Terms of Reference
Water Supply Design Engineer- Lilongwe, MALAWI

MISSION LOCATION
Lilongwe, Malawi

DURATION
6-8 weeks

OPERATIONAL CONTEXT
As of March 2018 there were approximately 37,000 refugees in Malawi with some 500 new asylum-seekers from the Democratic Republic of the Congo arriving each month. Most of those of concern to UNHCR live in Dzaleka refugee camp, which has a population of nearly 34,000, near the capital Lilongwe. Water supply is provided by two primary means: Hand pumps and reticulated water supply systems.

Handpumps: There are 29 handpumps (Afridev type), with concrete apron, drainage channels, and laundry stations. During a site visit in March of 2018 two handpumps were observed to be non-functioning and had been replaced with new boreholes with handpumps (functionality rate of 93%). Drainage is one of the most critical issue at all the water points. This is mainly caused by the poor design of the drainage channels and the improper design and maintenance of soak pits. Another critical issue is that of encroachment on these water points by houses and the impact on water quality at the water points (i.e. location of latrines and drainage of greywater from the households).

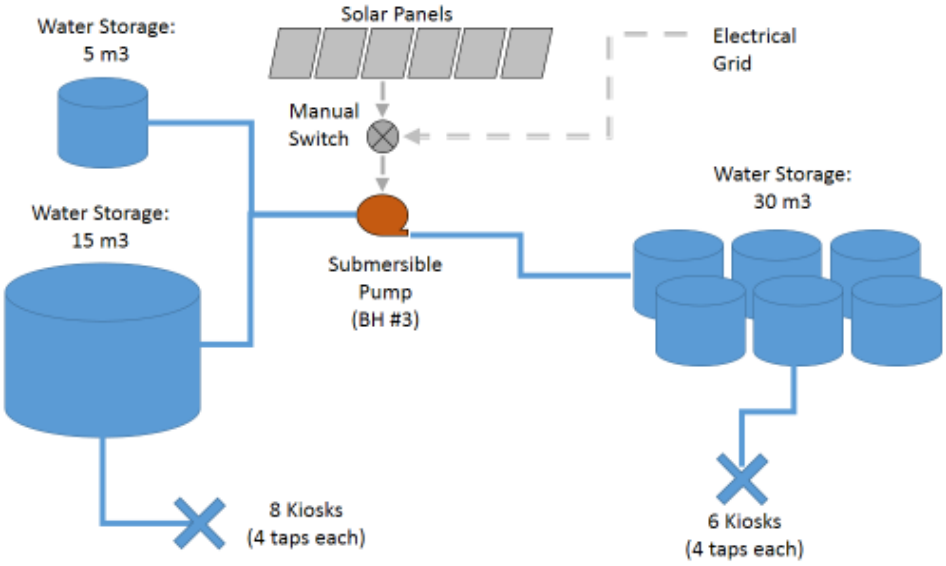
If considering the UNHCR standard of 1 handpump to 200-300 refugees, the 27 functioning handpumps would suffice to cover 8,100 refugees only with the remainder to be provided with water from the reticulated systems.

Reticulated Water Supply Systems
There are three reticulated water supply systems in the Dzaleka camp. These are connected to (at least) three boreholes :

The first borehole is located nearby the UNHCR offices and it is equipped with an electrical engine submersible pump, with a generator as a backup system. This borehole pumps water into a 5m3 elevated poly-ethylene (PE) tank and serves the UNHCR and JRS offices.

The second borehole is located at the secondary school and it is equipped with solar panels. The borehole pumps water into a 5m3 PE tank and distribute water into 2 faucets in the school only.

The third borehole is located at the distribution center. It is connected to a reticulated water supply system which distributes water via gravity to 15 water kiosks (each with 4 taps) located throughout the camp. Water is stored in three locations: a 5m3 poly-ethylene elevated tank located at the distribution center, a 15 m3 galvanized iron tank just south of the distribution center, and six 5 m3 poly-ethylene elevated tanks located in the Likuni 2 zone of the camp. The figure below has an overview of the system layout.



The borehole was drilled in 2013, and in 2015 a company (T&T Lilongwe) was contracted to install 25 solar panels with metal frames, provide and install a stainless steel submersible pump, and install 2.5km of pipes (GI and HDPE) for transmission and distribution for 15 kiosks . T&T was contacted and provided the following information:

- Submersible pump: GRUNDFOS SQ Flex 2.5-2N (Stewards and Lloyds of South Africa) with a pumping rate of 2300litres per hour @ 120m Head. Installed to a depth of 36m.
- Solar Panels: twelve 100 watt – 36 volt solar panels were installed
- Electrical control equipment: GRUNDFOS IO50 manual Control Gear was installed to regulate the supply of power from the Solar Panels to the submersible pump.
- Piping:
    - From pump to Storage Tank 50mm diameter HDPE Pipe (total length 245m)
    - 50 mm dia GI pipe where the pipe line is crossing the road and drains (total length 20m)
    - Distribution network 40mm diameter HDPE Pipe and reduced at the connections to Water Kiosks (total length unknown)

Existing information gaps:

- borehole design
- system hydraulic design
- geophysical or hydrogeological data
- pump test results

Note:
Additional 4 boreholes are currently drilled at Katubza, a new to be developed site extension in the most northern triangle of Dzaleka's public land boundary. One of the boreholes is planned to be fitted with a submersible – solar powered pump and to be used to further extend the reticulated water supply system to Katubza.
This design for this system will have to be included into the engineers TOR, subject to more detailed access to information from DWHH's deployed drilling Contractor.

MISSION OBJECTIVES

Work together with the UNHCR hydrogeologist (from HQ) and UNHCR-Malawi WASH Partners to conduct a detailed assessment of existing water supply infrastructure and produce a design for the rehabilitation and upgrading of system to meet UNHCR Standards.

EXPECTED OUTPUTS

The Water Supply System Engineer will be tasked to optimise the systems. This will include the following:

- Map of the proposed main water supply and water distribution network layout (1:2,500, A1 format and 1:5,000, A3 format), in AutoCAD (georeferenced file) or GIS and in PDF format
- Prepare technical drawings of hydraulic sub-components of the system, including technical specifications, BOQ, cost estimations and plumbing schematic (in AutoCAD). This should include drawings for all major components including: electromechanical equipment, water storage, water treatment, distribution networks, tab stands, laundry basins, etc.
- Financial analysis of the costs of water services including the capital investment costs, operation and maintenance costs, capital replacement costs, and support costs. This financial analysis should explicitly list what the expenditures will be in units of $/refugee served and $/cubic meter of water delivered. Priority should be given to systems which have the lowest life-cycle costs.
- Provide design parameters (in Word, Excel, EPANET, including calculations):
    - daily water demand calculations based on:
        - a minimum of 20 l/p/d
        - any institutional need for schools, health centres, feeding centre etc
        - a percentage increase (between 10% and 30%) for leakage and wastage
        - a daily peak factor (between 1.2 and 2) and
        - any other potential use other than domestic (for animals, bricks making etc) - upon request
    - daily water availability calculations
    - water distribution network peak flow calculations
    - main supply & water distribution optimal pipeline sizing calculations
    - pumps selection if required
    - water treatment calculation
    - water storage calculation
    - location of washouts, air valves, network isolation valves, manholes.
- All designs should be linked to national standards and UNHCR standards where appropriate. All designs should include a review/comparison of these standards and clearly state what standards were used in the final design with justifications as necessary.
- EPANET or other water supply scheme software (i.e. WaterCAD/WaterGEMS) raw data, parameters and modelling results
- Description of construction materials and workmanship specifications (in Word)

All relevant design materials will be handed over to UNHCR both on hard and soft copy, including:

- Soft copies of all data sets both quantitative and qualitative
- Clear explanation of the assumptions used for the calculations including relevant sources of information (materials strength, pricing, etc).
- The interpretation model and the graphical plot of the EPANET (or any other used software) piping scheme
- Calculations, specifications & drawings used during the course of the project execution

The technical drawings will be provided in AutoCAD (georeferenced file) or GIS and pdf format. All outputs should be developed in accordance to the principles as per the UNHCR WASH Manual available at wash.unhcr.org.

RESPONSIBILITIES

Under the supervision of UNHCRs Snr Programme Officer, the Water Supply System Engineer will be responsible for the following tasks:

- Identify, collate and review existing information on the water supply systems in Dzaleka Camp. This includes hardcopy and softcopy documents
- Work with UNHCR hydrogeologist to perform borehole inspection and pump testing of existing boreholes.
- Develop a map of the existing distribution network including a topographic assessment and physical inspection of the distribution network at various points. Use this information to create a hydraulic design for the system.

- Assess the current water storage capacity, including the size, location, material, etc of the water storage tanks.
- Assess the electromechanical equipment including but not limited to: submersible pump, switches, controls, photovoltaic generators, sensors, etc.
- Assess water distribution points and make required design improvements to ensure usability, durability, and adequate management of greywater
- Assess greywater and surface water management in the areas covered by the water supply system.
- Produce a design with a hybrid solar-grid powered system and which includes in-line chlorinators
- To produce designs in the required format which can be used for releasing construction tender.

PROFILE

University degree in Water / Civil /Mechanical Engineering. Advance training in water, sanitation or public health engineering will be preferable.

Experience:

Essential

- At least 8 years of progressively responsible functions in water / civil / mechanical engineering
- Proven experience in the design of water supply systems for towns or cities.
- Proven ability to deal with multiple tasks in a courteous and service-oriented manner in demanding working conditions that often have short deadlines.
- Proven technical expertise in the area of water supply area including survey, programme implementation, technical design, monitoring and coordination.
- Exposure to UNHCR mandate, its priorities and principles.

Desirable:

- Good understanding of integrated water resource management, water supply strategies and design.
- Applied knowledge in UNHCR programme management, project formulation, programme cycles and reporting standards.
- Previous exposure to UN sector approach, preferably both at the global policy level and at field implementation approach.
- Expertise in planning, formulation, implementation, monitoring and reporting on humanitarian operations.

Skills:

- Ability towards analytical and creative thinking for rapid solutions
- High ethical and professional standards
- Team player with service oriented attitudes.
- Proficiency in computer software such as water modelling software, GIS, AutoCad, EPANet, etc.

Languages:

- Excellent knowledge of English (written / oral / comprehension) is essential.
- Working knowledge of another UN language.