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Regional Water Development
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Hydro Water Engineering
Lilongwe

Dear Sir,

WATER QUALITY ASSESSMENT REPORT

1. INTRODUCTION

Hydro Water Engineering engaged Water Quality Services Division of the Regional Water Development Office (South) to assess the quality of water on 5 newly drilled boreholes in different villages under TA Nkagula in Zomba district. The assessment was conducted to determine the suitability of the boreholes for safe water supply guided by the Malawi Standards for Boreholes and Shallows (MS733:2005). This report provides findings of the assessment and offers recommendations in accordance with the

2. METHODOLOGY

The assessment utilised conventional scientific methods for water analysis, which included the collection of samples, laboratory testing, and analysis of the laboratory derived data.

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OFFICE (S)

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2.1. Samples collection

The water sampling process took place on 2nd September, 2026. Samples were collected from boreholes drilled at Manduwasa, Maliwata, Talandira, Mwala and Nsenda villages. Some field-based tests were done on each sampling site where physical water properties such as pH, Electrical conductivity and Total dissolved solids were measured. Following field activities, the samples were transported to a laboratory for more analyses. The sampling techniques were guided by the guidelines outlined in the Malawi standards for potable water sampling.

2.2. Samples Analysis

The examination of the samples centered on the testing of chemical and microbiological parameters, aiming to determine the suitability of the boreholes for water supply. Specifically, the scrutiny encompassed tests for various physical parameters, including pH, electrical conductivity, total dissolved solids, and turbidity. Chemical analyses were also carried out, focusing on carbonates, bicarbonates, sulphates, chlorides, nitrates, fluorides, sodium, potassium, calcium, magnesium, and

iron. On the microbiological water quality, focused on assessing the presence of Fecal coliforms as an indicator organism for contamination. furthermore; the analysis also involved the evaluation of physical water properties, specifically concentrating on pH, electrical conductivity and turbidity.

In order to ensure consistency and accuracy in the testing procedures, each test adhered to a standardized operational protocol. These protocols were derived from the guidelines articulated in the "Standard Methods for the Examination of Water and Wastewater, 21st Edition." This reference material serves as a comprehensive manual, furnishing detailed instructions and protocols for conducting tests pertinent to the assessment of water quality.

3. RESULTS AND DISCUSSIONS

The overall results show that all samples meet the National Standards for Boreholes and shallow Wells (MS733:2005) in terms of chemical, physical, and microbiological properties. Detailed results for each sample are included at the end of the report for further reference.

3.1. Physical Water Quality

pH values ranged from 6.83 to 7.22, all values were comfortably within the permissible range of 6.0–9.5. The highest pH was recorded at Manduwasa (7.22), while Nsenda had the lowest (6.83). Electrical conductivity ranged from 186 to 1,255 $\mu\text{S}/\text{cm}$, substantially below the maximum value of 3,500 $\mu\text{S}/\text{cm}$. Maliwata recorded the highest EC (1,255 $\mu\text{S}/\text{cm}$). Similarly, TDS ranged from 112 to 753 mg/L, with Maliwata having the highest concentration and Nsenda the lowest. Nevertheless, all sites were well below the 2,000 mg/L limit. Turbidity was measured low in all samples, with values falling within 0.25 to 2.30 NTU, compared with the maximum allowable value of 25 NTU. This indicates that the groundwater was generally clear and had low suspended particulate matter at the time of sampling.



3.2. Chemical Water Quality

The major chemical constituents were found at low to moderate concentrations and within the applicable MS 733:2005 limits. Chloride concentrations ranged from 11.7 to 41.4 mg/L, considerably below the standard of 750 mg/L. Sulphate concentrations were similarly low, ranging from 15.1 to 30.2 mg/L, compared with the limit of 800 mg/L. Nitrate concentrations were extremely low, ranging from 0.009 to 0.081 mg/L, against the standard of 45 mg/L. Bicarbonates results ranged from 63.1 to 231.6 mg/L. Although MS 733:2005 does not specify a limit for bicarbonate, the values are consistent with groundwater containing naturally occurring carbonate buffering. Carbonate was not detected in any of the samples also consistent with the pH values of less than 8.3 which does not favour carbonates formation.

Sodium concentrations ranged from 10 to 37 mg/L, well below the standard of 500 mg/L. Calcium ranged from 13.8 to 42.4 mg/L, compared with the limit of 250 mg/L, while magnesium ranged from 4.8 to 21.5 mg/L, against the limit of 200 mg/L. Iron concentrations were low at all sites, ranging from 0.073 to 0.190 mg/L, compared with the maximum allowable concentration of 3 mg/L. Although Nsenda had the highest iron concentration (0.190 mg/L), it remained far below the standard. Potassium concentrations were also low, ranging from 0.9 to 2.9 mg/L.

Total hardness ranged from 55 to 194 mg/L, with Maliwata having the highest hardness and Nsenda the lowest. Although the standard permits up to 800 mg/L, all results were substantially below this value. Based on these values, the groundwater can generally be described as soft to moderately hard. Total alkalinity ranged from 52

to 190 mg/L. The highest alkalinity occurred at Maliwata, corresponding with its relatively high bicarbonate concentration.

3.3. Microbiological Water Quality

Microbiological results were excellent across all five boreholes. Faecal coliforms were not detected in any sample, with all sites recording 0 counts/100 mL. This is substantially below the MS 733:2005 limit of 50 counts/100 mL. The absence of faecal coliforms indicates that there was no detectable faecal contamination at the time of sampling. From a microbiological perspective, all five boreholes therefore demonstrated satisfactory water quality. Nevertheless, continued sanitary protection of the boreholes and periodic microbiological monitoring remain important because groundwater can become contaminated through damaged infrastructure, poor drainage, or nearby sanitation facilities.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the findings and observations of the water quality assessment findings, the following recommendations have been drawn for consideration.

- The water quality assessment revealed that all boreholes under this assessment meet set standards for physical, Chemical and microbiological standards for water supply according to MS733:2005.



For: REGIONAL WATER DEVELOPMENT OFFICER(S)

LAB No.	26-345	26-348	MALAWI STANDARDS FOR BOREHOLES & SHALLOW WELLS (MS733:2005)
DATE SAMPLED	02/09/2026	02/09/2026	
DESCRIPTION	Manduwasu village BH, TA Nkagula, Zomba	Maliwata village BH, TA Nkagula, Zomba	
pH	7.22	7.15	6.0 – 9.5
CONDUCTIVITY ($\mu\text{S}/\text{cm}$)	696	1255	3500
TOTAL DISSOLVED SOLIDS, mg/L	418	753	2000
CARBONATE, mg/L	0	0	-
BICARBONATE, mg/L	165.5	231.6	-
CHLORIDE, mg/L	25.5	41.4	750
SULPHATE, mg/L	21.3	30.2	800
NITRATE, mg/L	0.034	0.081	45
SODIUM, mg/L	22	37	500
POTASSIUM, mg/L	1.8	2.9	-
CALCIUM, mg/L	29.47	42.4	250
MAGNESIUM, mg/L	15.86	21.5	200
IRON, mg/L	0.141	0.167	3
TOTAL HARDNESS, mg/L	139	194	800
TOTAL ALKALINITY, mg/L	136	190	-
TURBIDITY, NTU	1.2	0.25	25
F. Coliform, Count/100mL	0	0	50

LAB No.	26-349	26-350	MALAWI STANDARDS FOR BOREHOLES & SHALLOW WELLS (MS733:2005)
DATE SAMPLED	02/09/2026	02/09/2026	
DESCRIPTION	Makuluni village BH, TA Nkagula, Zomba	Mwala village BH, TA Nkagula, Zomba	
pH	7.14	7.09	6.0 – 9.5
CONDUCTIVITY (μ S/cm)	644	479	3500
TOTAL DISSOLVED SOLIDS, mg/L	386	287	2000
CARBONATE, mg/L	0	0	-
BICARBONATE, mg/L	170.4	105.8	-
CHLORIDE, mg/L	26.5	17.3	750
SULPHATE, mg/L	20.3	18	800
NITRATE, mg/L	0.009	0.028	45
SODIUM, mg/L	24	15	500
POTASSIUM, mg/L	1.5	1.3	-
CALCIUM, mg/L	29.2	20.8	250
MAGNESIUM, mg/L	17.3	9.3	200
IRON, mg/L	0.073	0.118	3
TOTAL HARDNESS, mg/L	144	90	800
TOTAL ALKALINITY, mg/L	140	87	-
TURBIDITY, NTU	2.30	1.40	25
F. Coliform, Count/100mL	0	0	50

LAB No.	26-351	MALAWI STANDARDS FOR BOREHOLES & SHALLOW WELLS (MS733:2005)
DATE SAMPLED	02/09/2026	
DESCRIPTION	Nsenda village BH, TA Nkagula, Zomba	
pH	6.83	6.0 – 9.5
CONDUCTIVITY (μ S/cm)	186	3500
TOTAL DISSOLVED SOLIDS, mg/L	112	2000
CARBONATE, mg/L	0	-
BICARBONATE, mg/L	63.1	-
CHLORIDE, mg/L	11.7	750
SULPHATE, mg/L	15.1	800
NITRATE, mg/L	0.015	45
SODIUM, mg/L	10	500
POTASSIUM, mg/L	0.9	-
CALCIUM, mg/L	13.8	250
MAGNESIUM, mg/L	4.8	200
IRON, mg/L	0.190	3
TOTAL HARDNESS, mg/L	55	800
TOTAL ALKALINITY, mg/L	52	-
TURBIDITY, NTU	1.2	25
F. Coliform, Count/100mL	0	50