improved drinking water source is "one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter" (JMP, 2010). Definitions of improved and unimproved drinking water sources and sanitation facilities can be found in Table 2.1. Furthermore, the World Bank ascertains that "access to an improved water source" can be referred to as:

> [T]he percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within one kilometer of the dwelling (World Bank, 2013).

From this point of view, the environment, and more specifically water, is recognized as an important aspect of development (United Nations, 2011; JMP, 2010; World Bank, 2013).

Table 2.1: Improved/Unimproved Drinking Water Sources and Sanitation Facilities

	Drinking Water	Sanitation
Improved	**Use of:** • Piped water into dwelling, yard or plot • Public tap of standpipe • Tubewell of borehole • Protected spring • Protected dug well • Rainwater collection	**Use of:** • Flush or pour-flush to: -Piped sewer system -Septic tank -Pit latrine • Ventilated improved pit (VIP) latrine • Pit latrine with slab • Composting toilet
Unimproved	**Use of:** • Unprotected dug well • Unprotected spring • Cart with small tank or drum • Tanker truck • Surface water (river, dam, lake, pond, stream, canal, irrigation cannel) • Bottled water (considered to be improved only when the household uses drinking water from an improved source for cooking and personal hygiene)	**Use of:** • Flush or pour-flush to elsewhere (that is, not to piped sewer system or pit latrine) • Pit latrine without slab, or open pit • Hanging toilet or hanging latrine • Shared or public facilities of any type • No facilities, bush or field (open defecation)

Source: JMP, 2012, p. 33

2.1 Water Resources and Environment: The Issue of Scarcity

The inherent limitations of the Earth's water usage can be conceptualized both in terms of consumption patterns (affecting quantity) and parameters of usage including pollution (affecting quality). Because of the intrinsic need for water by all humans as well as to the natural environment and its ecosystems, the issue of water scarcity has become prevalent on all of the world's continents (UN Water, 2013a). However, the reason for this scarcity, or lack of security, is heavily contested. Scarcity can be attributed to many factors that result in varying levels of water stress, which is the result of "an imbalance between water use and water resources" (World Water Council, 2012, The Concept of Water Stress). Water stress is measured using a variety of different indexes; the most

widely used being the Falkenmark water stress indicator (WSI). For more information regarding water scarcity and the different methods of measuring water stress see Büchs, 2008; Falkenmark & Rockström, 2004; Smakthin, Revenga, & Döll, 2004; White, 2012; World Water Council, 2012.

The definition of water scarcity varies slightly depending on the method of measurement used (White, 2012, p. 1); however, it can be broadly understood as "the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully" (UN Water, 2007, p. 4). In this view, water scarcity is multidimensional and can be broken down into issues of availability, due to physical scarcity, as well as issues of access, due to economic or political constraints such as water management, allocation and distribution.

International scholars hold opposing views with regards to physical scarcity, or the availability of water—the 'pessimistic' view and the 'optimistic' view (Kumar & Singh, 2005, p. 760; Allan, 1997). The 'pessimists' accredit the earth's increasing population with the consequential issues of water scarcity such as the depletion of freshwater ecosystems, which they view as imminent for all countries sooner or later without serious readjustments to current water management techniques (Postel, Daily, & Ehrlich, 1996; Raskin et al., 1997; Seckler et al., 1998, as cited in Kumar & Singh, 2005). These scholars subscribe to the theory of the earth's carrying capacity and argue that sustainability can only be achieved if this carrying capacity does not outweigh available resources. The exponential growth of the population as well as the economy has put enormous pressure on all of the earth's resources including the freshwater supply

(Hinrichsen et al. 1998; Postel, 1999; Rosengrant, et al., 2002; Shiklomanov and Rodda 2003; UNEP 2002b, as cited in Pimental et al., 2004, p. 1-2). The 'optimists' however, do not view water scarcity as a threat, but more so as an economic equation yet to be solved where the trade in water will compensate for areas facing inadequate water supplies (Allan, 1997, p. 1).

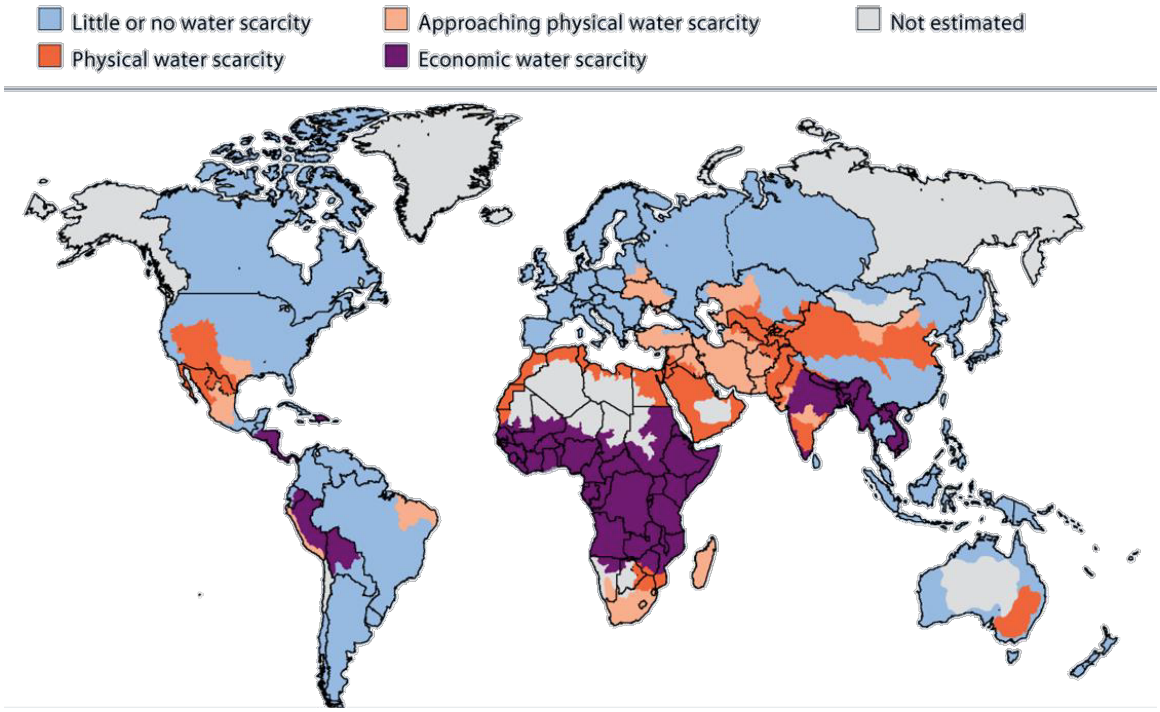
Regardless of which point of view is taken, the fact remains that the amount of water being used is a growing concern because although water is renewed by the hydrological cycle[2], there are in fact bounds or limits to its replenishment (European Report on Development, 2012, p. 49). This elevated demand on the world's freshwater supply has created varying degrees of water stress around the globe.

Access to water is another major element of water scarcity, which is often determined by economic means and limited by one's access to human, institutional and financial capital. Economic scarcity can even occur in instances where there are adequate local water supplies to meet human demands. Lack of access can come in many forms such as insufficient investment in infrastructure to facilitate available water sources (Rijsberman, 2006, p. 3), unequal allocation of resources or inadequate governance and management practices. According to Sandra Postel the world's water has been wasted and mismanaged for decades (1992), as resources are often promised to too many users as a result of overdevelopment, usually of the agricultural and often of the industrial sectors (Molden, 2007, p. 11-12). The economic dimension of water scarcity is most often a

[2] The hydrological cycle, also known as the 'water cycle', describes "the continuous process by which water is circulated throughout the Earth and its atmosphere. The Earth's water enters the atmosphere through evaporation from bodies of water and from ground surfaces. Plants and animals also add water vapour to the air by transpiration. As it rises into the atmosphere, the water vapour condenses to form clouds. Rain and other forms of precipitation return it to the Earth, where it flows into bodies of water and into the ground, beginning the cycle again. Also called water cycle" (American Heritage, 2005, p. 308).

result of poverty, inequality and unequal power relations; all of which can limit or impede access to water all together, even where no physical scarcity exists (European Report on Development, 2012, p. 47-48). Because institutions and infrastructure typically mediate access to water, resource management and governance are essential to ensuring adequate access to existing water sources.

Figure 2.1: Areas of physical and economic water scarcity



Source: Molden, 2007, p. 11

2.2 Water Security: The Issue of Quality

Using the aforementioned definition of water security[3] it is plain to see that problems of water quality can often be as severe as those of quantity, and thus is vital to

[3] European Report on Development, 2012, p. 5

achieving water security. Water sources can be contaminated by both human as well as natural activities. Some natural factors that contribute to this contamination include changes in nutrients, sediment, temperature, pH, salinity, pathogenic organisms and invasive species among other things (Gleick, 2012, p. 46-47). Examples of human activities which affect water quality include: agriculture; industry and energy production; mining and heavy metals; human-produced chemicals and other toxins; water-system infrastructure; uncontrolled disposal of human waste; population growth, urbanization and development; as well as climate change (Gleick, 2012, p. 47). Therefore, water scarcity can be either naturally occurring or socially constructed as a result of behaviour, which alters supply patterns and may be capable of being remedied or alleviated by changing behaviour (UN Water, 2006, p. 2).

Water contamination, both natural and human induced, can have serious repercussions for the health of surrounding ecosystems as well as for humans. Furthermore, continued contamination of a water source will inevitably surpass an ecosystem's resilience and lead to irreversible changes to the physical, chemical and biological characteristics of the given water source (Gleick, 2012, p. 46). Therefore, ensuring proper water quality is essential to the sustainability, vitality and usability of the source. The limited capacity of fresh water bodies to process increasing levels of contaminants caused by expanding urban, industrial and agricultural uses can lead to the degradation of water quality, which effectively reduces the amount of potable water within a given area, becoming a major cause of water scarcity (UN Water, 2007, p. 10). Therefore, water quality and water quantity are inextricably linked, as both are key determinants of supply.

Kenneth Vigil stresses that the most prominent menace exasperating water scarcity today is the issue of water quality. Moreover, he urges that water pollution is a major threat to the Earth's limited clean water supply (Vigil, 2003, p. 2). Rather than safeguarding water quality from a water management point of view, he approaches the subject from another angle—pollution management. Water pollution from various sources such as the agricultural and industrial sectors as well as from improper pharmaceutical and human waste management seriously threatens water quality. In addition to water pollution, many scholars attribute much of the world's water quality deficiencies such as salt-water intrusion to climate change (Noman & Farouque, 2008). Although a variety of threats to water quality exist, there is one central fact that remains: poor water quality significantly endangers water security because even if one has access to an unlimited supply of water, it is of no use if the quality of that water is non-potable, or unfit for human consumption.

2.3 Water Quality and Health

Poor quality, or contaminated water is detrimental to human health, as it can result in water-related diseases, which have large-scale impacts in developing countries. These can be caused by pathogenic microorganisms as well as chemical contaminants that enter the body upon contact with, or consumption of, contaminated water. Water that is contaminated by human or animal excreta is the main cause of water-related diseases (Gleick, 20012, p. 57). Water-related diseases can be classified into the following main categories including those which are: water-based, where the host spends all or part of its lifecycle in water (i.e. schistosomiasis); water-related, with insect vectors (i.e. malaria);

those which are carried by aerosols containing certain microorganisms (i.e. legionellosis); water-borne, where water is the agent for transmission (i.e. enteric and diarrhoeal diseases, typhoid, cholera, dysentery and viral hepatitis A); and chemically contaminated water (WHO, 2013; UNEP, 2012, p. 116-117; Gleick, 2012, p. 57-58; Abrams, 2001, p. 2).

Water-related diseases are amplified by inadequate water and sanitation facilities as well as poor hygiene practices (WHO, 2004). According to UN Environmental Program (UNEP) statistics, lack of access to safe water and sanitation leads to hundreds of millions of cases of water-related diseases and more than 5 million deaths yearly (2002, p.152). Globally, diarrhoeal diseases alone account for approximately 1.8 million deaths each year, 90 percent of which (1.6 million) are children under five (WHO, 2004). Developing countries account for the vast majority of these cases and it has been shown that Asia and Africa are amongst the most severely affected (UNEP, 2002b, p. 152). As identified in the African Water Atlas as well as multiple progress reports, Africa in general and Sub-Saharan Africa in particular, reveal a bleak future with regards to meeting the MDG's safe water target. Even more dire is the likelihood of achieving the sanitation target (UNEP, 2012, p. 125; WHO & UN Water 2010). Consequently, limited access to safe water and sanitation reveals a high incidence of water-related and water-borne diseases in this region (UNEP, 2012, p. 126). Thus, there is a necessity for improved water resource management.

2.4 Perceptions of Water Quality and the Associated Health Risks

The aesthetic attributes or organoleptic properties[4] of a given water source are vital determinants in perceived quality as they have been proven to affect consumption patterns (Dietrich, 2006, p. 11-12) and therefore, can be seen as having an impact on human health. For example, if quality is determined by the sensory properties of water, this does not account for potentially harmful microorganisms, which are not readily apparent using this method of judgement and therefore no health risk is perceived. Furthermore, if a consumer is unaware of, or unsubscribing to, the existence of microorganisms (or germs) that present potential health risks, then their perception of such a risk is non-existent.

The perception of risk is also influential in determining behaviour and consumption patterns. According to Pennings and Smidts, "risk perception reflects the decision maker's own interpretation of the likelihood of being exposed to the content of the risk, and may therefore be defined as a decision maker's assessment of the uncertainty of the risk content inherent in a particular situation (2000; 2003; as cited in Pennings & Grossman, 2008, p. 436-437). Within the risk perception literature, decision-making and thus behaviour, is affected by several factors including the perceived severity, or the content of the risk as well as the perceived susceptibility, or the likelihood of actual exposure (Silver, 2012, p. 14; Pennings & Grossman, 2008, p. 436-437; Redding et al., 2000, p. 181). Thus, if there is no perceived health risk associated with a given water source or method of storage for example, or if the perceived benefit outweighs the perceived cost of consumption, then there would be no incentive to question or change

[4] The features of water as experienced by the senses, such as: smell, taste and visual characteristics.

the ‘risky’ behaviour. Just as the quality of potable water is important to human health, consequently, the perception of quality is equally as important.

As perceptions of water quality and the associated health risks are intimately related to consumption patterns it can therefore be deduced that perceptions also play a role in the contraction of water related diseases caused by the consumption of contaminated water. Because of this, risk perceptions are an important factor in successful water quality management, thus the analysis of local perceptions of water quality and the associated health risks is an important niche to be filled with regards to successful management strategies. Furthermore, by analyzing local perceptions and aligning it with the actual risk level, one can then deduce whether water-related health issues are the by-product of a lack of knowledge or education, or a result of necessity (no other option). Depending on the case, distinguishing between the two scenarios is vital to the success of development projects because it will determine the appropriate course of action, for example whether the initiative should be education or resource based.

A variety of socio-cultural factors can influence the perception of quality and the associated health risks such as education, cultural values, traditional beliefs, social norms, media, family gender, ethnicity, age, socio-economic status and social memory (Silver, 2012, p.14). Perceptions play an important role in why people make the decisions they do and therefore can be very beneficial to balancing out the discrepancy between actual and perceived risks of drinking poor quality water for example. As Slovic explains: “[i]f successful, [risk perception] research should aid policy-makers by improving communication between them and the public, by directing educational efforts, and by predicting public responses to new technologies, events, and new risk management

strategies (1987, p. 281, as cited in Silver, 2012, p. 14). Risk perception is intimately related to the management of water quality and accurate analysis can lead to the enhancement of resource management thereby reducing the associated health risks by aligning perception with reality.

2.5 Approaches to Water Resource Management

Human water usage can be divided into three main sectors—domestic, industrial and agricultural. Each of these sectors, as well as the needs of natural ecosystems, are very demanding of the Earth's limited and unevenly distributed water resources. Economic growth, population increase and climate change all add to the already complicated task of managing this prized resource in a sustainable manner (UN Water, 2006, p. 12). Therefore, the management and storage of water is important for ensuring water security. Peter Gleick argues that the path to achieving water security is through sustainable water planning and management, more effective resource use and allocation, better data, case studies, and efforts to raise awareness in obtaining water security (2012, xiii-xv). He promotes water as a human right and policy change as a means to creating standards and improving water management techniques, in hopes of increasing the access and availability of water of an acceptable quality to all people.

Furthermore, Asit Biswas, Benedito Braga, Cecilia Tortajada and Diego Rodriguez stress the importance of quality with regards to water management. They argue, "the main water crisis in the coming years is most likely to stem primarily from water quality deterioration and lack of investment funds, rather than from physical water scarcities" (2006, p. v). They also suggest that although water quality deterioration is a

major issue in terms of water security, the bigger issue at hand is management. This is because it integrates water quantity, pollution control, efficiency, environmental considerations, and human health implications as one interconnected endeavour. Water quality management is therefore an essential component of ensuring efficiency in water management policies, plans, and programs (Biswas, Braga, Tortajada & Rodriguez, 2006).

2.5.1 Top-down Approaches

Because water is important for many aspects of our daily lives, the way in which to ensure the security of this resource is passionately contested as well. There are those that seek a top-down approach where water management is ameliorated through changes and additions to policy, which in affect are meant to prompt change downward. Furthermore, there are many alternative views that fall under this category as well. A Rights-Based Approach (RBA), for example, can be seen throughout the work of Richard Jolly of the UNDP and Peter Gleick, who advocate the human right to water and feel that legitimizing this right in the eyes of decision-makers will effectively lead to changes in policy and management practices (Gleick, 2007). The RBA "puts human rights at the heart of human development" (Filmer-Wilson, 2005, p. 213). As stated by the UNDP, this approach "describes situations not simply in terms of human needs, or of development requirements, but in terms of society's obligations to respond to the inalienable rights of individuals, empowers people to demand justice as a right, not as a charity and gives communities a moral basis from which to claim international assistance when needed" (1998, p. 173- 174). The right to water, adopted by the UN, states that "[t]he human right

to water is indispensable for leading a life in human dignity. It is a prerequisite for the realization of other human rights" (CESCR, 2002).

Gleick argues that acknowledging the human right to water will help improve water security by maintaining awareness of the issue and encourage the international community and individual governments to reaffirm their commitments to MDG 7c and to meet the essential water needs of their citizens through legally binding action and unified water policies (2007, p. 3). In addition, Jolly emphasizes that the human right to water "grounds the priority on the bedrock of social and economic rights, it emphasizes the obligations of states parties to ensure access, and it identifies the obligations of states parties to provide support internationally as well as nationally" (Jolly, 1998).

Another view that promotes a top-down approach to water management is an economically driven, neo-liberal approach[5]. From this point of view, the path to ensuring global water security is achieved through the 'valuation' or commodification of water; by viewing water as an economic resource, a monetary sum can be allocated. From this perspective, the distribution of water could be achieved more efficiently by applying market principles. As scarcity continues to increase and the 'water crisis' intensifies, so will conflicts over water and environmental degradation from the misuse, overuse and pollution of resources among other issues. This school of thought is based on the idea of natural capital, which gives economic value to the natural environment. This idea works on the premise that more care will be taken to preserve the environment if its value to human beings is legally determined (European Report on Development, 2012, p. 36).

[5] Neo-liberalism is an economic model or paradigm that can be thought of as an ideology, a mode of governance and a policy package, which promotes "deregulation (of the economy), liberalization (of trade and industry) and privatization (of state-owned enterprises)" (Steger & Roy, 2010, p. 11-14).

However, valuation frameworks must take into consideration the fact that indiscriminate use of a purely economic approach also risks overemphasizing the monetary aspect of value at the expense of the environmental and social value (UN Water, 2006, p. 4).

Some experts argue that this type of economic approach to water management and security could help mitigate tensions caused by water scarcity. According to Michael Jackson, water has a quantifiable market value, which should be converted to a water based monetary standard. He states this will increase access to water resources for everyone through "the elimination of user fees for public water and to protect the ongoing operation through revenues created through recognized rules of sovereignty and fiscal policy". He goes on to argue that the adoption of this monetary standard would "lower the daily cost of living … [and] create an environment of encouraged growth in a more stable economy, thereby increasing tax revenues" (Jackson, 1995, p. 1). Jackson suggests that the path to security is achieved by essentially putting a price on water, which reveals a market-driven approach.

2.5.2 Bottom-up Approaches

In contrast, there are also those who seek to mitigate management issues by using a bottom-up, or grassroots course of action by actualizing small-scale, locally relevant management initiatives. In comparison to the 'valuation' of water, the bottom-up approach seeks to recognize the non-market value of water such as the cultural, aesthetic, social and environmental values of water and water services. The contrasting outlook with regards to water's 'worth' thus lies in society's perception of water in all of its many uses (UN Water, 2006, p. 35).

By taking the non-market value of water into account with regards to resource management, it is necessary to acknowledge the cultural, traditional or social importance of water. Some experts, such as Veronica Strang, argue that the privatization or the commodification of water for profit is a violation of cultural rights and values (2004, Back Cover). In order to ethically and sustainably achieve proper water management and to ensure the human right to water, Strang argues that the cultural perceptions of water as well as its historical meaning to a given society need to be engaged in order to accurately achieve this goal. Culture is seen as a necessary element to achieving sustainable resource management. Furthermore, Strang states that "[w]ater is not merely a physical resource: in every cultural context it is densely encoded with social, spiritual, political and environmental meanings, and these have a powerful effect upon patterns of water use and upon the relationships between water users and suppliers" (2004, Back Cover).

In this same vein, Emmanuel Akpabio goes on to create a link between tradition, religion and environmental perception and management. Akpabio argues that tradition and religion play key roles in shaping public perceptions and attitudes towards the environment as well as the various management strategies adopted. He also believes that in areas where there are clashes in beliefs towards the environment "no successful environmental management strategies can be attained without giving consideration and understanding to these variables" (2006, p. 235). He suggests that the cultural background of a people is essential to successful environmental legislation and protection strategies. The solutions he proposes lie in environmental education programs as well as the integration of indigenous values, perceptions and knowledge of the environment into national policies and legislations on environmental matters.

2.6 Local Perceptions: Implications for Water Resource Management in The Gambia

Many differences exist in the way in which water is perceived and although different academics present different means to a possible end, the goal of ameliorating the current water crisis remains constant. Some described policy as the main culprit for water insecurity while others chose management or education as the major issue plaguing water security. Although each approach that was presented incorporated important aspects of water security, the bottom up approaches presented by Akpabio and Strang were the most compelling. They proposed the integration of local knowledge into resource management strategies, education programs and development initiatives that are sustainable and locally relevant. Both authors acknowledge the influence of socio-cultural factors, or personal baggage in shaping a person's knowledgebase and thus illuminate the importance of the inclusion of this local knowledge to the success of a given development project.

It is using this framework that the local perceptions of water quality and the associated health risks were analysed, as a means of integration into locally relevant water quality management strategies. The Gambia, was examined as a case study in which the role of local perceptions of water quality and the associated health risks were analyzed as a means of mitigating a community's vulnerability to water insecurity. By approaching the issue of water quality management at the local level many issues and variations became apparent which were not visible on a grander scale. Furthermore, as water sources as well as water quality vary drastically from region to region in The Gambia, it seemed relevant to investigate the disparities and/or similarities in perceptions as to enhance the possibility of successful locally adapted management strategies.

CHAPTER THREE

Case Study of The Gambia

3.0 The Global Water and Sanitation Situation

3.0.1 Millennium Development Goals: Drinking Water Target 7c

According to the United Nations, safe and clean drinking water and sanitation have been recognized as human rights since 2010 and are seen as integral to the right to an adequate standard of living as well as to all other human rights (Joint Monitoring Programme, 2012, p. 36). However, the implementation of these rights is a complex and time-consuming issue; it is a work in progress that needs care and attention to be accurately achieved. From an economic standpoint, World Health Organization (WTO) studies show that "the benefits of investing in water far outweigh the costs of making the improvements – by as much as 60 times (and never less than 3) in the major regions of the developing world" (UN Water, 2007, p. 17). Not only does increased access to improved water and sanitation have clear health benefits, but it is also an important contributing factor in attaining all other MDG targets (UN Water, 2007, p. 17). Furthermore, water quality management is an important part of attaining this target (UNEP, ERCE & UNESCO, 2008 as cited in UN Water, 2013b).

According to official statistics, the UN MDG drinking water target 7c has been met. As of 2010 over 2 billion people gained access to improved water sources since 1990 and the percentage of the global population using unimproved sources decreased from 24 to 11 percent (Joint Monitoring P, 2012, p. 4). This is a great achievement that should be recognized; however, this percentage is a global representation and it can be deceiving, as many disparities in the data can be identified. Regional differences, which when combined meet the global water target, are evident disparities within the current data, as progress towards this goal is not evenly distributed. As it stands, the overall percentage of those with access to improved water sources in the 'developing world' is 86 percent; however, within this category are those countries designated as 'least developed[6]' whose coverage is significantly less, at 63 percent (Joint Monitoring Programme, 2012, p. 4). On an individual level, many countries are far from meeting the target and according to Joint Monitoring Programme (JMP) statistics over half of the progress made can be attributed to those living in China or India (2012, p.7). In comparison, the countries of Sub-Saharan Africa account for the lowest drinking water coverage out of any other region—with only 61 percent improved water supply sources—while Latin America and the Caribbean, Northern Africa and large parts of Asia boast 90 percent or more (Joint Monitoring Programme, 2012, p. 4-9). These disparities in improvement rates are not accounted for in the overall percentage and therefore distort the reality of the situation in many areas.

Similarly, national data can also provide an inaccurate representation of the situation, as disparities can also be found within countries—between those living in rural

[6] According to the UN, there are currently 48 countries that are designated as 'least developed' based on criteria of per capita income, human assets and economic vulnerability. The complete country listing can be found in The Least Developed Countries Report (UNCTAD, 2012).

and urban areas, between the rich and poor, as well as between men and women (Joint Monitoring Programme, 2012, p4). Trends in the existing data show that the majority of people without access to improved drinking water sources live in rural areas (Joint Monitoring Programme, 2012, p. 13). Furthermore, in Sub-Saharan Africa, the poorest 60 percent of the population are largely denied access to piped drinking water supplies (AMCOW, 2012, p. 13). In addition, as women bear the brunt of the responsibility for water collection in this region, they are disproportionately affected by the hardships and health hazards associated with this task (Joint Monitoring Programme, 2012, p. 31).

The increasing population growth rate also distorts the rate of improvement, as the former often surpasses the latter in many regions, further enhancing the difficulty of reaching the MDG targets (UNEP, 2010, p.128). In Africa for example, from 1990 to 2010, access to improved drinking water sources increased from 56 to 66 percent (a 10 percent increase), providing 322 million people with access to improved sources (AMCOW, 2012, p. 3). However, in the same period the population relying on unimproved drinking water sources augmented from 279 million to 344 million (a 23.3 percent increase) (AMCOW, 2012, p. 3). At present Africa as a whole is not on course to meet the drinking water target of 78 percent, as only 23 of the 54 African countries, officially recognized by the UN, are on track (AMCOW, 2012, p. 9). In order for Africa to meet the MDG drinking water target, between 2010 and 2015, 215 million more people need to gain access (AMCOW, 2012, p. 3). The proportion of the population to be halved by 2015 for MDG 7c uses 1990 as the baseline population, not the projected population for 2015 (Joint Monitoring Programme, 2010, p. 35). Therefore, because the target is not adjusted for population growth rate, it is not representative of contemporary figures.

3.0.2 Millennium Development Goals: Sanitation Target 7c

As previously outlined in Chapter Two, sanitation and hygiene are integral to ensuring water quality and thus health. As present, the world is not on course to achieve the MDG sanitation target, which is an integral component of ensuring MDG 7c (Joint Monitoring Programme, 2012, p. 16). As of 2010, 2.6 billion people were not using improved sanitation facilities (Joint Monitoring Programme, 2012, p. 56). From the existing data it is apparent that many of the disparities with regards to drinking water are also relevant to sanitation. Access to improved sanitation facilities in many countries in Sub-Saharan Africa and Southern Asia is disproportionately lower than other areas of the world—with coverage amounting to less than 50 percent—which again presents regional disparities in the data (Joint Monitoring Programme, 2012, p. 19). Furthermore, throughout much of Africa access to improved sanitation corresponds directly to wealth and living in urban areas—sanitation coverage being significantly lower in rural areas (AMCOW, 2012, p. 13; Joint Monitoring Programme, 2012, p. 24). From 1990 to 2010 189 million people gained access to improved sanitation, increasing coverage from 35 to 40 percent. However, in the same period the population grew by nearly 400 million people, increasing the number of people without access to improved sanitation by almost 200 million—totalling 612 million in 2010 (AMCOW, 2012, p. 4). See Tables 3.1 and 3.2 below for country, regional and global estimates on water and sanitation.

Table 3.1: Country, Regional and Global Estimates on Water

Country, Area or Territory	Year	USE OF DRINKING WATER SOURCES (percentage of population)															Proportion of the 2010 population that gained access since 1995 (%)
		Urban					Rural					National					
		Improved			Unimproved		Improved			Unimproved		Improved			Unimproved		
		Total Improved	Piped on Premises	Other Improved	Unimproved	Surface Water	Total Improved	Piped on Premises	Other Improved	Unimproved	Surface Water	Total Improved	Piped on Premises	Other Improved	Unimproved	Surface Water	
World	1990	95	81	14	4	1	62	18	44	28	10	76	45	31	18	6	23
	2000	96	80	16	3	1	72	24	48	20	8	83	50	33	12	5	
	2010	96	80	16	4	0	81	29	52	14	5	89	54	35	8	3	
Developed regions	1990	100	97	3	0	0	94	69	25	6	0	98	89	9	2	0	6
	2000	100	97	3	0	0	95	72	23	5	0	98	90	8	2	0	
	2010	100	97	3	0	0	97	74	23	3	0	99	92	7	1	0	
Developing regions	1990	93	72	21	6	1	59	11	48	29	12	70	32	38	22	8	26
	2000	94	72	22	5	1	69	19	50	22	9	79	40	39	15	6	
	2010	95	73	22	5	0	79	24	55	15	6	86	46	40	11	3	
Eastern Asia	1990	97	92	5	2	1	56	12	44	34	10	68	35	33	25	7	24
	2000	98	93	5	1	1	70	29	41	24	6	81	53	28	15	4	
	2010	98	95	3	2	0	85	46	39	13	2	91	70	21	8	1	
Southern Asia	1990	90	53	37	9	1	66	8	58	29	5	72	20	52	24	4	31
	2000	93	52	41	7	0	77	11	66	20	3	82	23	59	15	3	
	2010	96	51	45	4	0	88	13	75	10	2	90	25	65	9	1	
South-Eastern Asia	1990	91	41	50	7	2	62	5	57	29	9	71	16	55	22	7	26
	2000	92	46	46	6	2	72	10	62	19	9	80	24	56	14	6	
	2010	94	53	41	6	0	83	13	70	13	4	88	30	58	9	3	
Western Asia	1990	96	92	4	4	0	68	43	25	29	3	85	72	13	14	1	29
	2000	96	93	3	3	1	72	53	19	21	7	87	78	9	10	3	
	2010	96	94	2	4	0	76	65	11	19	5	89	84	5	9	2	
Oceania	1990	93	72	21	3	4	42	11	31	14	44	55	26	29	11	34	13
	2000	93	72	21	4	3	44	12	32	14	42	55	26	29	12	33	
	2010	93	71	22	6	1	42	10	32	19	39	54	24	30	15	31	
Latin American & the Caribbean	1990	95	87	8	4	1	64	37	27	15	21	85	73	12	8	7	22
	2000	96	90	6	3	1	73	50	23	14	13	91	80	11	5	4	
	2010	98	92	6	2	0	81	61	20	13	6	94	86	8	5	1	
Caucasus and Central Asia	1990	96	85	11	3	1	80	31	49	14	6	88	56	32	9	3	11
	2000	97	84	13	2	1	76	29	47	12	12	85	53	32	8	7	
	2010	97	85	12	2	1	80	28	52	9	11	87	53	34	6	7	
Northern Africa	1990	94	86	8	6	0	80	32	48	17	3	87	58	29	11	2	23
	2000	94	89	5	6	0	84	51	33	12	4	89	70	19	9	2	
	2010	95	91	4	5	0	89	73	16	6	5	92	83	9	6	2	
Sub-Saharan Africa	1990	83	43	40	14	3	36	4	32	31	33	49	15	34	27	24	26
	2000	82	39	43	15	3	42	4	38	32	26	55	15	40	27	18	
	2010	83	34	49	14	3	49	5	44	32	19	61	16	45	26	13	
Gambia	1990	86	25	61	14	0	67	0	67	33	0	74	10	64	26	0	38
	2000	90	40	50	10	0	77	3	74	23	0	83	21	62	17	0	
	2010	92	51	41	8	0	85	5	80	15	0	89	32	57	11	0	

Source: Joint Monitoring Programme, 2012, p. 43- 55

Table 3.2: Country, Regional and Global Estimates on Sanitation

Country, Area or Territory	Year	Population (x1,000)	Percentage Urban Population	USE OF SANITATION FACILITIES (percentage of population)												Proportion of the 2010 population that gained access since 1995 (%)
				Urban				Rural				National				
				Improved	Unimproved			Improved	Unimproved			Improved	Unimproved			
					Shared	Other Unimproved	Open Defecation		Shared	Other Unimproved	Open Defecation		Shared	Other Unimproved	Open Defecation	
World	1990	5,286,139	43	76	10	8	6	29	4	28	39	49	6	20	25	20
	2000	6,100,780	46	77	11	7	5	38	7	22	33	56	9	15	20	
	2010	6,872,619	51	79	13	5	3	47	9	16	28	63	11	11	15	
Developed regions	1990	1,149,637	71	97	3	0	0	91	3	6	0	95	4	1	0	6
	2000	1,195,733	73	96	4	0	0	91	3	6	0	95	3	2	0	
	2010	1,244,386	75	96	3	1	0	93	3	4	0	95	3	2	0	
Developing regions	1990	4,136,502	35	65	13	12	10	21	4	31	44	36	7	25	32	23
	2000	4,905,047	40	69	15	9	7	32	7	24	37	47	10	18	25	
	2010	5,628,233	45	73	17	6	4	43	9	17	31	56	13	12	19	
Eastern Asia	1990	1,216,665	29	53	15	29	3	16	4	71	9	27	7	59	7	33
	2000	1,347,625	38	64	20	15	1	36	9	50	5	47	13	37	3	
	2010	1,424,218	49	76	24	0	0	57	14	27	2	66	19	14	1	
Southern Asia	1990	1,195,985	26	57	16	3	24	12	3	2	83	24	6	3	67	19
	2000	1,460,201	29	61	17	5	17	20	5	8	67	32	8	7	53	
	2010	1,704,146	32	64	18	8	10	30	6	9	55	41	10	8	41	
South-Eastern Asia	1990	445,361	32	68	9	10	13	36	5	20	39	46	6	17	31	26
	2000	523,831	38	74	9	7	10	49	7	15	29	58	8	12	22	
	2010	593,415	42	82	10	1	7	60	10	9	21	69	10	6	15	
Western Asia	1990	127,092	61	96	2	2	0	55	2	24	19	80	2	10	8	30
	2000	161,478	64	93	6	1	0	60	4	20	16	81	5	8	6	
	2010	206,841	67	94	6	0	0	67	5	19	9	85	5	7	3	
Oceania	1990	6,459	24	85	–	12	3	45	–	39	16	55	–	32	13	16
	2000	8,093	24	84	–	13	3	44	–	40	16	54	–	33	13	
	2010	9,943	23	84	–	13	3	46	–	38	16	55	–	32	13	
Latin American & the Caribbean	1990	443,032	70	80	6	7	7	38	3	14	45	68	5	9	18	21
	2000	521,429	75	83	6	7	4	49	5	16	30	75	6	9	10	
	2010	590,082	80	84	7	8	1	60	6	17	17	80	7	9	4	
Caucasus and Central Asia	1990	66,627	48	96	3	1	0	86	1	12	1	91	2	7	0	17
	2000	71,294	45	93	5	2	0	86	2	11	1	90	3	7	0	
	2010	77,358	45	96	4	0	0	95	2	3	0	96	3	1	0	
Northern Africa	1990	119,694	49	91	6	1	2	55	4	8	33	72	5	5	18	28
	2000	141,978	51	93	6	0	1	72	5	5	18	83	6	2	9	
	2010	165,907	54	94	6	0	0	85	6	0	9	90	6	0	4	
Sub-Saharan Africa	1990	515,588	28	43	28	19	10	19	9	26	46	26	14	24	36	12
	2000	669,118	33	43	29	19	9	21	10	27	42	28	16	24	32	
	2010	856,323	37	43	31	18	8	23	12	30	35	30	19	26	25	
Gambia	1990	966	38	–	–	–	–	–	–	–	–	–	–	–	–	29
	2000	1,297	49	67	24	8	1	60	14	18	8	63	19	13	5	
	2010	1,728	58	70	25	5	0	65	15	15	5	68	21	9	2	

Source: Joint Monitoring Programme, 2012, p. 42- 54

3.0.3 MDG Target 7c and Global Water Quality Monitoring

Finally, due to incomplete or inadequate global water quality monitoring there is a high probability that there has been an over-estimation of the percentage of people actually using safe drinking water supplies (Joint Monitoring Programme, 2012, p. 4). The existing methods of water quality testing have prohibitive costs as well as technical and logistic complications; therefore, achieving accurate data on a national scale for all countries is unrealistic at present. For this reason a proxy indicator has been used to determine water quality, which measures the use of 'improved' drinking water sources, defined as "as those that, by the nature of their construction, are protected from outside contamination, particularly faecal matter" (Joint Monitoring Programme, 2012, p. 4). However, because the water quality of these improved sources is not adequately monitored, it is possible that contamination has occurred as a result of inadequate maintenance. Thus, some sources in fact may not be providing 'safe' drinking water, a factor which is not accounted for in the present data. The disparity in the present data with regards to the accurate inclusion of water quality in the MGD drinking water target illuminates the necessity for better water quality monitoring and management techniques.

Water and health are intimately related—water quality being a major variable in the human health equation. Water-related diseases inflict a major burden on global human health due to insufficient quality and/or quantity of drinking water and inadequate sanitation. The unfortunate result of which are more than five million preventable deaths, predominantly in developing countries, each year (WHO, 2008). Water-related diseases linked to contaminated water are a growing tragedy affecting approximately 2.3 billion people worldwide. Furthermore, 60 percent of all infant mortality can be associated with

water-related infectious and parasitic diseases (UNEP, 2010, p. 176). In addition, water related diseases threaten socio-economic development and with a disproportionate affect on the poor, the burden of these health issues maintains a cycle of poverty and sickness (UN Water, 2007, P. 20; UNESCO, 2012, p. 95). According to UNESCO ten percent of the total global disease burden could be prevented with improvements to "drinking water, sanitation, hygiene, and use of environmental management and health impact assessments" (2012, p. 96). There is an immediate need for a global water quality assessment framework; however, at the moment there is an urgent lack of water quality data to facilitate successful decision-making and water resource management. Furthermore, the improved management of vulnerability and risks is essential to the management process (UNESCO, 2012, p. 98). For further information regarding necessary inclusions and recommendations for such a framework see UNESCO, 2012; Alcamo, 2011; and UN Water 2011.

3.1 Study Area: The Gambia

The Gambia, located in West Africa, comprises a total area of 11,295 km^2, 1,295 km^2 of which are covered by water (CIA, 2009). The country extends eastward from its small coastline on the Atlantic Ocean along both banks of the meandering Gambia River. Save for it's 80 km of coastline, The Gambia is completely surrounded by Senegal. This tiny country (the smallest on the continent) exists in the flood plain of the Gambia River, which is flanked by savannah and low-lying hills. The climate is generally tropical with two distinct seasons—the hot rainy season (from June to November) and the cooler dry season (from November to May) (CIA, 2009). As of 1982 there were 8 km^3 of renewable

water resources, 0.03 km^3 of which are withdrawn annually (as of 2000) by the three primary sectors—domestic (23 percent), industrial (12 percent) and agricultural (65 percent) (CIA, 2009; UNEP, 2010, p. 246). In the last thirty years drought has increasingly become an issue as rainfall has dropped by about 30 percent, which is evident in the reduced length of the rainy season as well as the quantity of rainfall recorded (Jarju, 2009, p. 3). Other current environmental issues that are most prevalent in The Gambia are deforestation, desertification and water-borne diseases (CIA, 2009).

According to the African Ministers' Council on Water (AMCOW), The Gambia is among the thirteen countries in Sub-Saharan Africa that are performing higher than the regional average for both water and sanitation (2012, p. 14). The MDG progress assessment shows that it is on track to meet the drinking water target and that progress has been made towards the sanitation target; however, this progress is insufficient to actually meet the target. From 1995 to 2010, 37.7 percent of the Gambian population gained access to improved drinking water sources and 28.5 percent to improved sanitation, with 89 and 68 percent respectively of total coverage in 2010 (AMCOW, 2012, p.14). According to the stated AMCOW document's disclaimer, these statistics are based on data obtained from the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation as presented in their 2012 report entitled *Progress on Drinking Water and Sanitation– 2012 Update.* The disclaimer further states that the "individual country estimates are based on data from national censuses and nationally representative household sample surveys using the international indicator definition for monitoring progress towards the MDG drinking water and sanitation target" (AMCOW, 1012, p. 2). Although this progress is commendable, these statistics show that there is room for

improvement in current management techniques and strategies. Furthermore, as human health is the primary focus of achieving higher levels of access to improved drinking water sources and sanitation, water quality management is integral to ensuring both of these targets, as the two are intimately related.

3.2 Methodology

3.2.1 Data Collection Methods

The review of library resources, which facilitated secondary data collection, was obtained primarily from government as well as NGO reports and websites, academic journal articles and past studies, online newspapers as well as various books regarding environment and development, water security, risk perception, resource management as well as water quality and water-related health risks. Data was collected on a global, regional and national level in order to provide a well-rounded overview of the situation. Upon analysis of the research methods used by other researchers throughout the literature (such as Akpabio, 2011; Njie, N/D; Silver, 2012), a qualitative approach to primary data collection, facilitated by the interview technique, was determined to be the most appropriate way to obtain information regarding local perceptions of water quality and the associated health risks. This method allowed for maximum information accumulation because it allowed participants to expand on the subject in their own words. Personal perceptions are an intimate subject that necessitates an intimate method of data collection and thus the interview technique seemed appropriate.

Primary research took place in two regions of The Gambia (one rural and one urban). Data was collected from fourteen different group interviews (with the exception

of interviews number five and twelve which were one-on-one) in the communities of: Kotu, Kartong, Banjul, Bakau, Sukuta, Ebo Town, Bantanto, Bansang and Fula Bantang (see Figure 3.2 for a precise map of interview locations). It was customary for people to already be configured into small groups so it seemed natural to conduct the interviews using the same composition as to allow for maximum participant comfort and ease. The groups varied in size—the smallest consisted of one participant while the largest had sixteen. Participants were chosen at random, at times snowballing from recommendations of specific participants or suggestions given for possible interview locations. In accordance with ethics approval requirements, consent was provided verbally before commencing the interview process.

3.2.2 Ethics Approval

Approval by the Saint Mary's University Research Ethics Board (REB) was obtained November 25th 2012, prior to the commencement of research. Based on recommendations made by the executive director (and Gambian local) of a local NGO that works in-country (Nova Scotia-Gambia Association), verbal consent was preferable due to language and literacy barriers as well as cultural norms. Verbal consent was accepted by the REB along with the condition of maintained participant confidentiality amongst translator (Kebba Suso), thesis supervisor (Dr. Cathy Conrad) and primary researcher (Meagan Symington). Confidentiality was maintained throughout this thesis through the generalization of any data that could reveal the identity of a particular interview group. Permission to record interviews with an audio recording device was also sought at the time of requested consent. Audio recordings were backed up electronically on the primary researcher's computer and immediately deleted from the recording device.

Interviews were later transcribed on to a word document and combined with hand-written notes taken by Meagan Symington and Dr. Cathy Conrad—notes were taken simultaneously as to allow for maximum authenticity of the data. Data will be kept for one year from the study period and then will be destroyed—deleted and/or shredded.

3.2.3 Participant Characteristics

Participants included men and women ranging in age from eighteen to approximately seventy-five years old. For many people in The Gambia, especially the older generation, age is unknown. Birthdates had not been recorded until relatively recently, thus the ages recorded were approximated. Furthermore, participants also varied in ethnicity (Mandinka, Fula, Wolof) as well as linguistic groups (Mandinka, Fula, Wolof, English and French) and religious association (Muslim and Christian). To ensure consistency throughout the research, interview groups were given numbers according to the sequence in which they occurred and will be referenced according to interview number. For further elaboration on the exact interview schedule as well as the group dynamics and specific interview questions, see Appendix A, B and C respectively.

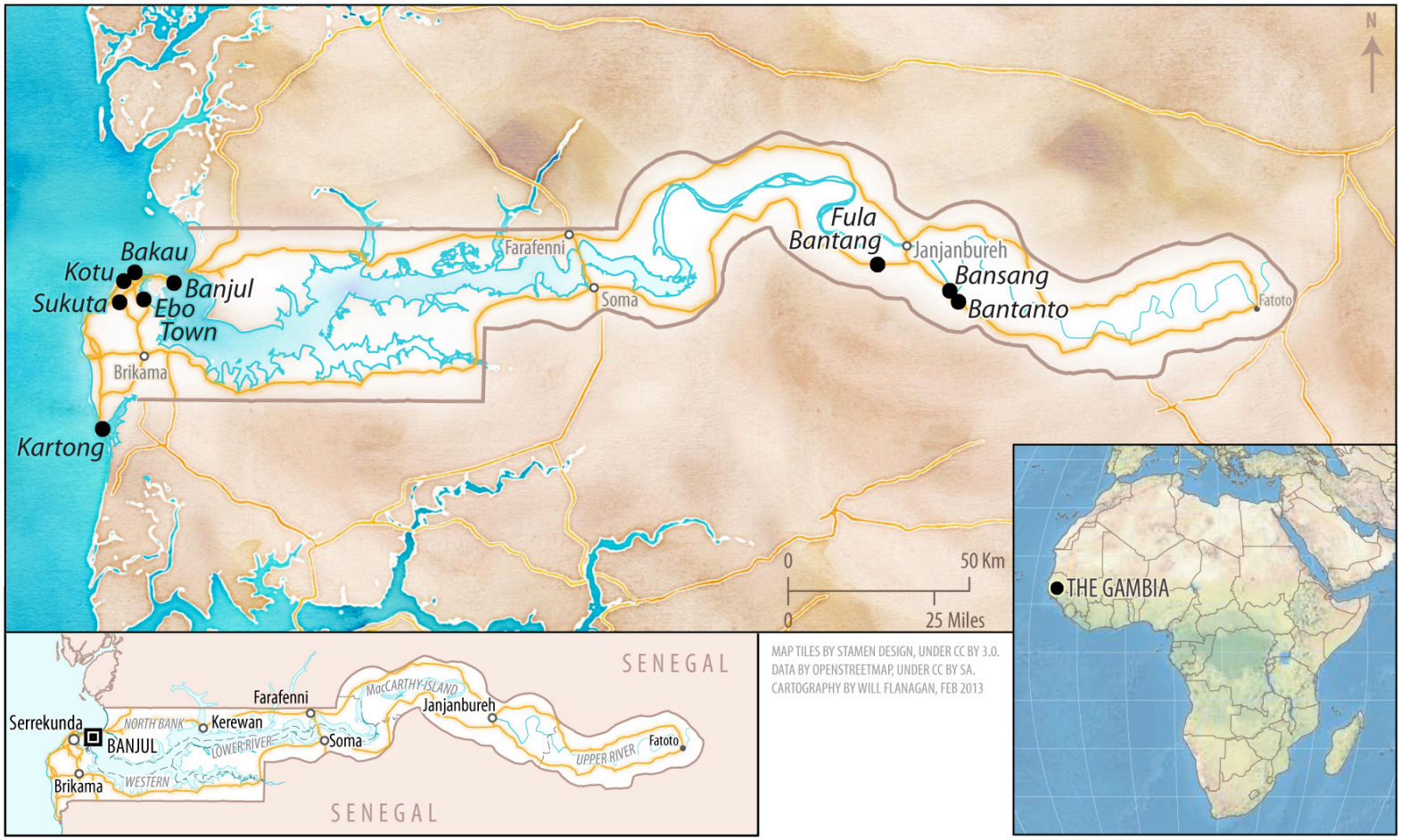
3.2.4 Interview Structure

Semi-structured interviews with open-ended questions were used to obtain maximum information from participant responses in their own language. Many of the responses were explained through the use of a translator, as in the majority of the interviews language was a barrier. Therefore, there is a possibility that some of the meaning in the responses could have been lost in interpretation. However, when necessary follow up questions were used to probe further elaboration on a subject. Although the use of a translator may have had certain weaknesses it also had many

benefits, as the collaboration with a local Gambian facilitated trust as well as cultural interpretation and further explanation when necessary. Furthermore, the specific translator used was an employee of a local NGO, the Nova Scotia-Gambia Association (NSGA), which works with Gambian youth on a variety of education and health promotion initiatives—including water and health. Thus he could offer much personal expertise as well as knowledge of where to find sources of information with regards to the local water-related health issues as well as the programs implemented by different organizations working on this topic. This proved to be extremely beneficial for achieving a wide expanse of data from various sources.

The use of primary as well as secondary sources of data allowed for similarities and discrepancies between perceptions and facts to be illuminated with regards to water quality and the associated health risks. By combining the two sources of data, the goal was to grasp a better understanding of the contemporary water situation in The Gambia with regards to quality and health. The end purpose of the research was to prove that perceptions analysis of water quality and the associated risks could be beneficial and positively contribute to water management by providing locally adapted strategies. The idea was that by aligning perceptions with reality, vulnerability to water related health risks could be mitigated through relevant management strategies. By studying these local perceptions it could also be determined whether the associated health issues were due to a lack of knowledge, a misguided perception of risk level, or necessity.

Figure 3.1: Interview Locations



Source: Will Flanagan, 2013b

3.3 Drinking Water Sources and Water-related Health Risks in The Gambia

3.3.1 Sources of Drinking Water

Drinking water in The Gambia comes from two different sources: surface water or groundwater. Surface water is water that is found on the surface of the Earth in bodies of water such as lakes, rivers, streams or oceans. In The Gambia, the main sources of surface water come from the Gambia River and its tributaries. This trans-boundary river is highly seasonal and is subject to marine influences (UNEP-DHI, 2008, p. 9). The river is subject to salinization upstream for approximately 70 kilometers (in the rainy season) and up to 250 kilometers (in the dry season), eastward from where the river meets the Atlantic Ocean (UNEP, 2010, p. 247). The increased concentration of salt levels in the Gambia River, at least partially resulting from sea level rise and climate change (Parry, Canziani, Palutikof, van der Linden & Hanson, 2007, p. 185), renders fresh, or potable, water unfit for human consumption. Therefore, within the country, groundwater is the primary source of drinking water (Healey, 2011, p. 18-19). Groundwater is water that flows or has collected in porous spaces beneath the Earth's surface as a result of rainwater seepage or from melting snow or ice. Ground water supplies aquifers, springs and wells; the upper surface of which is known as the water table. In The Gambia drinking water is obtained from boreholes[7], wells, hand pumps, taps as well as river water and rainwater (Fieldbook #1, 2012).

[7] A borehole is very deep narrow hole drilled or dug into the ground in order to retrieve water or oil (Macmillan, 2013).

3.3.2 Types of Water Scarcity

According to UNEP-DHI, the major threats, as determined by their magnitude, persistence and social impacts, to both surface and groundwater resources in The Gambia are the depletion of water stocks (quantity) as well as the pollution of water resources (quality) (2008, p. 9). During the Gambian dry season, as is the case in many warmer climates, water quantity is negatively affected due to lack of rain and excess withdrawal. The agricultural and industrial sectors as well as the tourism industry, population growth and rapid urbanization all contribute to increased water stress on the country's fresh water resources. For more information on these specific issues see Jarju, 2009; Latchford & Niang, 2011; Noble *et al*., 2012; Njie, N/D; Nash, 1993. However, at present The Gambia's water security issues with regards to quantity are not physical; they fall under the economic water scarcity category. As defined by the International Water Management Institute (IWMI), "economic scarcity occurs when there is a lack of investments in water or lack of human capacity [financial or otherwise] to keep up with growing water demand" (2006, p. 7). Inequitable distribution of resources including water, or economic water scarcity is characteristic of much of Sub-Saharan Africa, including The Gambia. Consequently, this impacts the quantity of water available for use for some of the population.

Trends in the primary data show that in some instances the consumption of 'safe' water varied with income as in some cases either the price of treated water itself or the maintenance costs associated with the pumps and taps were not appropriate to the average income (Fieldbook, 2012, Interviews 1, 2, 7, 14). Participants of interview group number one noted that, *"water costs one dalasi per container. The containers can be any size but*

no bigger than 20 litres. With the average income here it is expensive, so water usage will vary with income because of the cost. Well water is free but the quality is not good, it's very salty. Sometimes they have no choice but to use it because the tap water is so expensive" (Fieldbook, 2012). These interview locations were primarily rural. In some instances maintenance fees had not been paid in months and some water sources had even been shut off due to the inability to pay (Fieldbook, 2012, Interview 2, 7). Upon further inquiry some participants noted that it was common practice that when one family could not afford to contribute their share of the collective payment, others would pay for them. Also it was relatively common to fetch water from a neighbour (free of charge) when personal water sources had been shut off (Fieldbook, 2012, Interview 2, 7, 12). Participants from interview group number seven described the situation like this, *"if your tap has a problem or if you have any problems surrounding water you can go to your neighbour. Water is affordable but it all depends on how much you are using. Like if your neighbours are always coming to you then your bill will be high. But it's all about being kind to each other that they allow neighbours to come and fetch water from them. Your contribution is needed but some will do it for nothing anyway. That's Gambia"* (Fieldbook, 2012). Case Study 3.1 provides an account of the situation for the participants of interview group number two.

Case Study 3.1

An older man of approximately 60 years of age and the head of household for his compound was consulted regarding the particular water situation for his family and village. He confirmed that communal taps had been donated by a Village Development Project approximately eight years prior. Originally, villagers were supposed to contribute a monthly sum of ten dalasi as a "water tax" to cover maintenance costs; however, he admitted that even he had not contributed in several months due to his inability to pay. He

> stated that this was also the case for many villagers. He knew that the taps could not be sustained if a problem were to occur and no one had contributed but collection had been difficult, as many people simply did not have the money to contribute. Due to the lack of contributions when taps break repairs have taken a long time. They do not have any help from the government or from outside the village with regards to maintenance, although one villager works for the water company and often helps to fix things when he can. If something breaks and they have no money they will get their water from then next village tap or from their wells. He said, *"he knows people can get sick [from drinking bad water]. As the head of household you don't want your family to get sick because it is expensive so they would like to prevent this."* After the interview, this particular well was tested for the presence of coliform bacteria as well as levels of salinity and dissolved oxygen (DO). The well water was positive for coliform, showed high levels of salinity and low levels of DO, which is indicative of living organisms in the water—which were also visible from the surface. He stated that, *"he always plans to make sure his family has enough water but because of poverty it is not always the case. He said it was the same for most others in the village." (Fieldbook, 2012, Interview 2)*

Other, primarily urban, participants claimed that the price of water relative to its importance was affordable (Fieldbook, 2012, Interview 3, 4, 6). One participant from interview group number six stated that, *"for those who have the taps in their homes they find that its affordable and in his opinion as far as water is concerned the amount that they are paying is small compared to the importance of water. It is greater than what they pay because water is very important in life" (Fieldbook, 2012).* Rural participants who agreed that the cost of water was affordable had access to free water, which came either from hand pumps, wells or even rainwater collection, which was not necessarily treated in all cases (Fieldbook, 2012, Interview 10). The primary data determined that if you have a private tap either for your compound or in your home, water is paid for by the litre. If you retrieve water from communal village taps, water is paid for through a maintenance fee or "water tax". Water from wells and hand pumps is free, however these sources were

relatively limited for the amount of people who used them (i.e. one tap for an entire village).

Table 3.3: Improved and Unimproved Drinking Water Sources (IDWS/UDWS)

	Had Access to IDWS Village (V) Compound (C) Home (H) Tap (T) Pump (P)		**Had to Pay for IDWS by:** Consumption- per litre or per container (L) Maintenance Tax (M) Tap (T) Pump (P)		**Sometimes Used UDWS Because of:** Financial Constraints (F) Distance Constraints (D) Weather Constraints (W) Taste Preference (Tp) No Use (*)	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Interview 1	VT	—	LT	—	F	—
Interview 2	VT/CT	—	LT/MT	—	F	—
Interview 3	H	—	LT	—	—	*
Interview 4	VT/CT	—	LT/MT	—	—	*
Interview 5	N/A	N/A	N/A	N/A	N/A	N/A
Interview 6	VT/HT	—	LT/MT	—	—	*
Interview 7	VT/CT	—	LT	—	—	*
Interview 8	VP	—	—	P	D/Tp	—
Interview 9	VT	—	N/A	N/A	N/A	N/A
Interview 10	VP	—	—	P	D/W	—
Interview 11	VP	—	—	P	—	*
Interview 12	VT/HT	—	LT/MT	—	—	*
Interview 13	VP	—	N/A	N/A	N/A	N/A
Interview 14	VT/VP	—	MT	P	—	F/D

*N/A is listed in instances where the applicable data was not obtained for the particular interview.

3.3.3 Water Quality and the Natural Environment

As desertification, deforestation and water-borne diseases are key environmental issues in The Gambia (CIA, 2009), they can be linked to the degradation of water quality in the many ways. Large-scale changes in land use, both natural and human induced, can lead to degradation of water quality (Nash, 1993, p. 35). For example, increased population growth, rapid urbanization and poverty can lead to overloaded water and

sanitation infrastructure as well as increase pollution due to this urban influx. Furthermore, more people means more resource use and increased territorial expansion, which can have environmental impacts such as deforestation, the conversion of grasslands and savannahs and the loss of wetlands. Logging, for example, can directly impact water quality through increased erosion and sedimentation. This increases the amount of particles in the water (turbidity) and decreases the concentration of dissolved oxygen, which can be devastating to aquatic organisms and disturb the balance of the ecosystem and in turn render poor quality water (Nash, 1993, p. 35). Desertification can also be a determinant of water quality deterioration as it has been defined at the 1977 UN Conference on Desertification in Nairobi as "the degradation of destruction of land to desert-like conditions and can include the growth of sand dunes, deterioration of rangelands, degradation of rainfed croplands, waterlogging and salinization of irrigated lands, deforestation of woody vegetation, and declining fresh water availability or quality" (Gleick, 1993, p. 273). These environmental issues can therefore all be linked to water quality and thus health.

3.3.4 Seasonal Variations in Water Quality

Seasonal variations also affect water quality in The Gambia. During the rainy season there is a greater risk of diminished quality due to water contamination. Heavy rains can cause runoff to act as a catalyst for the contamination of drinking water sources. It can carry contaminants gathered from the ground, such as agricultural chemicals or human and animal excreta, into various bodies of water or even wells. A lack of access to improved sanitation for 32 percent of the population as well as inadequate hygiene also add to the issue of diminished water quality in The Gambia. Open defecation for example,

which is decreasing but still prevalent amongst part of the population, can contribute to water contamination and thus water-related diseases. As of 2008 open defecation was still practiced by one percent of the urban population and seven percent of the rural population—equalling four percent of the total Gambian population (Joint Monitoring Programme, 2010, p. 42).

Many interview participants verified seasonal disparities in water quality amongst well water, stating that they could notice a change in colour as well as taste. Some claimed that the water was saltier, which was thought to be due to salt-water intrusion (Fieldbook, 2012, Interview 1), while others identified a "bad" taste but not necessarily salty (Fieldbook, 2012, Interview 2, 10). Participants of interview group ten said, *"with the well, that is something they have been using for long, what they noticed the changes there in the rainy season the water is not that potable; it does not taste good. Though they have plenty of water in the well the taste is different from the dry season. The dry season, the water tastes better" (Fieldbook, 2012).* The salty or "bad" taste of water was perceived to be a determinant of quality and thus influenced their decision not to use this water for drinking. Another trend in the data was the comment that well water was also of poor quality because it did not become very foamy with the use of soap due to the salt content; this was perceived as problematic (Fieldbook, 2012, Interview 1, 6). Participants of interview group number one said, *"they can't drink the well water because it tastes bad. There is a high water table here so the water is very salty. They do use the well water for laundry and bathing but the soap doesn't get very foamy because of the salt" (Fieldbook, 2012).* Furthermore, participants from interview group number six noted: *"now people have discovered that it is better to drink potable water and in fact the well*

water is not good to drink. Even for domestic use, because the water is so contaminated, even the foam from the soap doesn't come out much compared to when you get the water from a potable source" (Fieldbook, 2012).

However, for one set of participants well water was thought to be of better quality than the pump water due to taste (Fieldbook, 2012, Interview 8). Furthermore, only one participant thought that well water quality augmented in the rainy season, although her primary source of drinking water was from the tap, not from the well (Fieldbook, 2012, Interview 12). Water from taps and pumps was noted to be consistent year round as these sources were treated. The only variation mentioned for tap water was when maintenance or cleaning was being done, which caused discolouration and change in quality of the water for the few hours that followed (Fieldbook, 2012, Interview 1, 2, 3, 4, 6, 12). Table 3.3 illustrates the perceived seasonal variations in water quality amongst improved and unimproved drinking water sources.

Table 3.4: Perceptions of Seasonal Variations in Water Quality

*Rainy Season (R) *Dry Season (D) *No Change (—) *No Consumption (NC)	Seasonal Changes in Water Quality Resulting in Water-related Diseases		Seasonal Changes in Organoleptic Water Characteristics		Seasonal Changes in Consumption as a Result of Quality Fluctuations	
	IDWS	UDWS	IDWS	UDWS	IDWS	UDWS
Interview 1	—	R	—	R/D	—	—
Interview 2	—	N/A	—	R	—	—
Interview 3	—	NC	—	NC	—	NC
Interview 4	—	R	—	NC	—	NC
Interview 5	—	R	N/A	N/A	N/A	N/A
Interview 6	—	NC	—	NC	—	NC
Interview 7	—	R	—	R/D	—	NC
Interview 8	—	R/D	R/D	R/D	—	—
Interview 9	—	N/A	N/A	N/A	N/A	N/A
Interview 10	—	R	—	D/R	—	—
Interview 11	—	N/A	N/A	N/A	—	NC
Interview 12	—	NC	—	R/D	—	NC
Interview 13	—	N/A	N/A	N/A	—	N/A
Interview 14	—	R	N/A	N/A	N/A	—

*N/A is listed in instances where the applicable data was not obtained for the particular interview.
*Changes in consumption patterns of IDWS due to cleaning have been omitted from this table.
*Improved Water Sources (IDWS) i.e. Pumps and Taps
*Unimproved Water Sources (UDWS) i.e. Wells and Rainwater

3.3.5 Seasonal Variations and Water Related Health Issues

Rowland studied the correlation between seasonal variations in water quality and water related diseases such as diarrhoea in The Gambia (and Bangladesh) and found "a close link between the time of the annual peak in diarrhea in young children and the summer rains. A second peak of diarrhea in the winter also was significant and was shown to coincide with a short period of intense transmission of rotavirus[8]" (1986,

[8] Rotavirus is "a virus that causes gastroenteritis (inflammation of the stomach and intestines). The rotavirus disease causes severe watery diarrhea, often with vomiting, fever, and abdominal pain. In babies and young children, it can lead to dehydration (loss of body fluids). Rotavirus is the leading cause of severe diarrhea in infants and young children worldwide. Globally, it causes more than a half a million deaths each year in children younger than 5 years of age" (CDC, 2011).

Abstract). At the time of Rowland's research (1986) water, in rural areas of The Gambia was accessed "almost exclusively" from relatively shallow wells approximately 15 to 20 meters in depth. The research showed faecal contamination of well water year round; however, the level of contamination was increased up to 100 fold within a day or two of the beginning of the rainy season. This influx in contamination was attributed to excreta being washed into the wells by rapid increase in rain levels. Furthermore, it was found that contaminated water as well as poor sanitation and hygiene contribute to the contamination of food, which is heightened during the summer months due to elevated bacterial growth caused by high temperatures. The magnified levels of food contamination in the summer months also coincided with peak prevalence of diarrhoea (Rowland, 1986, Abstract). Although there has been much progress towards providing access to improved water sources that protect from outside contamination (particularly from fecal matter) in The Gambia, it is clear from the data that sanitation plays a major role in water quality and thus health. Without access to improved sanitation facilities, which hygienically separate human excreta from human contact (UNEP, 2010, p. 176), in many areas of The Gambia sources of drinking water that have been deemed 'improved' may in reality become contaminated, thus compromising the 'safety' of the source.

One interview group noted in the past intense flooding caused by extreme rain during the rainy season had led to flooding which destroyed houses as well as many pit latrines, which contaminated some water sources. Furthermore, it was noted that during this time there were elevated levels of sickness in the community, especially amongst children (Fieldbook, 2012, Interview 14). That being said, several interview groups also noted that the incidences of water-related diseases had diminished since the introduction

of improved drinking water sources (Fieldbook, 2012, Interview 2, 3, 6, 7, 8, 9, 11, 14). Case Study 3.2 provides an example of an interview group that experienced this situation.

Case Study 3.2

Here, five women (four of them sisters) between the ages of 25 to 30 and one man of approximately 35 years old were asked to describe their current drinking water situation. They described severe seasonal disparities in water resources with droughts in the dry season and extreme flooding in the rainy season. They said that flooding destroyed houses and pit latrines and left much stagnant water, which resulted in an increase in mosquitos and thus vector-borne diseases such as malaria. One participant said, *"even children had boils."* They noted that they had recently been the recipients of drinking water taps, as a result of a grant given by the Taiwanese government the previous year. They said that before this year they knew that the wells were not safe but had no choice but to drink from them. Now they have treated taps, which help, however they found that the cost was prohibitive. At the end of every month five dalasi per head must be paid to the Village Development Committee, which goes towards the maintenance of the borehole. One participant stated that, *"yes, its expensive. It is not equal, a baby is not the same as an elder… if you don't pay you are not allowed to get water so you have to go to the well or walk to the school pump."* They went on to state that they are *"exposed to a lot of sickness during the rainy season." (Fieldbook, 2012, Interview 14)*

3.3.6 Water Constraints: Collection and Storage Techniques

Water collection and storage techniques are other causes for concern with regards to water contamination. Although access to improved water sources may reduce the risk of water source contamination, often these sources are far from the home, so large quantities of water are transported and stored in various containers. In this instance, travel distance to water sources can be linked to health, as the longer the water collection time, the greater likelihood that either less water will be collected or larger quantities will be stored for longer periods of time, thus increasing the chance of contamination. High

temperatures and sunlight further add to the risk of increasing pathogenic organisms in drinking water. Other than the relatively small percentage of bachelors living alone, women are primarily responsible for water collection in the household (Fieldbook, 2012) and are disproportionately affected by the health, education and economic impacts of this task. For further elaboration on the effects of water collection times see UNEP, 2010.

Some participant groups noted that distance to improved water sources, such as pumps and taps, at times led them to use unimproved water sources, such as well water or rain water, most notably during the rainy season when travel can be difficult or impossible due to weather conditions (Fieldbook, 2012, Interview 8, 10). Participants from interview group number ten said, *"for them, even if you notice those [changes in water quality], you have the well, you have no choice, you still drink it because you need to drink. Because the pumps are too far or even sometimes it might be raining hard and you need water but before you go to the pump its far, so its better you get water from the well, you know, then its quicker and easier" (Fieldbook, 2012).*

Certain groups that retrieved their drinking water from communal village taps stated that there were time restrictions on when they could access water, which at times affected their consumptions patterns (Fieldbook, 2012, Interview 1, 2, 7). Participants from interview group number one said, *"there are water constraints here. For example the tap is only open between 7:00am and 7:00pm so if you need water before or after that you cannot get it. Also water usage varies depending on income because of the cost. People line up before 7:00am to get water" (Fieldbook, 2012).* Participants from interview group number two noted an even greater time constraint where, *"taps are only open from 5:00pm to 7:00pm and are not open the rest of the day. They are solar*

powered so they cannot be open all day. The VDC [Village Development Company] runs a project that supplies the community with water and donated the taps but it is up to the community to pay for maintenance. The taps are only open for two hours to allow for electricity and for the tank to be refilled. Wells are still used for domestic work and are open for everyone to use during the day, although not all compounds have [wells], maybe half have them" (Fieldbook, 2012).

Some groups said that they knew the well water was of a lower quality but used it out of necessity (Fieldbook, 2012, Interview 2, 10, 11, 14), while others did not distinguish between the quality of the two sources (Fieldbook, 2012, Interview 8). Furthermore, some participant groups stated that wells were no longer used, and in fact many had been abandoned, as tap water was used almost exclusively (Fieldbook, 2012, Interview 3, 4, 6, 7, 9). In addition, some said that even if the taps were broken they would not drink from the wells (Fieldbook, 2012, Interview 4). Case Study 3.3 illustrates one such situation where participants relied solely on improved drinking water sources.

Case Study 3.3

In this case three sisters between the ages of 25 and 35 were interviewed. They told us they were all single and lived there with their children and elderly mother. One woman was a nursery school teacher. We were invited into their home to conduct the interview and upon appearances they seemed to be quite well off, with access to a private tap in their home and refrigeration for water storage. They explained that water was always available from the tap except during cleaning or if there was a problem with the main tank, although this was said to be a rare occurrence. In their own words they said that, *"tap water is safe to drink. Sometimes the colour of the water will change if the pipe was broken. Sediment needs to pass by before they can drink it. Also if they were cleaning the tank. Either way if there was for some reason a water shortage, when the water comes back on it is not good to drink at first, it is not safe so they buy water. You need to run the water for a while before it is good again but this does not happen often."*

> They confirmed that there were wells in the community, however, they were used for domestic work only and that personally even if the taps were to break they would not drink from the wells because they could not tell if it was safe; they would buy water instead. They exclaimed that, *"people do not get sick here because they drink clean water."* However, they did note that there was a high incidence of malaria in their region during the rainy season, which they said was amplified by the state of the stagnant gutter water, which was filled with mosquito larvae. However, they now have mosquito nets, which help. When asked what was the importance of water in their lives they stated, *"water is very important to all aspects of life. Water is life." (Fieldbook, 2012, Interview 4)*

In The Gambia water is usually transported from a water source (taps, pumps, wells, the river etc.) in open buckets and stored inside the home in covered clay jars or plastic Jerry cans, which hold approximately 20 litres (Fieldbook, 2012, Interview 1, 2, 7, 10, 11, 12). The amount of water stored is dependent upon the size of the family living in the compound[9] (K. Suso, personal communication, November 2012). Rural-urban disparities in water storage techniques, most likely directly related to disparities in wealth, were also apparent. The participant groups located in urban areas often had better access to improved water sources with many having taps directly in their homes (Fieldbook, 2012, Interview 3, 6) or in their compounds (Fieldbook, 2012, Interview 2, 4, 7) and at least access to communal village taps. Furthermore, many of these groups claimed water was stored in 1.5 litre plastic water bottles kept in the refrigerator (Fieldbook, 2012, Interview 3, 4, 6, 7). Some groups only had access to communal village taps (Fieldbook, 2012, Interview 1, 9, 12) and others only had access to communal village pumps (Fieldbook, 2012, Interview 8, 10, 11, 13, 14). Table 3.4 illustrates the different storage methods used by the different interview groups.

[9] A compound is a communal living area in The Gambia, generally shared by extended members of a single family.

Table 3.5: Water Storage		
	Plastic Jerry Cans / Clay 'Jars'	**Refrigerated in Plastic Water Bottles**
Interview 1	Yes	
Interview 2	Yes	
Interview 3		Yes
Interview 4		Yes
Interview 5	N/A	N/A
Interview 6		Yes
Interview 7	Yes	Yes
Interview 8	N/A	N/A
Interview 9	N/A	N/A
Interview 10	Yes	
Interview 11	Yes	
Interview 12	Yes	Yes
Interview 13	N/A	N/A
Interview 14	N/A	N/A

*N/A is listed in instances where the applicable data was not obtained for the particular interview.

Sanitation practices for water storage containers were relatively consistent throughout the participant groups. When asked about the methods and frequency of the cleaning of water storage containers, all groups stated that once empty, containers were cleaned before being refilled with fresh water. Some groups specified that for plastic containers soap was used for cleaning, while for clay jars a brush made out of small twigs was used to scrape away any debris before rinsing (Fieldbook, 2012, Interview 2, 10). Many groups also stated that they knew the main water tanks were cleaned periodically as well (Fieldbook, 2012, Interview 2, 4, 7, 12).

Furthermore, sharing the same cup for drinking in The Gambia can be linked to local norms and practices, as it is not unusual for entire families or compounds to use the same cup when retrieving water to consume (Healey, 2011, p. 21). It is also customary

that when a guest enters into one's home, they are offered water to drink (K. Suso, personal communication, November 2012). The sharing of cups for drinking water brings with it the risk of exchanging germs, or transmitting viruses, which in effect can have health implications as well as possibly contaminate stored water if the cup comes in contact with the water supply. According to WHO/AFRO, cultural practices can be important determinants of health (p.8), this being an example of one such situation with regards to water.

Figure 3.2 Jerry Can

Source: Charity: Water, 2011

Figure 3.3 Water Storage Containers

Source: Personal Photo, 2012

3.3.7 Prevalence of Water-related Diseases

Sub-Saharan Africa has recorded a high or even endemic prevalence of water-borne pathogens across the region (ΑΓΓΕΛΙΚΗ, 2011, p.4). As previously noted these diseases can be broken down into several categories including fecal-oral, water-borne or water-washed diseases (e.g. diarrhoea and dysenteries, rotavirus, salmonellosis, cholera,

E. coli, giardiasis, typhoid, hepatitis A); water-washed, skin and eye infections (e.g. trachoma and scabies); water-based, penetrating skin, ingested (e.g. dracunculus medinensis (guinea worm), schistosomiasis); water-related insect vector, biting near water or breeding in water (e.g. trypanosomiasis (sleeping sickness), onchocerciasis (river blindness), malaria, yellow fever, dengue) (Nash, 1993, p. 26; AMREF, 2013; ΑΓΓΕΛΙΚΗ, 2011, p. 3). Many water-related diseases are caused by the ingestion of water that is contaminated with pathogens, often contained in human or animal excreta; many, but not all, of which cause diarrhoeal illnesses (ΑΓΓΕΛΙΚΗ, 2011, p. 2-3; CDC, 2013). According to the Centers for Disease Control and Prevention (CDC) there are several water-related diseases common to The Gambia including but not limited to: hepatitis A, typhoid, diarrhoea, dysentery, cholera, schistosomiasis, malaria, yellow fever and trypanosomiasis (2013). An interview with a local public health officer confirmed that the most prevalent types of water-related diseases were waterborne, water washed and water related (Fieldbook, 2012, Interview 5).

3.3.8 Water-related Education and Water-related Diseases

For all but one group of participants (Fieldbook, 2012, Interview 8) well water was perceived to be of worse quality than tap or pump water. Many participants noted that drinking water from wells often lead to sickness but that it was still used it from time to time out of necessity, due to either financial or physical constraints such as long distances or severe weather conditions (Fieldbook, 2012, Interview 1, 2, 10, 11, 14). All of the participant groups noted the correlation between drinking contaminated water and sickness and noted the following common signs, symptoms and water-related diseases: stomach pain, vomiting, diarrhoea, dysentery, malaria, cholera. Seasonal variation in

sickness was also mentioned, with peak sickness levels occuring at the beginning and end of the rainy season (Fieldbook, 2012, Interview 1, 4, 7, 10, 12, 14). It was common for participants to know that water quality and sickness were related but they said they could not distinguish between various diseases without visiting a health facility, which was also stated to be the primary source of water-related health education (Fieldbook, 2012, Interview 2, 3, 5, 6, 7, 10, 11). Other sources of water-related health education came from elders and family education (Fieldbook, 2012, Interview 1, 2, 3, 4, 5, 6, 7, 10, 11), school (for the younger generation) (Fieldbook, 2012, Interview 1, 4, 5, 6, 11), as well as media sources such as the radio or television (Fieldbook, 2012, Interview 5, 7). Many participants stated that there had been a much lower sickness rate since the installation of improved water sources such as taps and pumps (Filedbook, 2012, Interview 2, 3, 4, 5, 6, 7, 10, 12, 14).

Table 3.6: Water-related Education

	Education from family	Education from health facility	Education from school	Education from media sources
Interview 1	Yes		Yes	
Interview 2	Yes	Yes		
Interview 3	Yes	Yes		
Interview 4	Yes		Yes	
Interview 5	Yes	Yes	Yes	Yes
Interview 6	Yes	Yes	Yes	
Interview 7	Yes	Yes		Yes
Interview 8	N/A	N/A	N/A	N/A
Interview 9	N/A	N/A	N/A	N/A
Interview 10	Yes	Yes		
Interview 11	Yes	Yes	Yes	
Interview 12	N/A	N/A	N/A	N/A
Interview 13	N/A	N/A	N/A	N/A
Interview 14	N/A	N/A	N/A	N/A

*N/A is listed in instances where the applicable data was not obtained for the particular interview.

An interview with a public health officer also revealed that the prevalence of water-related diseases varied seasonally and the following additional water-related diseases were noted as common to The Gambia: schistosomiasis (decreasing prevalence but common to areas where people drink river water), rotavirus (causing severe diarrhoea) and cholera (decreasing in prevalence but common to areas with severe flooding such as Ebo Town) (Fieldbook, 2012, Interview 5). Furthermore, an interview with a local doctor affirmed that sanitation is also a key component of the water (and food) contamination, which leads to many water-related diseases (Fieldbook, 2012, Interview 9). He stated that he encountered many people with water-related health problems such as diarrhoea and dysentery, especially children. He went on to say, *"you know most of the people here they get water from the taps and I think it is quarterly or is it every six months, or every year, the people working at the … they do chlorinate at the main stream in Bansang. What they do is that they put that chemical there and they chlorinate the water because most of the people here before taps many used to get water from the wells but right now about 98 percent are from the taps… Diarrhoea is a problem but not merely associated with drinking water, maybe it is food poisoning and lack of hand washing also" (Fieldbook, 2012, Interview 9).*

3.3.9 Determinants of Perceived Water Quality and Related Health Risks

With regards to the local perceptions of water quality and the associated health risks in The Gambia, trends in the primary data show that organoleptic properties play a major role in determining water quality and thus influencing behaviour and consumption patterns. When asked how poor water quality could be identified most participants stated that it could be determined through sight (colour change, particles, moving organisms),

smell and taste (Fieldbook, 2012, Interview 1, 2, 3, 4, 10). In Mandinka, for example, there is a specific word given to the pathogenic organisms, which can be seen moving in water once it has become stagnant. *Jiindingo*, meaning "water babies", are a key determinant of water quality in The Gambia. If *Jiidingo* is seen in water sources, they know that source is not safe to drink and that it can cause water-related sicknesses (Fieldbook, 2012, 1, 10). Some of the participant groups noted that stagnant water was not safe to drink (Fieldbook, 2012, Interview 1, 2). Large quantities of water that are stored in peoples homes are kept in clean covered containers in shaded areas out of direct sunlight as to reduce the risk of *Jiindingo*. Although this storage method will help to slow the formation process of pathogenic organisms, it will not prevent it (Healey, 2011, p. 21). Some participants also acknowledged that there might be things in the water that could not be seen by the naked eye that could cause water-related diseases (Fieldbook, 2012, Interview 1, 10). Frequency of use was also stated as being a determinant of well water quality (Fieldbook, 2012, Interview 2). Some participants said that sometimes water was boiled or filtered with a cloth before use if the quality of the water source was unknown (Fieldbook, 2012, Interview 1, 10). However, some also mentioned that the quantity of water needed often prevented them from properly purifying water (Fieldbook, 2012, Interview 1). There was a consensus among all groups that water, which came from improved water sources such as taps and pumps, was safe to drink although the perception of well water quality, as well as the associated health risks, varied slightly from group to group. Case Study 3.4 gives a depiction of changes in water-related education throughout the years.

Case Study 3.4

Interview number six provided an interesting opportunity to speak with a village *Alkalo,* or village leader, and his wife, who were approximately 70 to 80 years of age. The following is the description of how water-related education has changed since their youth form their point of view. *"In those days, the awareness before, like when they were young, the awareness of certain illnesses surrounding water might not be known, it wasn't even known to them because maybe people were not that educated and so they were using well water. But here and there like a child you would draw water and somebody would tell you* "oh don't drink this water its not good" *that is from the family level. But it wasn't like a general thing. For example he said to us every area has a well but if they were having those knowledge they could have discussed with everybody who had wells and who were using those well to know what are the effects of using contaminated water. This is what is going to happen but that was not put in place. It was not formal education like today. Now people have discovered that it is better to drink potable water and in fact the well water is not good to drink. Even for domestic use, because the water is so contaminated, even the foam from the soap doesn't come out much compared to when you get the water from a potable source. He said civilization is coming and things are changing. People are more aware now than before. He's taking us back to his young age where they could even go like in a stream in the rainy season and you can even get water to drink as a child. But now if you ask his son or his grandson if you can drink from those streams he would get sick before even taking one sip of water because his mind is there because the water is not potable." (Fieldbook, 2012, Interview 6)*

Socio-cultural aspects such as family education and learning from elders were listed as important sources of water-related health education, which has an influential bearing on the local perceptions of water quality and the associated health risks. For example as the water-related education is passed down from generation to generation, unless it evolves and expands to incorporate the new and growing water quality and health issues, the information will be out-dated and possibly detrimental to health. Some groups who still used well water from time to time for consumption also stated that it was out of convenience, as the wells were closer (Fieldbook, 2012, Interview 8, 10). Although

distance is an issue, the perceived risk factor associated with consumption also comes into play. Those who stated that well water was still used out of convenience perhaps had a low perception of risk. While those who made the effort to walk the longer distances to fetch water from improved water sources, had higher perceptions of health risks associated with contaminated drinking water. Thus, all of the aforementioned factors such as organoleptic properties (sight, smell and taste), socio-cultural aspects as well as variations in education sources among other factors, influence the local perceptions of water quality and the related health risks in The Gambia. This demonstrates the relationship between perception of water quality and water usage, as the perception of water-related health risks influence behaviour, which thus affect consumption patterns.

CHAPTER FOUR

Trends and Generalizations: Analysis of the Causes, Effects and Solutions

4.0 Introduction

This chapter provides an overview of the observed generalizations along with individual analysis of each, where the causes, effects and possible solutions will be presented. Furthermore, the contributions and approaches of certain scholars presented in Chapter Two will be evaluated in light of these trends and suitable perspectives for relevant development will be appraised.

4.1 MDG Target 7c: Possible Disparities in Reported Progress

Returning to the thesis statement of the current research—which proposed that a more thorough knowledge of local perceptions regarding water quality and the associated health risks can be an important tool for water education initiatives for the improvement of local water resource management and consumption—it has been established that this area of focus relates directly to the MDG target 7c. Recalling that this goal seeks to "[e]nsure environmental sustainability" (UN, 2011, p.48) and more specifically this target aims to "[h]alve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation" (UN, 2011, p. 51). Although claims have been

made that the drinking water portion of the target has been met, due to the interconnected nature of water and sanitation, and the fact that the sanitation target is far from being met in many areas, questions of sustainable progress come to the forefront. With regards to MDG 7c, many disparities exist, both in the method of calculation (improved versus unimproved drinking water sources) as well as in the means of progress monitoring, which assesses the quality of sources after implementation. These generalizations further emphasized the need for a more adequate and integrated water quality and sanitation monitoring system. There is a need for more efficient and consistent water quality monitoring techniques in order to accurately assess progress. At present, the means of monitoring the quality of improved water sources after installation are not sufficient, and thus leave room for discrepancies and misrepresentations in the data (UN Water, 2011).

4.1.1 Causes, Effects and Possible Solutions

The discrepancies in the assessment of access to safe water in MDG 7c are rooted in the way in which 'safe water' is quantified—as access to 'improved drinking water sources'. This description essentially equates safe water with improved drinking water sources without accounting for possible technical problems; issues of distance or time to water sources; or contamination after implementation. Additional discrepancies can be found in the measurement of progress on a global scale as this method leaves room for regional disparities on the international as well as national level. Finally, the measurements of progress between countries can also be distorted by the variation in population growth rates from region to region. The effects of these discrepancies could lead to a distortion of progress made (or not made) and could possibly deter aid away from an area in need, if an improper assessment of the situation is undertaken.

As previously outlined in both the second and third chapters of this thesis, the perception of water quality was a key determinant of consumption. Many factors contribute to shaping one's perception; therefore, by gaining an understanding of the local perceptions of water quality as well as its determinants, the vulnerability to water insecurity could be lessened through the proper assessment of relevant management techniques. An analysis of local risk perceptions of water quality and water-related health issues could be undertaken in areas where improved drinking water sources have already been implemented, in order to determine whether the perception of risk is accurate to the reality of the situation. This of course would be further aided by water quality testing and continued monitoring; however, it could serve as a starting point towards an efficient water quality monitoring framework. Furthermore, it could be determined whether the health issues are due to a lack of knowledge and awareness, a lack of resources, or some combination of the two. This information would thus allow for proper and efficient management techniques such as educational programs and awareness campaigns or resource facilitation and implementation initiatives.

4.2 Water Scarcity: Rural-Urban Disparities in Access to Improved Water Sources

Water scarcity in The Gambia was found to be primarily economic in nature as often, insufficient access to improved drinking water sources was due to the lack of financial capital. This occurred both at the individual level as well as at the community or country level, as in certain, primarily rural, areas improved water sources were scarce in relation to the number of people dependent on that particular source. Rural-urban disparities were also noted regarding access to improved water sources. It was determined from the communities interviewed that all urban communities had access to at least

communal taps or piped water sources (most of which were located at the end of each street) and in many cases, they had access to private sources as well. In the rural communities, improved water sources were mostly in the form of water pumps shared by the village. There were a few rural communities with access to taps; however, it was not as common as in more urban settings.

With regards to unimproved water sources, many of those located in urban communities stated that these sources were rarely used with the exception of domestic work such as laundry and that they would not use well water or rainwater, for example, for drinking. This distinction, however, was not so clearly defined for those located in rural communities. Here some participants stated that unimproved sources of water were periodically used out of necessity or convenience due to physical constraints such as distance, or even taste preference. It was noted that water, which came from improved sources, was consistently of good quality year-round. It could be gathered that economic means as well as geographical location are influential in determining access to safe, or improved drinking water sources and thus water security in The Gambia.

4.2.1 Causes, Effects and Possible Solutions

With regards to water scarcity trends, both the primary and secondary sources of data show that the lack of access to improved drinking water sources has a correlation with financial capital, or the ability to pay for the improved sources, as well as a lack of resources or infrastructure. Thus, it can be confirmed that many of the issues of access can be attributed to economic water scarcity, rather than physical availability of water. However, to adequately assess the impact of this correlation on water consumption patterns, further research regarding income, water resource prices and maintenance costs

would be necessary. An assessment of the potential financial wages that are forgone as a result of the amount of time necessary to collect water as well as the impact of the "lost" income on the community or individual households would also have to be undertaken.

Although there are many aspects of economic water scarcity, income distribution and disparities in wealth relative to the cost of ensuring access to safe and improved water sources would have to be addressed in order to augment the number of people with sustained access to safe drinking water. A reassessment of water resource prices and management costs to accurately represent the economic reality of individual regions or communities could be beneficial.

4.3 Environmental and Human Induced Water Quality Degradation

Threatened by both natural and human induced degradation, poor water quality and contamination were seen as prominent issues with regards to water security in The Gambia. Poor water resource management practices, such as: the construction of wells in areas that are vulnerable to saltwater intrusion, placing sanitation facilities too close to drinking water sources or the destruction of buffer zones that are important for the prevention of erosion and sedimentation for example, were found to have negative impacts on the quality of drinking water. These impacts were further enhanced by a lack of available resources as well as a lack of knowledge or awareness surrounding proper management and sanitation practices. Poor quality, or contaminated drinking water was noted as a key determinant of water-related diseases. Therefore, it was concluded that proper water quality management was an essential component of ensuring access to safe drinking water and thus reducing vulnerability to water-related health issues.

4.3.1 Causes, Effects and Possible Solutions

In The Gambia, it was noted that the most prevalent environmental issues affecting water quality were: saltwater intrusion, erosion, deforestation and desertification. Issues of human activity that were found to be detrimental to water quality were caused, or further enhanced by population growth, rapid urbanization, agricultural runoff as well as other types of pollution. Furthermore improper, or unimproved sanitation facilities greatly affected water quality, as excreta was at times found to enter drinking water sources and cause severe health issues. Education, regarding proper sanitation and hygiene practices as well as human induced environmental degradation and pollution, could be a beneficial management tool to preserve existing water quality.

4.4 Consistency in Variation: Seasonal Changes in Water Quality and Health

The data presented consistencies that could be found in the seasonal variations of water quality and water-related diseases. Notable changes in the organoleptic characteristics of water were noticed amongst unimproved water sources such as wells. For many interview groups, water quality of unimproved water sources decreased in the rainy season, as was the case for increases in water-related diseases. In the dry season, although quantity often declined, water was thought to be of higher quality. It was agreed that water, which came from improved sources was of good quality and was consistently safe for consumption throughout the year. Thus, it could be determined that water quality as well as water-related diseases varied depending on the season, with more notable negative effects occurring in the rainy season.

4.4.1 Causes, Effects and Possible Solutions

The increased incidence of water-related diseases at the beginning and end of the rainy season was thought to be caused by the increase in vector or insect-borne diseases (i.e. malaria) as well as water contamination due the flushing of fecal matter into drinking water sources as a result of increased rain levels and improper, or unimproved sanitation facilities and sources of drinking water. The presence of this trend was notable in both the primary and secondary sources of data, which demonstrated an alignment, to some extent, amongst the perceived correlation between seasonal variations and water-related health risks, and the existing data. By determining the local perceptions of water-related health risks, water resource management could potentially be ameliorated by incorporating this information into seasonally adapted techniques as to reduce vulnerability to water-related health risks.

4.5 Water Collection and Storage Methods: The Role of Culture

Two distinct methods of water collection and storage were evident throughout the data collection. For those who had private access to improved drinking water sources (either within the home or the compound) they stored their drinking water in plastic water bottles inside their refrigerators. This trend seemed to be consistent with access to financial capital, although this generalization is based solely upon personal observation—no assessment of income was done. Interview groups who had access to communal improved drinking water sources (either tap or pump fed), which were located in primarily rural areas, stored their water either in plastic Jerry cans or in clay ‘jars’, which were covered (as seen in Figure 3.2 and 3.3). Covering stored water within the home was

seen as an important preventative measure taken to avoid contamination; however, when it came to covering, or sealing unimproved water sources such as wells, in many instances this was not done due to financial constraints. All groups reported they collected water in either plastic buckets or Jerry Cans and cleaned their storage containers consistently after use and before refilling—this was held to be an important sanitation practice and was a consistent trend throughout the primary data. However, when it came to consumption it was noted in the secondary sources of data that it was common practice to share a single cup for drinking, which can be seen as a cultural norm that could possibly contribute to the spread of germs and diseases without proper sanitation after each use. Thus, these generalizations bring the issue of hygiene and sanitation to the forefront. Figures 4.1 and 4.2 provide visual examples of improved and unimproved drinking water sources.

Figure 4.1 Unimproved Water Source (Uncovered Well)

Source: Personal Photo, 2012

Figure 4.2 Improved Water Source (Water Pump)

Source: Personal Photo, 2012

4.5.1 Causes, Effects and Possible Solutions

Due to cultural norms where the sharing of drinking water containers is a habitual and intimate act, which represents unity amongst those involved, the spread of germs and

diseases is amplified. This practice also opens up the possibility for the contamination of drinking water, which may have previously been of a safe quality. The continuation of this practice could be attributed to a lack of knowledge or education concerning the spread of germs and diseases. These issues could be ameliorated through public education, as well as education in the formal school system, surrounding water-related health issues as well as proper hygiene and sanitation practices. Because of the integrated nature of water quality, hygiene and sanitation, it seems imperative that any education initiatives undertaken include all of these aspects in order to ensure success.

4.6 Perceptions of Water Quality and Water-related Diseases

Based on the primary data collected, the perception of water quality in The Gambia is of a mixed nature. There was wide consensus that improved water sources such as taps and pumps were of an excellent quality (with the exception of times when the tanks were being cleaned). However, with regards to unimproved sources, such as wells and rainwater, the results were not so clear-cut. Water from unimproved sources was seen as acceptable for bathing and domestic work such as laundry, however, there was a division amongst participants about whether or not well water was suitable for drinking. Some participants recommended filtering or boiling water from unimproved sources but also admitted that this was not plausible for large quantities of water due to time and logistic constraints. However, it must be taken into consideration that it cannot be assumed that all unimproved drinking water sources are of unsafe quality; just as not all improved sources can be assumed to be of a safe quality without proper testing. The generalization that could be supposed, however, was that there was a clear majority

perception that water from improved drinking water sources was of a safe quality, while unimproved water sources were perceived to present more of a risk with regards to water-related health issues.

4.6.1 Causes, Effects and Possible Solutions

The uncertainty regarding the quality of unimproved drinking water sources could be seen as a by-product of insufficient means of water quality testing and monitoring, due to lack of resources—financial or otherwise. Therefore, a need for an efficient means of water quality monitoring for both improved as well as unimproved drinking water sources in The Gambia could be surmised. An improved monitoring framework, which builds upon the existing resources and incorporates local knowledge, would be advisable to ensure maximization of existing human, social and financial capital.

As logistics, as well as the costs associated with water quality testing, present obstacles to efficient monitoring, community-based water quality monitoring may be an important addition to government-run programs. This method solicits the local area expertise of civil society groups such as NGOs, as well as concerned citizens, to actively take part in the monitoring of their own resources. Certain NGOs such as the Community Based Environmental Monitoring Network (based out of Halifax, Nova Scotia) have already been working in The Gambia in this endeavour alongside the Governmental Department of Water Resources, where equipment, training sessions as well as training materials have been provided to enhance the existing expertise. Further expansion and implementation of this type of collaboration could be beneficial.

4.7 Determinants of Perceived Water Quality and the Related Health Risks

Organoleptic characteristics, formal and informal education as well as culture were notable determinants of perceptions pertaining to water quality and the associated health risks. As previously mentioned, changes in the quality of drinking water from unimproved sources as well as levels of water-related diseases were perceived to vary depending on the season. The change in water quality was described through changing organoleptic characteristics such as taste, smell, colour, debris as well as moving organisms known as *Jiidingo.*

Different types of education were also important determinants of perception in this regard. Among all groups it was noted that the primary form of water-related education was obtained from elders at the family level. In addition a few groups also stated that the younger generation was beginning to have access to water-related education through the formal education system. Many also reported that hospitals and health facilities were other major source of water-related education with regards to water-related diseases, which was sought after sickness had already occurred. Due to the remedial nature of this form of action and information, the need for preventative forms of education was apparent.

Interview number five was held with a public health officer who had worked for the government implementing various public health initiatives. With regards to water-related health education, he stated that the primary means of educating the public was done through Reproductive and Child Health (RCH) pre-clinic talks, which used free clinics held in health facilities across The Gambia, as forums for discussion and education

around water-related health. School education surrounding personal hygiene was also noted as including a component on the importance of clean water. Lastly, community sensitization was another form of public education regarding water, where existing community structures were used to implement education. The participant from interview number five said, *"we use the community centres, we use the existing community structures in place, those are the* alkalos*, the influential leaders, the village health workers and the TBAs [traditional birth attendants]; they are used as ambassadors. We give them messages for them to go back to their communities and disseminate the information. We also have what we call village health support groups. Normally we call them, they are part of this team and we talk to them about water" (Fieldbook, 2012).*

4.7.1 Causes, Effects and Possible Solutions

These forums of education were extremely valuable; however, as they were not mentioned by a single interview group the need for expansion in this area is clear. The lack of, or insufficient knowledge surrounding water quality and water-related diseases in The Gambia poses a threat to human health. An increased awareness in this area could help to mitigate vulnerability to water-related health issues. Furthermore, there was little to no mention of media sources such as billboards, radio, newspapers, television, flyers and brochures being used to portray educational messages regarding water and health other than by the public health officer and one other interview group. Thus, this could be a potential means of public education to be expanded upon. The diversification of the means of public education through the use of media outlets as well as through the formal school system could prove to be a beneficial long-term goal. The implementation of a combined school-based and community oriented education system has proven to be

successful in various communities across The Gambia. The Nova Scotia-Gambia Association (NSGA), a local NGO, has been using a successful peer health education model to implement health education programs in over 158 schools across the country. The organization uses a sort of pyramid approach where staff members are educated on various health topics who then educate teachers who inform chosen 'peer health educators' (students) who then share the information with their friends and families through a variety of drama inspired skits and presentations in the community. This model has been successful in reaching a considerable number of people and could serve as an excellent forum for water-related health education in The Gambia.

4.8 Re-evaluation of the Literature in Light of the Present Data

Given the data presented in this thesis, which has lead to the recognition of various development issues regarding water quality and human health in The Gambia, differing approaches could be taken in attempt to mitigate these issues. The aforementioned development approaches can be divided into two categories—top-down approaches or bottom-up approaches—although a combination the two may also be possible and quite beneficial.

4.8.1 Top-down Approaches to Water Security

Many experts believe that the path to successful development can be created through policy reform and implementation. The ideology behind this approach is that by solidifying the development discourse, framework and legal authority at the national or even international level, it will ensure the responsibility of governments to act and work towards given development areas. Concerning water security, there were two approaches

that were previously discussed in chapter two: the rights-based approach (RBA) and the neo-liberal, market-led approach.

The RBA is based on the premise that by ensuring the right to water in human rights discourse, it will give individuals the authority to demand action on the part of individual governments towards ensuring access to safe water for their citizens. This is the approach taken by the United Nations and its various sub sections as well as by Peter Gleick (2007), Richard Jolly (1998) and Emilie Filmer-Wilson (2005). The inclusion of MDG target 7c as a key target for global development is the embodiment of this approach within the United Nations framework for development. However, this generalized approach does not address issues unique to the individual realities of different countries or regions within countries, as it is applied on the basis of universalism. In addition, arguments have been made that human rights are a form of Western cultural imperialism and that state sovereignty and respect for culture should take precedence in all regards.

This approach does not differentiate between levels of access. Using the given data for example, this approach would not account for, or distinguish between, those with access to private improved drinking water sources versus those with access to shared sources. Furthermore, it ignores the aspect of water resource preservation with regards to environmental and human induced water quality degradation, sanitation and hygiene practices, water contamination, cultural norms and education surrounding water-related diseases as well as risk perceptions of water-related diseases. That being said, human rights, as enshrined in the UN Universal Declaration of Human Rights, has made commendable progress in development, equality and dignity since its adoption by the UN General Assembly in 1948. The declaration holds considerable weight amongst the

international community, which has led to much action on the part on individual governments as well as civil society groups and international NGOs.

The neo-liberal, market-led approach to water security entails the commodification or the monetary valuation of water. The basis of this approach is that by assigning a monetary value to water as well as putting a price on pollution through a system of fines and taxes, the market will inevitably aid in the efficient allocation of water resources and the protection of water quality and thus the environment. Based on market principles, this approach calls for minimum state intervention in the market and recommends the privatization of water resources in order to achieve maximum 'efficiency'. From this point of view prices would be lowered as a result of competition, thus alleviating economic water scarcity. However, the argument remains that the privatization of public goods and services such as water, can lead to the corruption and exploitation of the resource by those in power, which essentially would prohibit access to the majority rather than improve it. Experts such as Veronica Strang (2004) have stressed that the valuation of water for personal gain, or the privatization of water resources, is a violation of human and cultural rights. It could be also argued that this approach is rooted in Western ideology and does not incorporate local knowledge or realities of individual communities into the management of local water resources, as decisions and action is taken at the government level and carried out downward.

The notion of fining or taxing environmental polluters seems to be a step in the right direction in the sense that the persecution of perpetrators in order to deter behaviour may be beneficial; however, difficulty remains in how to evaluate all costs of the violation. All aspects of life surrounding water and the environment (the non-market

value of water) need to be considered, such as: the social, environmental, cultural, political and economic costs of pollution, which are arguably immeasurable in monetary terms (Strang, 2004). It is perceived that by assigning a monetary sum to the cost of pollution it is essentially integrating pollution into the 'costs of doing business' and does not account for the unknown impacts for future generations.

State led or controlled public water resources however, do have certain benefits as the taxes placed on water consumption can be used to further progress access to improved water resources for a greater number of people. In The Gambia it was noted that the methods of paying for water and maintenance of improved drinking water sources, as well as the sum of money paid, varied between communities. Although variation in methods and prices could be beneficial, as adaptions could be made to accommodate the individual realities of different communities, for some of the groups interviewed the costs were not consistent with their means of payment. Therefore, in order to amend this approach a re-evaluation of costs would be beneficial. Enhanced access, however, also provides the opportunity for increased consumption, which may not be sustainable with regards to the amount of water stress placed on resources. Along with improved access, there is a need for increased education on water conservation, quality preservation and further research into ways of reusing and reducing global water consumption to allow for sustainable water security.

4.8.2 Bottom-up Approaches to Water Security

The bottom-up approaches to water security previously discussed in Chapter Two were taken by Emmanuel Akpabio (2006) and Veronica Strang (2004). This style of approach looks to incorporate local knowledge and participation into the development

initiatives set forth for a given area. According to Akpabio and Strang, in order to ensure sustainable water resource management, cultural relevancy and the incorporation of local and traditional knowledge into management techniques is imperative. This approach to ensuring water security focused on the local, where the needs of individual communities and the knowledge contained within their unique cultural heritage, was taken into account when developing water resource management techniques. From this point of view, the consideration of the local perceptions of water was integral to the successfully implemented water resource management strategies.

This approach could be extremely beneficial for individual communities and could work towards finding individual solutions to issues of economic water scarcity as well as water-related education and health. However, due to its individual nature, it is very difficult for it to be applied on a grand scale such as the country level. Although The Gambia is a small country, there is a wide variety of ethnic groups (CIA, 2013) that co-exist within it borders, all of which have different cultural backgrounds and practices. Management plans that incorporate all of their collective traditional knowledge would be ideal and could be facilitated through various NGO involvement; however, due to the wealth of diversity within the country it would be extremely costly to develop a unique management plan for individual communities. It would also be logistically difficult to produce under a collective national framework.

4.8.3 Hybrid Approaches to Water Security Issues

Upon analysis of the pros and cons of both the top-down and bottom-up approaches to water security, it seems as though a hybrid approach, which incorporates their positive aspects, in an attempt to resolve areas of critique within the respective

approaches, would be constructive. Over the past few decades there has been a notable increase in the prevalence of NGOs, which possess considerable influence over development projects and facilitate the provision of essential public goods and services, in developing countries (Petras, 1999). Although these organizations have been successful in increasing access to essential public resources, it is also important to work with governments in resource provision such as access to safe, or improved drinking water sources. If development projects are solely undertaken by NGOs, it runs the risk of relieving governments of their responsibility to provide access to safe water to their citizens. Furthermore, due to the volatile nature of NGO funding, this method of provision may not be sustainable in the long-term and also risks the possibility of promoting an agenda based on donor requirements rather than recipient needs (Petras, 1999).

The egalitarian principles of universalism found in the RBA are beneficial to providing equal access to all and although this concept may have been rooted in Western culture, the idea can be transferred across cultures. The Universalist idea of equal rights, in this case access to safe drinking water, is not committed to the cultural origin of the idea itself and can be used to benefit individual purposes. Therefore, although The Gambia is home to a diverse population, the concept of equal access to improved drinking water sources could be applied across the country. Taking the neo-liberal, market-led approach into consideration, perhaps rather than the valuation or commodification of water itself, resources could be paid for through a system of management or maintenance costs, which would not claim to put a price on the value of water itself, more so on the cost of provision. This could build upon a system which is already in existence in certain

areas, as some interview participants who retrieved their drinking water from improved sources often mentioned that water itself was free, however, there was a fee to be paid towards maintenance and repair costs. An assessment of maintenance costs and local ability to pay could be done in order to provide access to safe water while accommodating the average income level of the community.

One such framework that is already in existence was exemplified in interview number five. Here water-related health education was provided and implemented using existing community structures such as the *alkalos* and other influential village leaders. This framework revealed a willingness of community members to participate in their own development projects and could serve as an important means of incorporating the local into the national. This framework could be applied country-wide while incorporating local expertise into a national water management system, which could incorporate community based water quality monitoring and education programs with the goal of mitigating vulnerability to water-related diseases. Furthermore, this framework could facilitate perception analysis of water quality and the associated health risks, which could in turn aid in accurately assessing the necessary management techniques to be implemented (i.e. education and awareness or resource provision or improvement).

CHAPTER 5

Final Thoughts and Lessons Learned

5.0 Summary

Access to safe drinking water is essential to all human life. The importance of this concept has gained international acceptance and has been enshrined in the United Nations Universal Declaration of Human Rights. However, for many people in the developing world access to this resource has been compromised on account of the quality of available resources as well as the lack of access to safe drinking water sources. Recalling the definition provided in the introductory section of this thesis, water scarcity was described as, "the availability of, and access to, water sufficient in quantity and quality to meet the health, livelihoods, ecosystem and production needs of populations, coupled with an acceptable level of water-related risk" (European Report on Development, 2012, p. 5). Both the unsafe quality of unimproved drinking water sources as well as various economic obstacles, which restrict access to improved drinking water sources, jeopardize water security in The Gambia. This type of water scarcity, categorized as economic scarcity, was made evident as trends in the primary data revealed that in many cases the type of drinking water sources as well as the ability to consume, were related to access to financial capital as well as location. Improved drinking water sources were in higher

abundance in urban areas than in rural settings, which had an effect on access due to distance times to these sources.

Various water-related health issues arise as a result of unsafe drinking water in The Gambia; many of which, such as diarrhoea, are preventable. Thus, it was determined that there was a need for preventative health measures to be taken regarding water quality and the consumption of unsafe drinking water. As was concluded from the analysis of the methods of measurement, and assessment of progress, with regards to MDG Target 7c, the urgent need for a more efficient means of assessing access to safe drinking water was plain to see. Discrepancies in the current methods of assessment allowed for the possibility of inaccurate representations of progress that could potentially hinder future development.

Without intervention, the environmental and human induced water quality degradation in The Gambia could persist and potentially worsen, hence maintaining the current prevalence of water-related health issues. By increasing awareness and knowledge regarding water quality degradation and its effects on human health, the possibility of mitigating the vulnerability to such issues could be enhanced. As it was determined that the prevalence of water-related diseases was augmented primarily during the beginning and end of the rainy season in The Gambia, the importance of including this reality into water resource management strategies seemed to be a necessity.

In The Gambia there were two primary methods of water storage. The first was in plastic water bottles inside a refrigerator and the second was in either plastic Jerry cans or in clay jars. The results concluded that the latter storage methods were much more

prevalent all around, as five out of the nine interview groups (55 %) whom answered questions pertaining to water storage, refrigerated their water (4 out of 6, or 66 % urban and 1 out of 3, or 33 % rural). In contrast, six out of the nine groups (66 %) stated that plastic Jerry cans and clay jars were used (3 out of 6, or 50 % urban and 3 out of 3, or 100 % rural) (Fieldbook, 2012). In either case the importance of covering stored water as well as cleaning storage containers before and after use was a consistent trend among all interview groups. The covering of unimproved drinking water sources such as wells, however, was seen as important but was not done due to financial constraints. With regards to the containers used for consumption, such as cups, it was customary to share a single cup between different individuals. Without proper sanitation this practice facilitates the exchange of germs, which could effectively contribute to the spread of disease. Thus, education surrounding water-related health issues, hygiene and sanitation as well as the spread of germs could aid in deterring or amending such practices.

The overall majority perception amongst interview groups was that the water obtained from improved drinking water sources was consistently of excellent quality. However, with respect to unimproved drinking water sources such as wells, there was a greater perceived, as well as actual, potential for health risks. It was also ascertained that education, family, culture and the organoleptic characteristics of water were major determinants of perceived water quality and thus consumption. As perceptions are influential in determining consumption, there is an apparent link between the perceptions of water quality, water-related diseases and human health. If water quality is perceived as relatively risk-free with regards to water-related diseases, consumption will take place. However, there is also another scenario that is possible, where although there is a

perceived risk, consumption still takes place out of necessity. Perception analysis is important because it can help to determine which category is relevant to a given situation in order to allow for adequate management. Thus, by determining relevant management strategies (i.e. education and awareness or resource provision), vulnerability to water insecurity and water-related health risks could be mitigated.

5.1 What Does this Mean for Development?

There are certain implications for development, which could be ascertained from the aforementioned trends in the data. The most general of findings being that, at present, there is still insufficient access to improved drinking water sources in The Gambia—most notably in rural areas. As it relates to the understanding of development in general, this trend is important to consider when implementing water resource management strategies, as it seems that population density is a major deciding factor when it comes to the location of implemented resources. Although rural areas are not as densely populated as urban centres, they often facilitate the crucial service of sustenance provision for urban populations through agricultural practices. Thus, it is important that essential services, such as the access to water of a safe quality, are available to enable this provision in a healthy manner. Population ratios are important to consider for development projects when resources are limited, as implementers often seek to reach as many people as possible. However, when considering the egalitarian principles that govern the rights that demand universal access to safe drinking water, it is clear that although urban communities are more densely populated, rural communities must not suffer due to their location relative to these urban centres. A study comparing rural-urban access to

improved drinking water sources in relation to the geographical presence of water-related diseases would be beneficial in this regard.

Another important finding was the imperative need for an efficient means of water testing and an integrated water quality monitoring framework including an educational component that encompasses water quality, water-related diseases, hygiene and sanitation as well as environmental water education. The primary data revealed a tacit assumption or perception that there was no risk of water-related diseases from improved drinking water sources while the risk level from unimproved sources was much higher amongst the majority of interview participants. Without knowing the quality of the individual water sources it would be imprudent to make recommendations for use or deterrence of use, as it could have negative economic as well as health implications. For example if a community was deterred from using water obtained from their local wells based on the assumption of unsafe quality without proper testing, the distance to improved sources may present unnecessary hardship to the women who have to fetch it. In addition, this could prove to be a disservice to their families as well, who will loose out on the labour time which would have otherwise been available.

Two distinct scenarios in which a decision to use water from unimproved drinking water sources was made were revealed in the data. The first was due to a lack of knowledge or awareness regarding water quality and the health risks that could result from consuming water from unsafe sources. The second motivation for consumption resulted out of necessity or constraint such as a lack of financial means, weather restrictions, time as well as distance traveled in order to obtain water from improved drinking water sources. From these two scenarios it was also apparent that in order to

appease these situations two main development paths could be taken: education and/or resource creation, implementation or amelioration.

Furthermore, it was concluded that perceptions are a key determinant of consumption and therefore an analysis of the local perceptions of water quality and the associated health risks could be useful in determining the relationship between perceived risk level and the prevalence of water-related diseases in a given area. Perception analysis could also be helpful in determining the appropriate scenario of a given community, such as those mentioned above, as well as the necessary direction of development that should be taken.

Finally, it was noted that the traditional social structure at the community level in The Gambia was quite prominent. There was a distinct hierarchy of leaders and influential members of society, such as the *alkalos*, village leaders, village health workers, traditional birth attendants and village health support groups, that held significant respect and influence over the health, social organization and political aspects of society. Furthermore, the benefits of including these members of society in development initiatives, such as educational programs, were quite notable. Thus, it was found that the incorporation of this existing community structure into an integrated and community based water quality monitoring and educational framework would be a great way to incur development in a participatory manner as well as both logistically and financially beneficial.

5.2 Recommendations: What Can be Done?

In many areas it was found that a lack of resources or the cost of, and/or distance to improved drinking water sources was prohibitive for some to adequately achieve access to safe drinking water. At times this was seen to lead to the consumption of water from unimproved sources out of necessity. It was also concluded that a lack of awareness or knowledge concerning the potential health risks associated with poor quality drinking water as well as the means of water contamination and disease transmission, factored into the use of unimproved drinking water sources. Enhanced public education regarding water quality, water-related diseases, hygiene and sanitation as well as health and the environment could effectively reduce preventable disease transmission. In an attempt to address the issues of insufficient or inadequate access to safe drinking water, water quality monitoring and water-related health education in The Gambia, the below policy recommendations have been devised.

5.2.1 Community Based Water Quality Monitoring and Education

As it was previously concluded, at present, the basic infrastructure, or framework for large-scale surveillance of drinking water quality is unavailable. Therefore, a community-based approach to water management seems to be the most viable interim solution. In order to overcome the issue of limited resources (financial capital, trained experts, training materials etc.) the idea of integrating individual community members into a possible national framework for water quality monitoring as well as water-related health program seems a viable option to maximize the capacity of the existing resources. Various government sectors such as the Department of Water Resources and public health officers as well as civil society groups such as NGOs and community leaders across The

Gambia could be consulted to assist in, and collaborate on the implementation of this framework. Here, existing village leaders as well as other concerned citizens could participate in the education and development of their own communities on a voluntary basis. This would facilitate the flow of input and traditional knowledge from individual communities into water resource management at the country level. Although concerns of commitment time could be presented it would be possible to implement a rotation system of commitment as to allow for the sharing of responsibilities.

5.2.2 Perception Analysis of Water Quality and the Associated Health Risks

A community-based framework could also expedite perception analysis of water quality and the associated health risks, which would provide insight into the individual scenario of a given community. As was concluded from the existing literature and primary data, due to the multidimensional definition of water security, the causes of insecurity were also multifaceted. In order to reduce vulnerability to water insecurity and the associated health risks, it proved important to gain an understanding of the scope of determinants, which define risk assessment and hence consumption. With this information, appropriate development strategies could be prescribed and executed through the integrated framework.

5.2.2 The NSGA Model: Peer Health Education and Community Film Nights

The Nova Scotia-Gambia Association (NSGA), works in collaboration with Canadians and West Africans to build healthy communities in The Gambia through youth education on topics such as: gender equity, environmental education and sustainability, malaria prevention, landmine sensitization and education as well as sexual and reproductive health (NSGA, 2012). The NSGA “uses drama and theatre, radio and

community video shows, and peer education techniques to build healthy communities and to introduce its programs" (NSGA, 2012). This model has been successful in informing Gambian youth as well as their peers and family members on important health related issues. As important values and practices are developed during childhood, engraining healthy practices with regards to water-related health issues as well as hygiene and sanitation would be beneficial to future generations of the Gambia. Peer health education, within the formal school system, provides youth with the opportunity and skills to take a leadership role in the health and education of their peers. It also empowers them to take on this role in their communities.

Community film nights are a key component of the NSGA's education model as it is a means of brining educational content and discussion into community settings. The films cover a variety of health topics and are created and developed by NSGA staff members with the help of peer health educators (students) 'starring' in the productions. It is common for the vast majority of community members to attend these shows and to participate in community discussions, which follow. These film nights serve as an effective means of encouraging discussions on sensitive health topics amongst men, women and children from various generations in a neutral forum. Due to the success of this educational model in reaching a wide expanse of the Gambian population, it is suggested that this model be integrated into, or used as a forum for water-related health education. Two direct initiatives that could be beneficial in this regard would be: 1) the expansion of the NSGA's current water education program to include more schools and communities, 2) the creation of a community film which focuses on water quality, water-related health, sanitation and hygiene as well as environmental education.

5.2.3 The Diversification of Media Outlets Used for Public Education

Finally, various media outlets can be extremely effective in reaching large numbers of people. Therefore, it seems reasonable to conclude that methods such as radio, television, billboards, pamphlets, newspapers and magazines could be helpful sources in which to provide educational water-related health and sanitation information and to advertise important messages. Not all people in The Gambia have access to all of these sources of media, such as television; therefore, the diversification of these sources is important in order to reach the maximum number of people.

In light of the development issues and possible solutions presented, is important to recall the thesis statement of the present research, which states that *a more thorough knowledge of local perceptions regarding water quality and the associated health risks could be an important tool for water education initiatives for the improvement of local water resource management and consumption.* Based on this thesis statement, it can be determined that the proposed community based frameworks for education and water quality monitoring could provide a forum for local perception analysis and thus conceivably contribute to locally relevant solutions towards improved water resource management and thus the mitigation of water-related health issues.

By taking a participatory approach, and engaging those affected by the consequences of the aforementioned development issues into the solution building process, the divide between ‘donor’ and ‘recipient’ wants and needs could be bridged. It could also allow for a more accurate representation of data and create lasting benefits for those involved. After all, solutions can only be created once an understanding of the

problem is obtained and who better to help find the solutions than those with the most experience with the problems?

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APPENDIX A

Table A.1: Interview Schedule

Interview Number	Interview Location	Interview Date	Translator
1	Kotu	November 25th 2012	Kebba Suso
2	Kartong	November 25th 2012	Kebba Suso
3	Banjul	November 26th 2012	Kebba Suso
4	Bakau	November 26th 2012	Kebba Suso
5	Sukuta	November 28th 2012	N/A
6	Sukuta	November 28th 2012	Kebba Suso
7	Ebo Town	November 28th 2012	Kebba Suso
8	Bansang	November 30th 2012	Kebba Suso
9	Bansang	November 30th 2012	N/A
10	Bantanto	November 30th 2012	Kebba Suso
11	Bantanto	December 1st 2012	Kebba Suso
12	Bansang	December 1st 2012	N/A
13	Bansang	December 2nd 2012	N/A
14	Fula Bantang	December 4th 2012	Kebba Suso

APPENDIX B

Table A.2: Interview Group Dynamics

Interview Number	Location	Language	Number of Participants	Approximate Range in Age	Category
1	Kotu	Diola (Jola)	16 W 0 M	~18-60 W N/A	Urban
2	Kartong	Mandinka	9 W 2 M	~ 18-60 W ~ 50-60 M	Urban
3	Banjul	Wolof	4 W 0 M	~25-40 W N/A	Urban
4	Bakau	Mandinka / English	3 W 0 M	~25-35 W N/A	Urban
5	Sukuta	English	0 W 1 M	N/A ~35-40 M	Urban
6	Sukuta	Mandinka	1 W 2 M	~60-70 W ~40-70 M	Urban
7	Ebo Town	Wolof	4 W 1 M	~30-60 W ~30-35 M	Urban
8	Bansang	Mandinka / Wolof	5 W 0 M	W N/A	Rural
9	Bansang	English	0 W 2 M	N/A ~ 35-45 M	Rural
10	Bantanto	Mandinka	6 W 1 M	~18-65 W ~60-65 M	Rural
11	Bantanto	Mandinka	1 W 0 M	~55-65 W N/A	Rural
12	Bansang	French	1 W 0 M	~ 45-55 W N/A	Rural
13	Bansang	English	1 W 0 M	Unknown W N/A	Rural
14	Fula Bantang	Fula	5 W 1 M	~20-30 (W) ~35 (M)	Rural

*Men (M)
*Women (W)

APPENDIX C

Table A.3: Interview Questions
SOURCES OF WATER AND WATER MANAGEMENT
1. Where do you get your drinking water?
2. Who owns the sources of water?
ACCESS TO WATER
3. Does everyone have access to these water sources?
4. Does water cost money and if so is it expensive?
5. How much time out of your day do you spend getting water?
WATER STORAGE AND TRANSPORTATION
6. Who is in charge of getting water for your family?
7. How do you transport water from the source to your house?
8. Where do you store your water at home—in what kind of container? (Bucket, plastic bottle, clay container?)
9. How often do you clean this container and what do you use to clean it?
WATER QUANTITY
10. Is there always enough water to drink?
11. Is water available at all times of the day?
SEASONAL VARIATIONS
12. Are there some times of the year when there is more/less water than others?
13. Does the quality of the water change at different times of the year? (colour change, taste differently, more/less salty, smell different etc.?)
14. If so, do these changes affect whether or not you use the water or how much you use?
WATER QUALITY
15. What do you think about the quality of your water—is your drinking water clean and safe?
16. How do you know if water is safe to drink or not?
17. When water is not safe to drink and why is the water that way?
18. What happens if you drink unsafe water?
WATER AND HEALTH RISKS
19. Do people ever get sick from drinking unsafe water?
20. Do people get sick more often at some parts of the year than others?
21. What kind of sicknesses do people get from drinking bad water?
WATER AND EDUCATION
22. Have you ever learned about water and health from school, the radio, the newspaper, books etc.? If so which ones?
23. If yes, what types of things did you learn?
WATER AND CULTURE
24. Is there any cultural significance of water in The Gambia? **For example**: Some people believe that the water from the first rains of the season is the cleanest.
25. Are there important or special beliefs like this about water in The Gambia?
26. What is the importance of water in your life?