KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

CE 378 - INTEGRATED DESIGN

Preliminary Technical Brief

Student Name: Frempong Owusu Obed

Index Number: 1706422

Group Number: group 31

Specialization: Water Supply Engineering

Lecturer: Dr. Jojo Ayeh

Declaration

I hereby declare that this work is my own and has not been copied or plagiarized from any source.

Signature: _____ **Date:** 26/06/2025

1. Introduction

This report outlines the initial findings and assessments related to the development of a water supply system for a community. It covers the identification of viable water sources, projection of water demand, and the design of key infrastructure components. The recommendations and designs reference standards from the Ghana Water Company Limited (GWCL), the Community Water and Sanitation Agency (CWSA), and the World Health Organization (WHO).

2. Assessment of Water Sources

2.1 Groundwater Sources

- **Boreholes**: Deep wells with mechanical pumps; suitable for stable groundwater reserves.
- **Hand-dug Wells**: Economical for shallow aquifers; require protection against contamination.
  Reference: CWSA Groundwater Development Guidelines (2014)

2.2 Surface Water Sources

- **Rivers and Streams**: Require proper filtration and disinfection.
- **Dams and Reservoirs**: Seasonally variable; must undergo treatment before distribution.
  Reference: WHO Drinking-Water Quality Standards (2017)

2.3 Rainwater Harvesting

- Functions as a supplementary source in areas with substantial rainfall.
  Reference: GWCL Rainwater Harvesting Guidelines (2020)

3. Projected Water Demand

3.1 Population Details

- Current population: 5,000
- Growth rate: 2% annually

- Planning period: 20 years

3.2 Per Capita Consumption

- Household use: 50 liters/person/day
- Public & commercial use: 10 liters/person/day
- Total: 60 liters/person/day
  Reference: CWSA Water Demand Estimation Manual (2018)

3.3 Total Demand Calculations

- **Present demand**:
  5,000 people × 60 lpcd = 300,000 liters/day (300 m^3/day)
- **Projected demand in 20 years**:
  ~7,500 people × 60 lpcd = 450,000 liters/day (450 m^3/day)

4. Proposed Water Supply Infrastructure

4.1 Water Extraction

- Mechanized borehole with electric pump (subject to feasibility).
- Surface water alternative with treatment facility.

4.2 Water Storage

- Elevated tank with 50,000-liter capacity to provide reserve during interruptions.

4.3 Distribution System

- Network of PVC/HDPE pipes, sized by flow demand.
- Control valves and system fittings included.

4.4 Water Purification

- Chlorination system for disinfection.
  Reference: GWCL Water Distribution Standards (2019)

5. Pipeline Network Design

5.1 Pipe Sizing

- Hydraulic calculations using Hazen-Williams formula.
- Main line: 100mm diameter
- Secondary lines: 50mm–75mm diameter

5.2 Network Configuration

- Looped pipe system for reliability.
- Isolation valves at key points for efficient maintenance.

5.3 Pressure Regulation

- Recommended pressure range: 15–60 m head
- Pressure-reducing valves (PRVs) to manage excess pressure.
  Reference: WHO Water Network Design Principles (2020)

6. Conclusions and Recommendations

- **Recommended Water Source**: Mechanized borehole (subject to geological verification).
- **System Design**: Elevated storage tank with a looped distribution network.
- **Next Steps**:
  - Conduct detailed geological and hydrogeological investigations.
  - Perform comprehensive water quality testing.

\

References

- CWSA (2014). *Groundwater Development Guidelines*.
- GWCL (2019). *Water Distribution Standards*.
- WHO (2017). *Drinking-Water Quality Standards*.
- GWCL (2020). *Rainwater Harvesting Guidelines*.
- CWSA (2018). *Water Demand Estimation Manual*.
- WHO (2020). *Water Network Design Principles*.