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Water Quality in Maungani, South Africa

GROUP C

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1. Introduction

Access to clean water is a necessity, for sustaining life. Humans can only survive for some days without water. Consuming water from contaminated sources can lead to the spread of diseases (Omatayo et al., 2021). In South Africa rural communities face a challenge in accessing water and proper sanitation facilities, which creates a dual crisis (Mngadi et al., 2023). This lack of access to water and sanitation does not just affect South Africa but also contributes to preventable deaths and illnesses in rural communities worldwide (Hove et al., 2019).

Water quality in areas of South Africa suffers greatly due to factors like pollution from activities, mining operations and inadequate wastewater treatment. These factors make it difficult for communities those in disadvantaged areas to obtain clean and safe water (Hove et al., 2019). Improving the infrastructure for water treatment and implementing water management practices pose challenges that require collaboration between government agencies, NGOs and community organizations (WHO/UNICEF, 2013). By addressing these challenges and ensuring the provision of high-quality water we can break the cycle of poverty while improving the health and well-being of communities, in South Africa.

1.1 Goals and Objectives

The objective is to assess the water quality in Maugani Village. This will involve evaluating the physical characteristics of the water using a portable multi-parameter reader. Additionally, the presence and quantity of Total coliforms and E. coli will be identified using the Colilert Quanti-tray methods. Salmonella and Shigella bacteria will be isolated using membrane filtration and standard culture techniques. Lastly, the susceptibility or resistance of Salmonella and Shigella to various antibiotics will be determined using the guidelines from the European Committee on Antimicrobial Susceptibility testing.

2. Materials and Method

2.1 Methodology

The study is conducted in Mauagani, South Africa. The sampling technique employed was purposive sampling. Samples were collected from water sources before and after the village, household storage containers, and questionnaires were answered with the help of the households involved. A total of seven samples were examined for physicochemical parameters and bacteriological investigation. Bacteria presence will be decided using pH, total suspended solids, conductivity, temperature, and dissolved oxygen measurements. Membrane filtration on EMB agar was used to isolate Salmonella, Shigella, and E. coli. Tests such as gram, KIA, Simon citrate, and antibiotic testing will be conducted on positive colonies. Additionally, quantitative analysis and PCR will be performed for E. coli.

2.2 Study Area and sampling points

Maungani village is situated outside of Thohoyandou and covers an area of 7.48km2. According to the Census of 2011, the village has an estimated population of 7,271 people living in 2,264 households.

The village experiences a subtropical climate, characterized by temperature variations ranging from a minimum of 10 °C in winter to a maximum of 40 °C in summer. The annual rainfall in Maungani is approximately 500mm, with the majority (87.1%) occurring between the months of October and March.

The community in Maungani is predominantly composed of people who utilize the area for settlement, agriculture, subsistence farming, and as a location for student accommodation due to its proximity to the University of Venda.

Figure 1: Maungani village

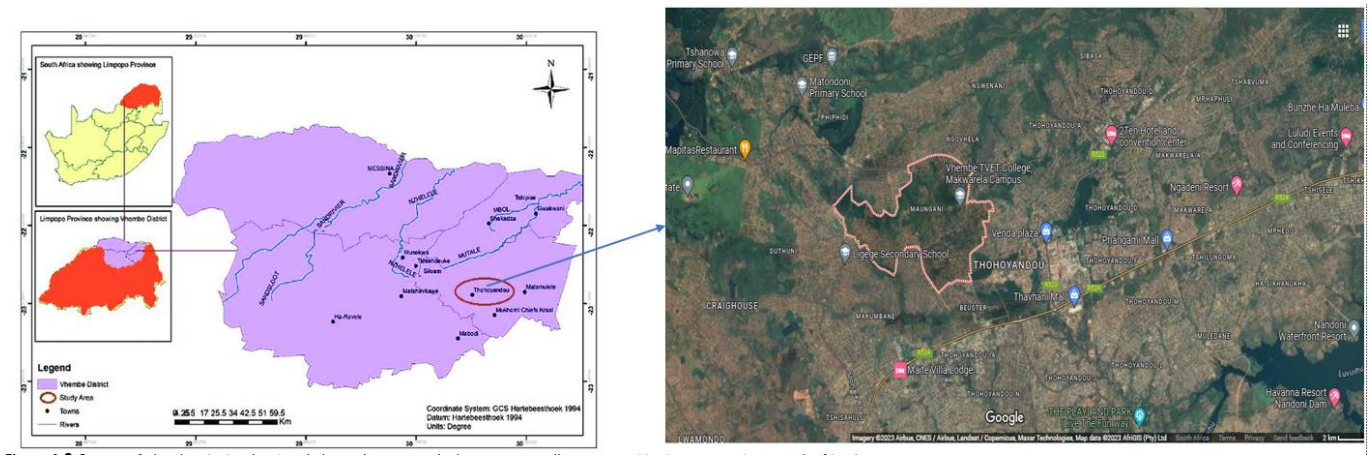
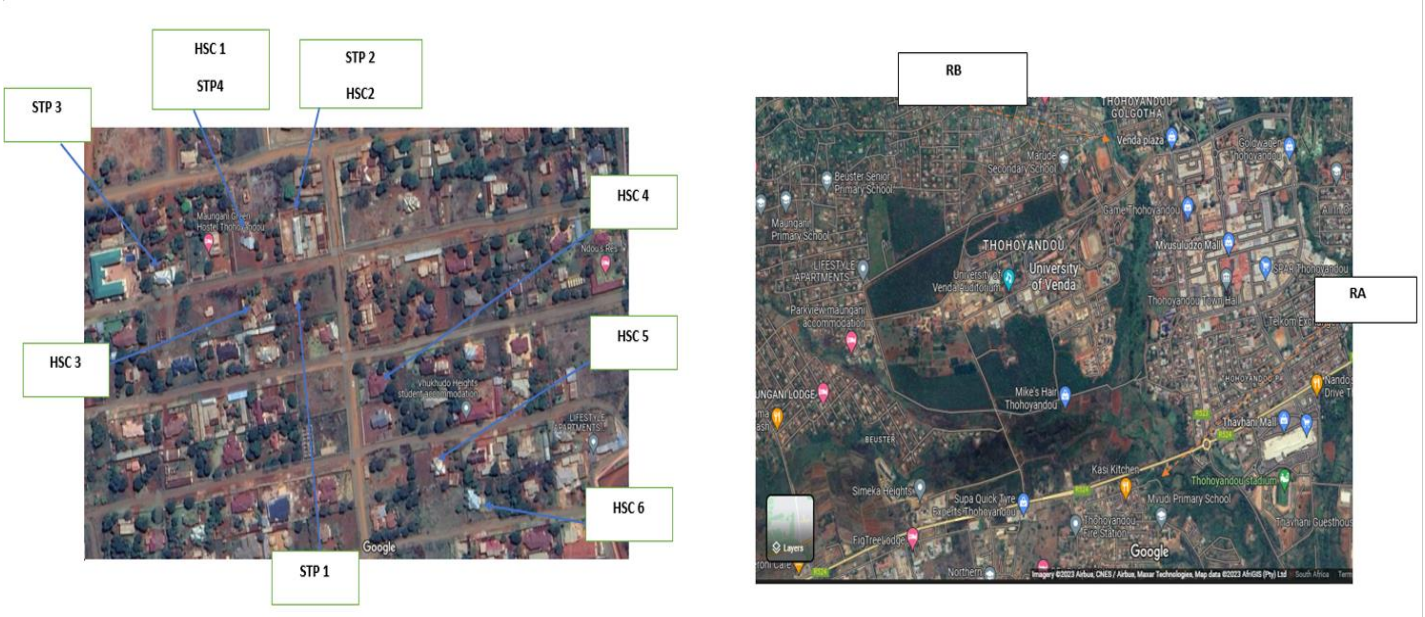


Figure 2: Sampling locations in Maungani village



3. Results and discussions

3.1 Water quality Analysis

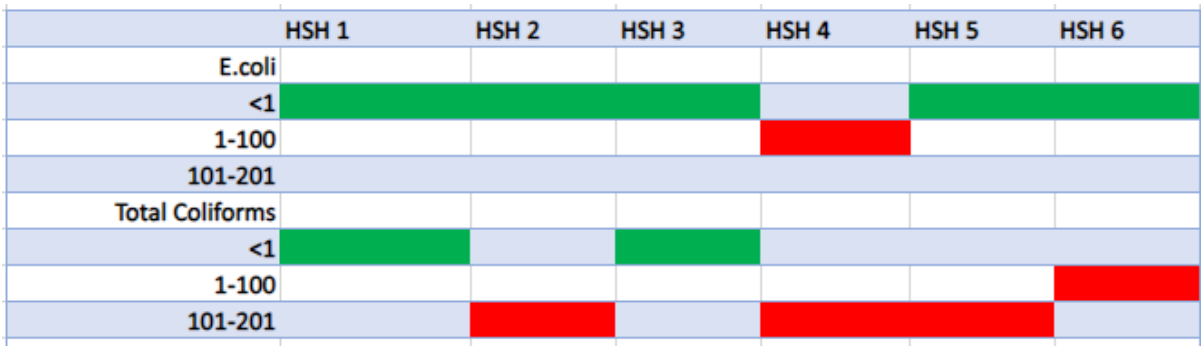
Sanitary Inspection Results:

A recent sanitary inspection conducted in Maugani village revealed the following findings:

Water Source: The main water source in the village is municipal and some private boreholes. Water samples were collected from 6 households and from the nearby river. The water was observed to be clear and free from any visible contaminants. But the results revealed that there are some traces of e coli and total coliforms.

The water analysis (table 1) revealed that 16.6% of the households tested positive for *E. coli &* 83.3% tested negative. Moreover, 66.6% of the households tested positive for total coliforms & 33.3% tested negative.

Tabell 1:Water analysis Results



	HSH 1	HSH 2	HSH 3	HSH 4	HSH 5	HSH 6
E.coli						
<1						
1-100						
101-201						
Total Coliforms						
<1						
1-100						
101-201						

Sanitation Facilities: Most households in the village have pit latrines as their primary sanitation facility. The inspection found that some pit latrines were in a state of disrepair and required maintenance.

Solid Waste Management: The village has a designated waste disposal area. However, during the inspection, it was observed that some households were improperly disposing of solid waste, leading to scattered litter in certain areas.

Hygiene Practices: Overall, hygiene practices were found to be satisfactory in the village. The presence of handwashing facilities and the use of soap were observed in some households.

Animal Husbandry: Some households in Maugani village engage in small-scale animal husbandry, primarily poultry farming. Proper waste management practices and separation of animal waste from human living areas were observed in these cases.

3.2 Risk assessment from Questioners

After conducting the questions, we have identified a direct relationship between contamination and certain households. Our observations revealed the presence of animals near water sources in some households, potentially contributing to environmental and water contamination. Additionally, we noticed that the practices related to cleanliness and water storage systems posed a high risk of contamination in some cases.

Tabell 2: Risk assessment from Questioners

	Very high	Medium	Low	Very Low
Animals	5			
Toilet facilities			6	
Solid waste mangment		3		
Washing hands with Soap			6	
Water storage(cleanes and location)	4			
Availability of water inside households		3		

3.3 Antimicrobial Susceptibility Testing

We have conducted antimicrobial susceptibility testing and we have compared the results with the European Committee on Antimicrobial Susceptibility Testing. Antimicrobial testing was done to see the presence of Shigella, Salmonella and other microorganisms. Through the testing we have observed some presence of coliforms and potential presence of disease-

causing microorganisms. Moreover, we have tested the results to see the resistance and susceptibility to the antibiotics. The antibiotics that are used in this study are listed below in table 3.

Tabell 3:Results from antibiotic testing

Column1	AP10	AK30	CTX30	T30	CIP 5	FOX30	A25	ATH15
HSC3	0	15	15	16	25	0	0	0
HSC4	0	0	20	16	0	0	0	0
HSC5	0	15	25	17	32	22	0	0
HSC6	0	15	11	8	19	0	0	18
STP4	0	15	20	14	16	8	0	0

Codes	Description
AP10	Ampiclin
AK30	Amikacin
CTX30	Cefotaxime
T30	Tetracyline
CIP5	Ciprofloxacin
FOX30	Cefoxitin
A25	Amoxicillin
ATH15	Azithromycin

Below on table 4, we have compared with the guidelines of the European Committee on Antimicrobial Susceptibility Testing.

Tabell 4::The comparison with guidelines of the European Committee on Antimicrobial Susceptibility Testing.

(S = Susceptibility, R=Resistant & I= Intermediate)

Antibiotes	AP10	AK30	CTX30	T30	CIP 5	FOX30	A25	ATH15
HSC3	R	R	R	S	R	R	R	R
HSC4	R	R	S	S	R	R	R	R
HSC5	R	R	S	S	S	S	R	R
HSC6	R	R	R	R	R	R	R	I
STP4	R	R	S	I	R	R	R	R

4. Recommendation

Recommendations for Improvement:

Based on the findings of the sanitary inspection, the following recommendations are made to improve the sanitary conditions in Maugani village:

Repair and Maintenance: Household pit latrines in need of repair should be promptly fixed to ensure proper sanitation facilities for all residents.

Solid Waste Management: Awareness campaigns should be conducted to educate residents about proper waste disposal methods and the importance of maintaining a clean environment. Regular waste collection and disposal should be ensured.

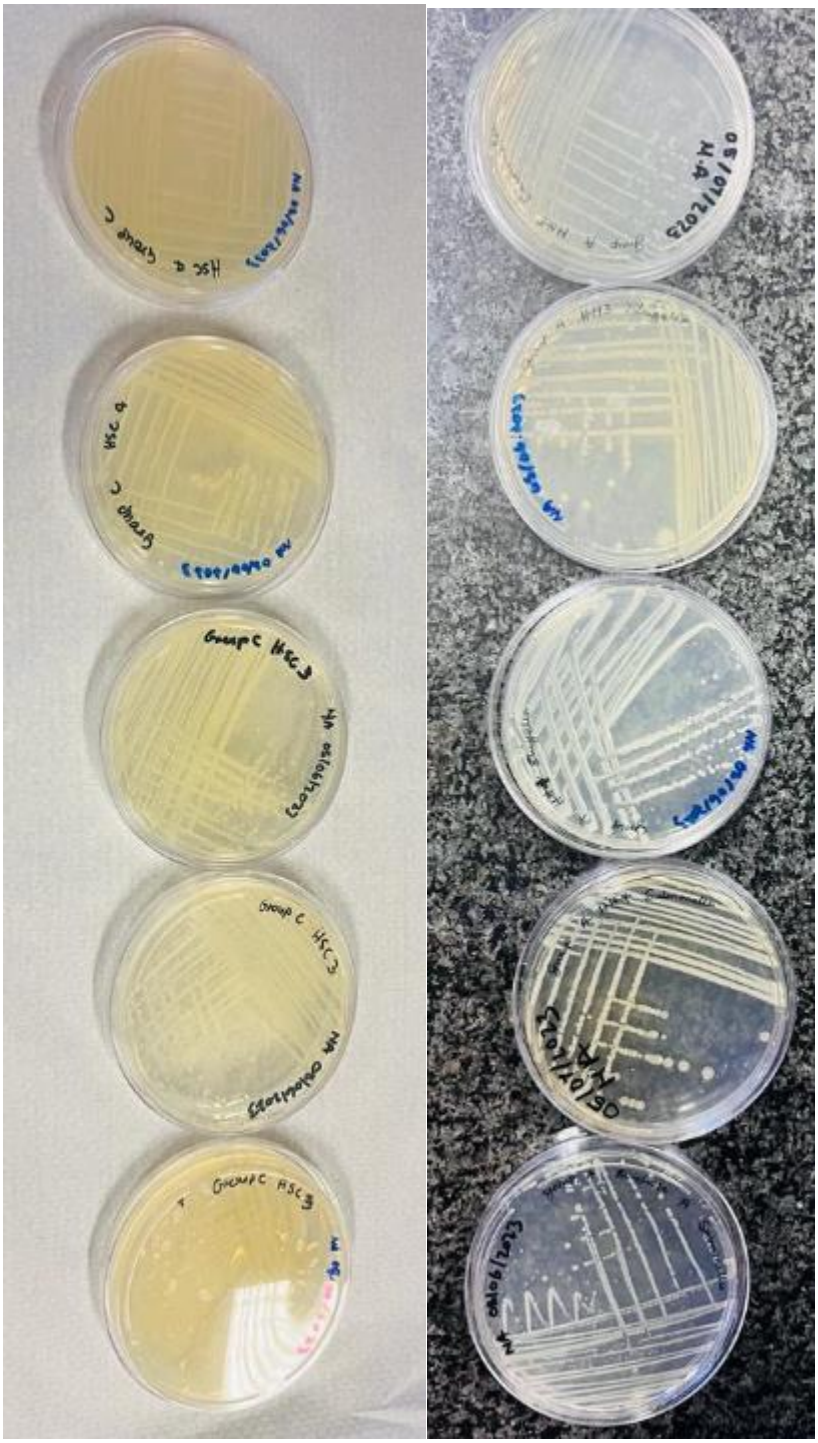
Hygiene Promotion: Continued promotion of good hygiene practices, such as handwashing with soap, should be encouraged among residents, particularly in schools and community gathering areas.

Monitoring and Compliance: Regular monitoring and follow-up inspections should be conducted to ensure that the recommended improvements are implemented and maintained.

By addressing these recommendations, the overall sanitary conditions in Maugani village can be improved, leading to better health outcomes and enhanced quality of life for its residents.

5. Appendix

5.1 E. coli Testing



5.2 Testing presence of microorganism

The development of yellow color represents Coliforms and potential presence of disease-causing microorganisms (e.g., The fluorescence of wells shows the presence of *E. coli*.

Reference

Hove, M., Tauro, T., & Hoko, Z. (2019). Rural Water Supply and Sanitation Challenges in Developing Countries: Case of Masvingo District, Zimbabwe. Journal of Sustainable Development, 12(1), 77-88. (Reference used for the statement about water quality in rural communities worldwide)

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