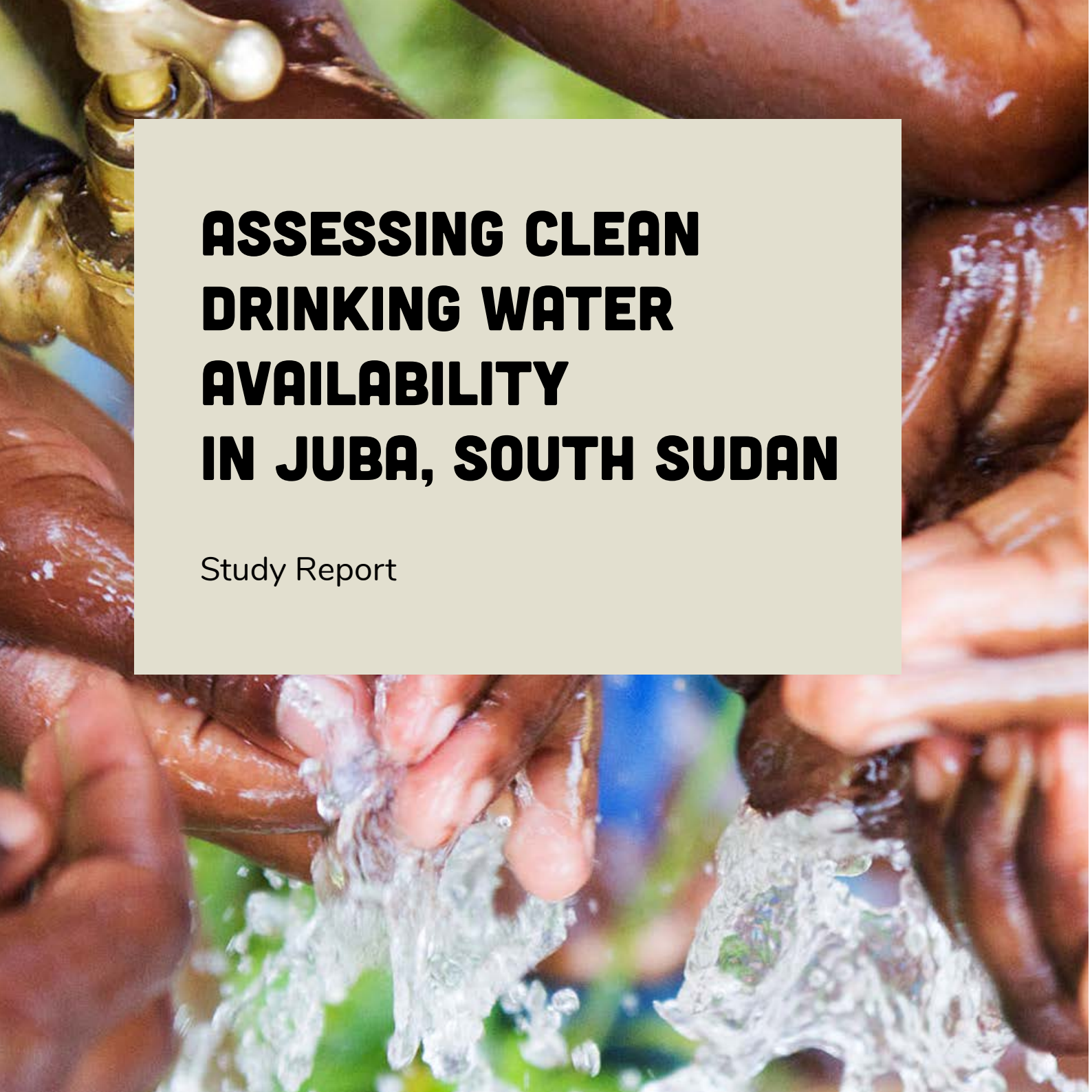

ASSESSING CLEAN DRINKING WATER AVAILABILITY IN JUBA, SOUTH SUDAN

Study Report

HOMEF

HEALTH OF MOTHER EARTH foundation

Acknowledgments

This study was carried out on behalf of Health of Mother Earth Foundation (HOMEF) South Sudan by the Nile Initiative for Health and Environment (NIHE) under the project leadership of Bior K. Bior. The study was accomplished by HOMEF with the support of Sign of Hope under the Right to Water project.

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HOMEF is solely responsible for the contents of this report.

CONTENTS

1. INTRODUCTION

Since the independence of the Republic of the Sudan from the Great Britain in 1956, the southern region of the Sudan remained grossly neglected in terms of political and socio-economic development. This disparity in socio-economic development denied the southern region the opportunity to develop strong infrastructure capable of serving its populations both in urban centers and in the rural areas. This desperate situation was exacerbated by the South-North civil war that devastated the rudimentary infrastructure in Southern Sudan.

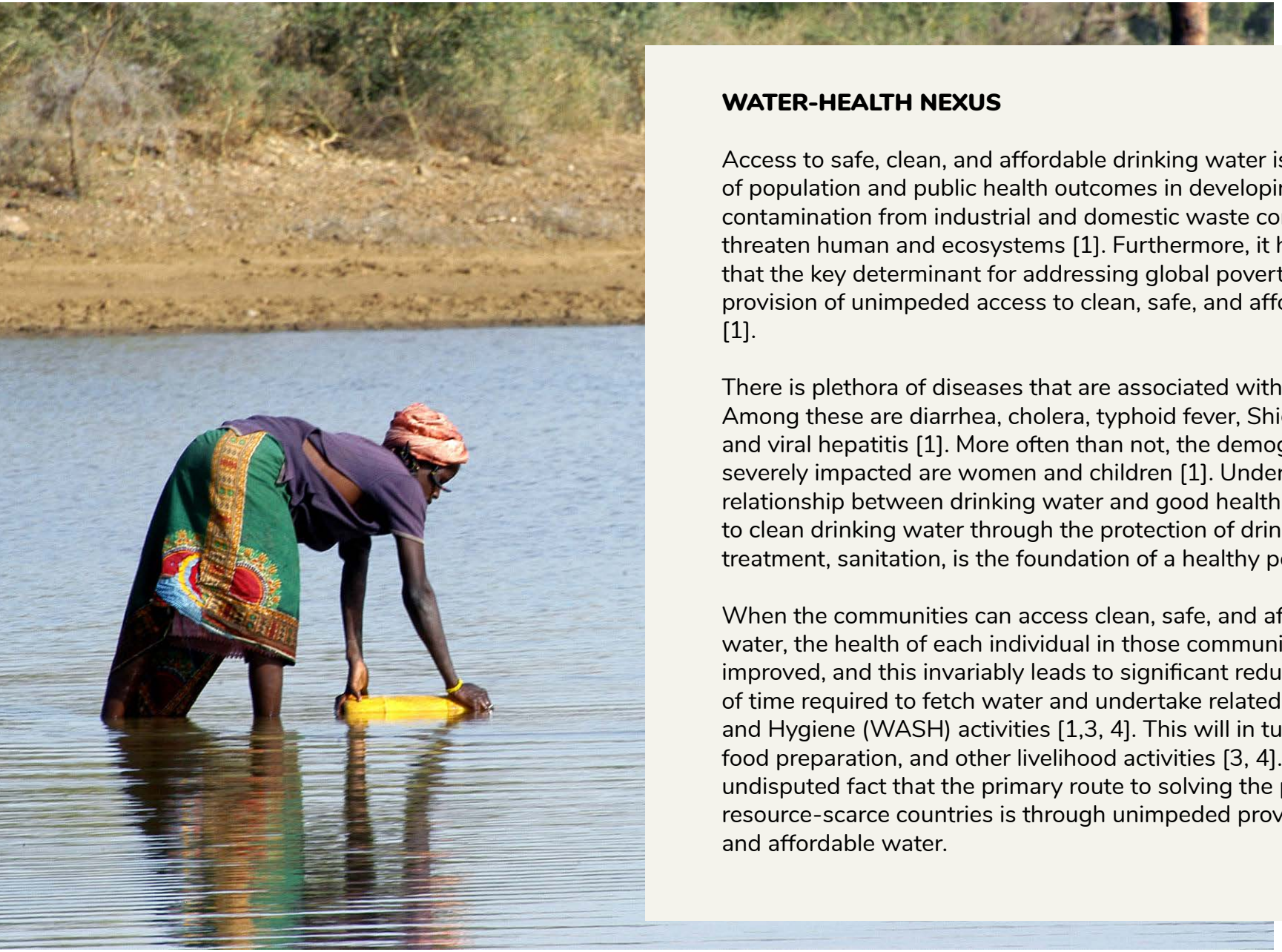
When the Republic of South Sudan gained its independence in 2011, the nascent republic was confronted with an uphill task of providing services to 12 millions people with minimal infrastructure. Although the country has been receiving a substantial amount of petrodollars from its oil industry, the level of services provision to citizens has stagnated at the pre-independence period due to a number of factors, including smoldering conflicts.

The persistent conflict has resulted in the death of several civilians and close to two (2) million more displaced persons. While a great number of people have sought refuge in the neighboring countries as refugees or in the UNMISS-administered Protection of Civilians sites (PoCs) throughout the country, thousands more have fled to Juba where they managed to find shelter at the outskirts of the city.

Before the conflict erupted in 2013, the population of Juba was estimated to be 80,000 according to the 2008 national census. After the crisis, this figure mushroomed to 325,000 as of 2015, and has been rising ever since as the conflict forces more people to abandon their homes, especially in the Greater Equatoria Region (GER) and Greater Upper Nile Region (GUN). This influx of people is noticeably putting an unimaginable pressure on the water supply system in Juba.

Any interventions aimed at assuaging the chronic water supply problem in Juba must be informed by a full understanding of the magnitudes of the problem. Currently, literature on the crisis of water supply in Juba is sketchy, and any attempt to deal with the problem without a body of data informing it will be piecemeal and destined to fail. Therefore, this study aimed at achieving the following measurable objectives:

1. to review water provision infrastructure in Juba City,
2. to assess how the residents of Juba access drinking water,
3. to assess whether the residents of Juba have access to clean drinking water, and
4. to use the findings of the assessment to inform intervention strategies to provide the residents with access to clean and affordable drinking water.



WATER-HEALTH NEXUS

Access to safe, clean, and affordable drinking water is a critical determinant of population and public health outcomes in developing countries [1]. Water contamination from industrial and domestic waste continues to dangerously threaten human and ecosystems [1]. Furthermore, it has been recognized that the key determinant for addressing global poverty issues is the provision of unimpeded access to clean, safe, and affordable drinking water [1].

There is plethora of diseases that are associated with water contamination. Among these are diarrhea, cholera, typhoid fever, Shigella, polio, meningitis, and viral hepatitis [1]. More often than not, the demographics that are severely impacted are women and children [1]. Understanding the relationship between drinking water and good health is critical as access to clean drinking water through the protection of drinking water source, treatment, sanitation, is the foundation of a healthy population [1].

When the communities can access clean, safe, and affordable drinking water, the health of each individual in those communities is substantially improved, and this invariably leads to significant reduction in the amount of time required to fetch water and undertake related Water, Sanitation and Hygiene (WASH) activities [1,3, 4]. This will in turn result in improved food preparation, and other livelihood activities [3, 4]. It is, therefore, an undisputed fact that the primary route to solving the problem of poverty in resource-scarce countries is through unimpeded provision of safe, clean, and affordable water.

2. METHODOLOGY

2.1 QUALITATIVE DATA COLLECTION

To gain an appreciable understanding of water provision system and infrastructure in Juba City, South Sudan, a desk review of relevant documents concerning government plans, water provision assessments, and limited number of study reports was undertaken. Qualitative data were also collected by conducting interviews with relevant authorities in the Ministry of Water, Dams and Electricity, Juba Municipal Council, Ministries of Environment and Health, South Urban Water Corporation (SSUWC), and some individuals in the private sector who deal in water services provision businesses in the city such as the Ethiopian water trucks owners and bicycles water distributors. Some of these meetings and discussions took place over tea, in the offices of the interviewees, or sometimes on the phone over the course of two (2) months.

The qualitative method of data collection was chosen because it requires less time, and an in-depth knowledge about a particular issue being researched could easily be assessed without having to collect large and cumbersome volume of data over a prolonged period of time [6].

2.2 LABORATORY WATER PARAMETERS TESTING

The quality of drinking that that is provided to most suburbs of Juba was tested in the laboratory by sampling water from three (3) water collection hubs in Juba, namely Juba bridge water collection hub, Konyokonyo water collection hub, and Gumbo Water Treatment Plant (GWTP), which was installed by Oxfam-South Sudan and managed by the community of Gumbo Township. Using a previously validated water safety parameters testing protocol [5], the water safety parameters such as the pH, Total Dissolve Solids (TDS) and the presence of bacterial contamination (Microbial Total Coliforms Test) were tested at the South Sudan Public Health Laboratory by a trained water laboratory technologist.

Microbiological Analysis

The water samples were tested for the presence of total bacterial coliforms using a WAGTECH Potatest®+ method [5]. This method is based on the membrane filtration principle, which uses semi-permeable membranes to separate materials. Briefly, the membrane acts as filter that allows water to flow through, while it retains suspended solids and other substances such as bacteria. To perform the test, the sample is vacuum filtered

through the membrane filters. The filters are then laid on nutrient medium. The membrane has a printed millimeter grid printed on it and can be reliably read to count the number of colonies under a binocular microscope after 18-24 hours of incubation.

Physical Parameters

TSD and Electrochemical conductivity

The Total dissolved Solid (TDS) in the samples was measured using WAGTECH TDS probe meter. The probe was placed inside the samples tubes, and the Electrical Conductivity (EC) of the water was recorded and converted into TDS values using conversion factors as demonstrated previously [5].

pH

The pH of the water samples was measured using Wagtech pH meter as demonstrated previously [5]. The pH values were recorded in (Fig.3). Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in the air. The turbidity of the water samples obtained from various water collection points was measured using Nephelometric Turbidity tube as shown previously [5].

3. RESULTS

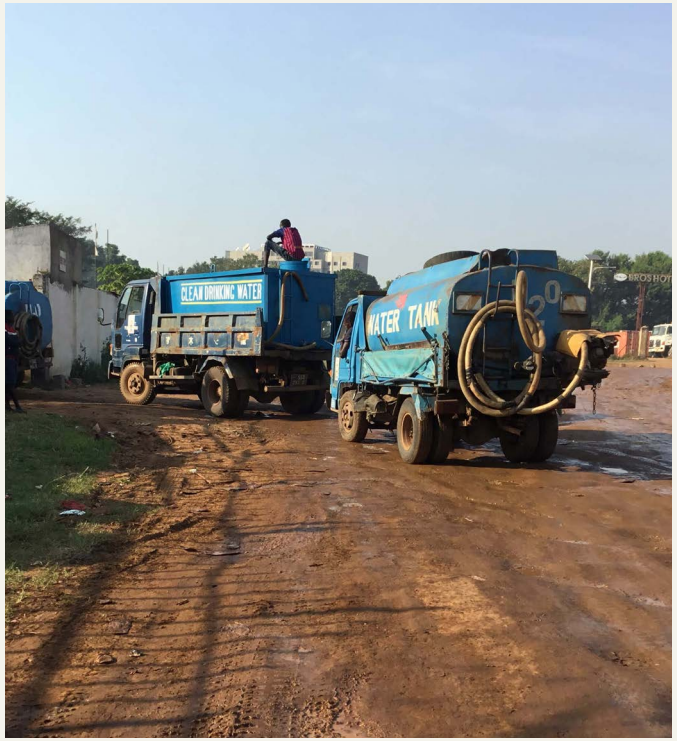
3.1 EXISTING AND PLANNED WATER SERVICES PROVISION INFRASTRUCTURE IN JUBA

After the conclusion of the civil unrest in Sudan, Juba City was crowned in September 2005 as the capital of the autonomous Southern Sudan. Throughout the hectic twenty (20) years in which the civil unrest raged, the government of the Sudan strategically neglected the southern region in terms of services provision as a war strategy.

In the water provision sector, no appreciable effort was undertaken to install and maintain water supply infrastructure in Juba City. A limited water infrastructure, which was put in place at the end of the first civil war, which ended in 1972, was left in a dilapidated state and by the time the peace accord was signed in 2005, this infrastructure required serious rehabilitation for it to provide water to the government institutions that were connected to it. There was also a need to install new water provision system in the city as the population was rising at a fast rate [1].

Currently, the residents of Juba obtain water either by means of house connection to the water grid, public taps of South Sudan Urban Water Corporation (SSUWC), public wells that are equipped and furnished with mechanical pumps, or through private water venders like the ones that distribute water in most of the neighborhoods in juba using Jerry cans that are carried by bicycles, motorcycles, or sometimes donkeys. In certain suburbs, such as Gumbo, INGOs such as Oxfam-South Sudan have installed water treatment plants that are managed by the communities.

But because there is no water distribution network such as water pipes in those areas, water is sent to the households by water trucks that are ubiquitous on the streets of Juba (Fig. 1A, B, & C). However, according the officials at the SSUWC, only 2% of Juba city residents have access to this treated water, while another 8% have access to water that is provided by the SSUWC through their limited water distribution system which only caters for government institutions and official residential quarters. The rest of the city residents obtain their water straight from the Nile River, which tends to be untreated and raw for consumption.



(Fig. 1A) At Juba Bridge water collection point along the Nile River, water Trucks like this one have been licensed by the Juba Municipal Council to take water from the River to neighborhoods of Shirikat, Kator, Juba Town, high Cinema, and Juba Nabari. The water that is collected from this collection point is not treated prior to distribution.

Courtesy of Martin Ayuen, NIHE research assistant.

(Fig. 1B) At Konyokonyo water collection point along the Nile River, water Trucks like this one have been licensed by the Juba Municipal Council to take water from the River to neighborhoods of Shirikat, Kator, Juba Town, high Cinema, and Juba Nabari. The water that is collected from this collection point is not treated prior to distribution.

Courtesy of Martin Ayuen, NIHE research assistant.

(Fig. 1C) Outside Gumbo Water Treatment Plant (GWTP), water Trucks like this one have been licensed by the Juba Municipal Council to take water from the water treatment plant to neighborhoods. No pipes have been installed to distribute the water to the neighborhood.

Courtesy of Martin Ayuen, NIHE research assistant.

3.2 GOVERNMENT OF SOUTH SUDAN'S PLANNED WATER INFRASTRUCTURE IN JUBA CITY

The government of South Sudan has a comprehensive plan to revamp the water provision infrastructure in Juba City. The planned system envisages an expansion of the existing SSUWC plan to twice its size in capacity by building two additional water treatment plants on selected high elevations around the city ostensibly to harness the power of gravity for water delivery [1]. The plan targets to serve areas like the suburbs of Juba Town, Kator, Munuki Payams, Gumbo, Rejaf Payams, and Gudelle Payams (Fig. 2A & B [water system map]). The plan envisages that once it is installed, all the population of Juba will be adequately served. The plan will have an overall water output of 235,000 m3/day by 2025. However, due to the fragile peace in the country, which has resulted in a challenged economic future for the government, the plan has been shelved until such a time when it could be resuscitated. Meanwhile, the citizens of Juba continue to consume water that is not safe, clean and affordable [1].

Fig.2a: Study location map.
Retrieved from SSUWC archives.

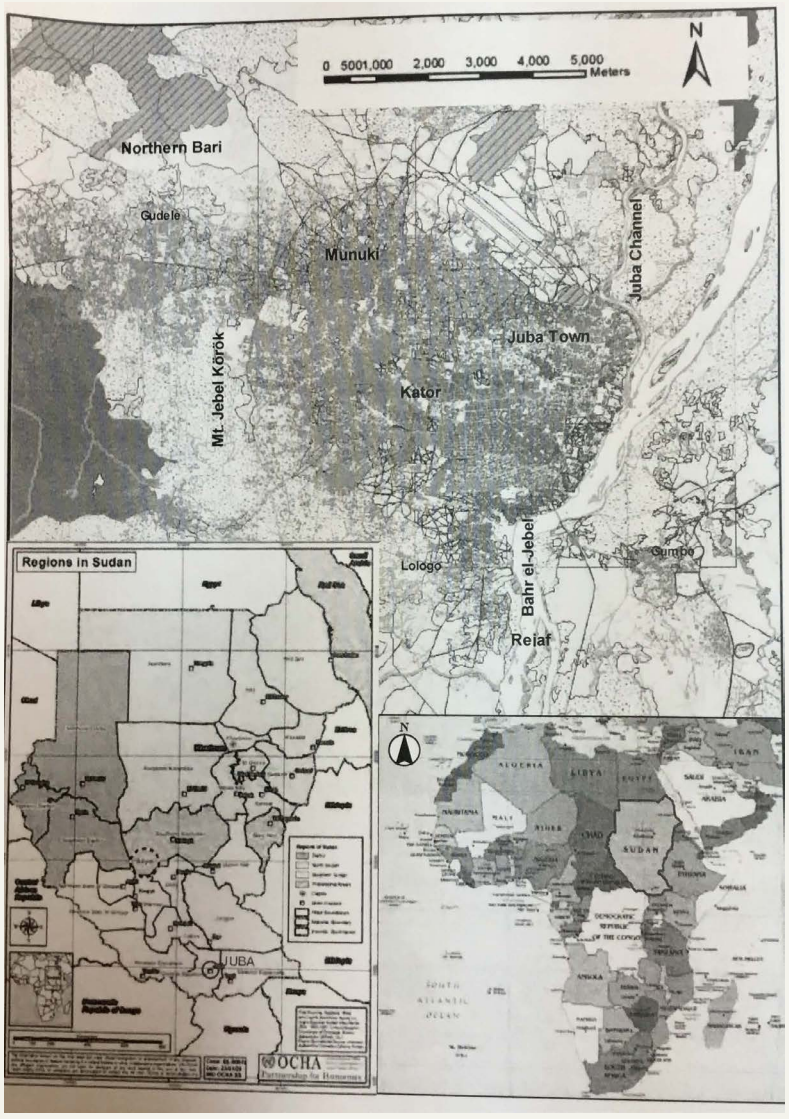
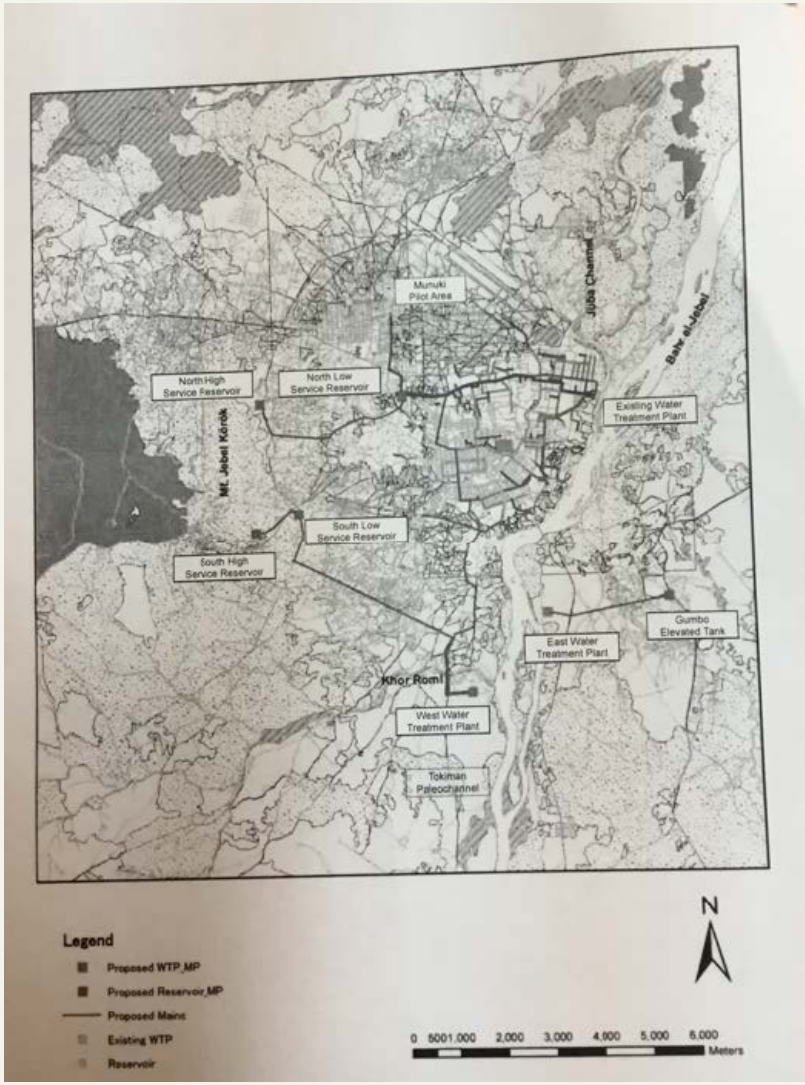


Fig.2b: Proposed main water supply facilities in the Master Plan.
Retrieved from SSUWC archives.



3.3 WATER SAFETY PARAMETERS

The Joint Monitoring Program (JMP) for Water Supply and Sanitation, implemented by the World Health Organization (WHO) and UNICEF, reports that 783 million people in the world (11% of the total population) have no access to safe water, 84% of whom live in rural areas [3,4]. About 187 million people use surface water for drinking purposes; 94% of them are rural inhabitants and they are concentrated in sub-Saharan Africa [3,4]. Regarding the quality of drinking water, microbiological contamination is a primary concern of developing countries.

The city of Juba is facing water crisis and this crisis, is largely exacerbated by the unrest in the countryside, which is forcing displaced persons to come to the city.

There are about two principal water collection points along the Nile River where water trucks that have been licensed by the Juba Municipal Council (JMC) collect the water for distribution to the neighborhoods around Juba, namely, Konyokonyo Water Collection Hub (KWCH), and Juba Bridge Water Collection Hub (JBWCH). To determine whether this water is clean and safe for drinking, water samples were collected from KWCH, JBWCH, and the Gumbo Water Treatment Plant and taken to the South Sudan Public Health Laboratory (SSPHL) for testing. At the laboratory, basic water safety parameters such as pH, Total Dissolved Solid (TDS), and Total Microbial Coliforms tests were conducted. The values obtained were compared with the water quality guiding values (GVs) that have been established by the World Health Organization (WHO) [5].

In all the samples tested, the pH was found to be consistent with the pH guiding values established by the WHO (Fig. 3).

While the water samples taken from GWTP didn't exhibit any bacterial growth (zero Colony-Forming Unit [CFU]), the samples collected from KWCH exhibited growth that was designated "Too Numerous To Count TNTC-CFU" per 100ml of water sample tested. This shows that this water is not safe for drinking; it should not be distributed to the neighborhoods prior to treatment.

Similarly, the samples taken from JBWCH yielded 55 Colony-Forming Unit per 100ml (55 CFU/100ml), which is well above WHO GV of zero Colony-Forming Unit per 100ml (CFU/100ml) of water tested (Fig.3). This water is also not fit for human consumption without treatment. In all the samples tested for Total Dissolved Solids (TDS), the samples from GWTP and KWCH were within the range of WHO TDS GV of 500mg/L while the samples taken from JBWCH has TDS above WHO recommended value of 500mg/L (Fig.3). Without treatment, this water is also not fit for human consumption.

These results show that the residents of Juba have no access to clean and safe drinking water, and since they have no other options beyond River Nile, they will continue to consume raw water from the river, which is saturated with disease-causing microorganisms, organic and inorganic impurities that find themselves into the river either from industrial wastes or domestic wastes. As the population of Juba continues to grow, the water crisis in the city will continue to worsen, and if no appreciable measures are taken, and expeditiously so, the public health implications of this water crisis will soon become apparent to the government of South Sudan and the residents of Juba.

Water Facility Sampled	Location	Total Coliform	WHO GV*	pH	WHO GV*	TDS	WHO GV*
Gumbo Treatment Plant	Juba	0 CFU/100ml	Nil/100ml	8.2	6.5 - 8.5	5mg/L	500mg/L
Konyokonyo Point	Juba	TNTC	Nil/100ml	7.9	6.5 - 8.6	300mg/L	500mg/L
Juba Bridge Point	Juba	55 CFU/100ml	Nil/100ml	8.3	6.5 - 8.7	557mg/L	500mg/L

Fig. 3: From the samples taken from Gumbo Water Treatment Plant in Gumbo suburb of Juba, there was no bacterial grown observed (0 CFU). This is because this water treatment facility uses modern water filtration and sterilization techniques to filter water before it is distributed to the households. This value meets the WHO standard of nil CFU/100ml of water for the water to be safe for drinking. The samples collected at Konyokonyo water collection point exhibits too much general bacterial grown, which was designated "Too Numerous To Count (TNTC)". The samples collected at Konyokonnyo water collection point yielded 55 CFU/100ml. This is well above WHO GV*. This means that this water is not fit for human consumption. The pH values for all the water samples are within the WHO guiding values (6.5 – 8.5). For TDS, two samples meet WHO GV standard of 500mg/L while the water samples collected at Juba bridge collection point have a little elevated TDS relative to WHO GV*.

Keys:

(WHO GV) Means World Health Organization (WHO) Guiding Value
*(CFU) Colony-Forming Unit.
*(TDS) Stands for Total Dissolved Solids in the water

4. RECOMMENDATIONS

It is obvious that the existing water provision infrastructure in Juba is inadequate for the growing population. While only less than 20% of the population in Juba has access to clean and safe water drinking water, the vast majority of Juba residents continue to consume water that is not fit for human consumption. Therefore, this study, based on the presented findings, makes the following recommendations:

I. The government of South Sudan needs to expeditiously invest in water services provision infrastructure in the city by executing its water services provision Master Plan;

II. There is an urgent need to install chlorination units to ensure that the water collected along the Nile River for distribution in the neighborhoods around Juba, is minimally treated before it is distributed for consumption in the neighborhoods around Juba;

III. There is also a need to monitor water quality along the Nile River to ensure that people are not supplied with polluted water.

IV. It is also recommended that the government regulates and ensures that residential and commercial units close to the Nile River do not contaminate the river with their waste.

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About Health of Mother Earth Foundation (HOMEF)

HOMEF is an ecological think tank and advocacy organization registered in Nigeria. Nigeria is our base but Africa is our focus. We work to bridge the yawning gap between policy/ decisions made by government and the actual needs at the grassroots.

HOMEF works with local communities to build and share knowledge. We recognize that current global crisis have systematic roots and the prevalent paradigms of development and growth based on competition will lead to critical destruction of biodiversity and continued destructive extraction of natural resources as well as dependency on risky technologies. In all these concerns of grassroots communities are ignored, repressed or exploited. We work to build solidarity and ensure justice.

Our Core Values: Justice& Equity in all circumstances, People and the planet in harmony and free from exploitation, Dignity (Respect), Action (Solidarity), Knowledge

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