DFID Department for International Development

Terms of Reference

Engineering Management Services to Rehabilitate Freetown Water Supply, Sierra Leone

1 Background

At the United Nations (UN) International Ebola Recovery Conference in New York in July 2015 the UK pledged a total of £240m over the next two years (2016/17) to Sierra Leone. £130m was pledged to making adequate basic services available to all, particularly health, education and water.

The Rehabilitation of Freetown's Water Supply System project was approved by the Secretary of State for International Development in June 2016. The main elements of the proposed rehabilitation works have been identified by GVWC engineers with support from a DFID funded Technical Assistance programme. The Evidence on Demand 'Engineering Review Report' details the Works to be rehabilitated as part of the this project

The water supply to Freetown is in a critical situation. It relies principally on a single source, Guma Dam, which was built in the early 1960s, supplies only around half of the city's theoretical demand and is vulnerable to climate effects. Inadequate water from municipal systems forces the population to seek informal sources seriously increasing the hazards to health and the risk of disease.

2 Objective

The purpose of this Terms of Reference (TOR) is to seek an Engineering, Procurement and Construction contractor for the rehabilitation and construction of the proposed engineering works under the DFID funded Freetown Water Supply Rehabilitation project

3 Project Objective

The main objective of the project is to improve the water situation for the 600,000 people in the east of Freetown.

An Engineering, Procurement and Construction Contractor is needed to provide detailed design and construction services to deliver the project on behalf of the Government of Sierra Leone and to safeguard the use of UK Government funds.

Impact - The expected impact of the proposed programme will be to reduce morbidity and mortality rates associated with incidences of diarrhoea, malaria and other water-borne and vector-linked diseases.

Outcome - The expected outcome will be increased sustainable access to safe water in Freetown, the capital city. This will be achieved through rehabilitation of water infrastructure for improved public service delivery of water.

4 The Client

The Client for these services will be the Government of Sierra Leone (GoSL), specifically the Ministry of Water / Guma Valley Water Company (GVWC). DFID is the contracting authority for the Services. The citizens of Sierra Leone are the recipients of the Services described in the TOR.

5 Freetown Water Supply Network

Over 90% of the total water supply to Freetown is supplied from Guma Dam and the Guma Water Treatment Plant. A full description of the water supply network is provided at Annex A. In brief it consists of the following main components:

- Guma Dam
- Guma Water Treatment Works
- Transmission Line
- Distribution network – including the Bulk Transfer System and Water Service Reservoirs (WSR).
- Standalone water service reservoirs at Babadori and Kaningo.

Guma Dam is sized to provide water reliably to around 800,000 people and the current population is significantly higher than this, estimated to be approaching 2 million. Generally Guma Reservoir fills every year during the rainy season and gradually drains during the dry season. Reservoir 'Control Rules' dictate how much water can be abstracted depending upon the reservoir water level on any particular day. Over abstraction or a year with low rainfall creates a real risk of emptying the reservoir and leaving Freetown without any supply as occurred in 2006, with dire consequences. Further details regarding network complications and problems are provided at Annex B.

6 Overview of the Works

The Works require the detailed design, construction and commissioning of Nine works packages within the Freetown area. These are:

- **WP1. Rehabilitate bulk treatment facilities** and improve the reliability of the existing Guma Dam and Treatment Works. (PA1)
- **WP2. Construction of the Upper Sussex Diversion**. (PA1)
- **WP3. Rehabilitate the transmission system, remove the spaghetti connections and reduce supply pressures.** (PA2)
- **WP4. Rehabilitate the distribution network in the west of the city, extend the network reducing pressures and remove spaghetti connections.** (PA3)
- **WP5. Rehabilitate the distribution network – Pipelines.** (PA3)
- **WP6. Enhance the Allen Town water supply system in the east by upgrading Charlotte Weir.** (PA4)
- **WP7. Develop Kaningo water supply system (weir, treatment and pipeline facilities).** (PA5)
- **WP8. Enhance Babadori water supply system to increase supplies in the higher elevations of the city.** (PA6)

- **WP9. Enhance water supply to Wilberforce and surrounding communities by replacing old and dilapidated plant at Spur Road.** (PA8)

A preliminary feasibility study has been prepared and the report is attached at Annex C. The preliminary report includes estimated costings for all of the works and some preliminary designs for some of the works. All of the works packages require design development to detailed design.

7 Scope of Works

A Scope of works for each Works Package is provided at Annex D – Appendices 1-9.

The priority works in order of priority are: WP6, WP1, WP3, WP5

We expect the packages to be developed in parallel, with works commencing for individual packages once the respective designs are complete. Design work should start immediately upon contract commencement and the initial tranche of design work should be completed within the first three months. Construction should commence at the earliest opportunity once design has been completed, and we expect this to be during the next dry season. Procurement of materials for these works should take place in a timely manner in order to facilitate construction works. We are keen to identify opportunities to construct work prior to July 2017 if feasible – and this is aligned with the stated order of priority above.

8 Role of the Engineering, Procurement and Construction Contractor

Provide the client with a single point of responsibility, communication and coordination related to the rehabilitation and construction works. The EPC Contractor (EPC) will be expected to deliver, commission and handover a complete facility for each works package.

The EPC will take overall responsibility for detailed design and engineering, procurement and construction – including contract and construction management of the Works. The EPC will provide quality assurance and manage implementation risks, ensuring that the project is delivered on time, according to internationally recognised procurement and construction standards, and represents maximum value for money.

The EPC will have the financial, managerial, and technical skills as well as equipment and manpower resources (whether in-house or through subcontractor arrangements) to properly execute the entire project. As the Design and Build Contractor, the EPC obligations to the Client as Engineer are not to be compromised. The EPC is expected to adopt best practices in this model for proper execution of the works.

The EPC will manage the Works using an appropriate form of design and build construction contract (NEC, FIDIC or similar), to be agreed between the Client and the EPC before commencement of the contract. The EPC will procure the services of and manage construction contractors to implement the Works and will make payments to the contractors for completed Works.

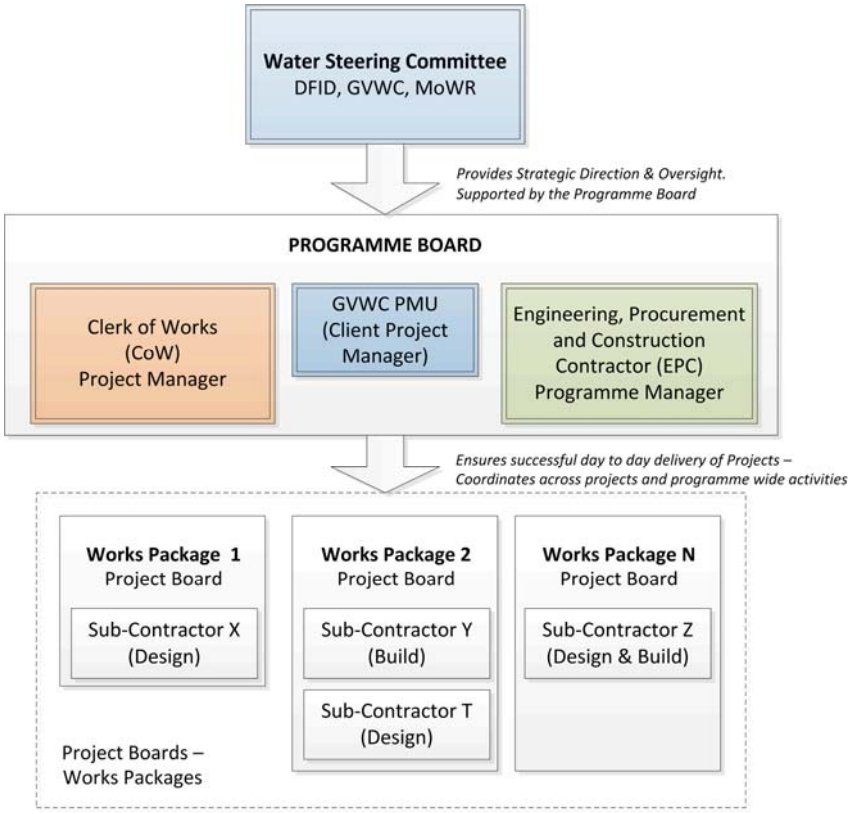
9 Project Governance

Strong project management and a clear governance structure will be key factors in the success of this project. The diagram below shows the proposed governance structure for the project.

The EPC will report directly to the Client through the Guma Valley Water Corporation (GVWC) Project Management Unit (PMU). A separately contracted Clerk of Works (CoW) will support the Client by fulfilling the Owner's Engineer role and providing additional oversight, advice consultant, supervision and assistance to the Client.

The EPC, GVWC PMU and CoW contractor will be expected to work in partnership with each other through the Programme Board.

The Client will be responsible for public consultations, provide access to the existing water supply system, and will be responsible for issuing construction permits and resolving any land and/or connection disputes prior to construction. The Client may also provide the EPC with pre-procured supplies and plant for specific work packages. The Client will inspect the rehabilitated works prior to payment.



Key components and roles of the governance structure include:

- **Water Steering Committee (Sponsoring Group)**. The Water Steering Committee provides the strategic direction for the programme. It is a joint DFID/GVWC Committee, comprising no more than two senior representatives of GVWC, two representatives of DFID and a representative of the Ministry of Water Resources. The Committee is the driving force behind the programme and provides the investment decision and top-level endorsement for the rationale and objectives of the programme.

- **GVWC Project Management Unit (PMU)**. The PMU is responsible for the day to day running of the programme on the Client side (GVWC and DFID), and will support the Water Steering Committee as required to ensure the programme continues to move forwards in the right direction. The Project Manager will be from the PMU.

- **Programme Board**. The primary purpose of the programme board is to drive the programme forward and delivers the outputs, outcome and objectives in an expeditious and

effective manner. The Board will oversee the day to day running of the programme and ensure coordination between the Programme components and cross-cutting activities. The Programme Board comprises of the GVWC Project Manager (PMU) and the senior representative from the CoW and EPC contractor. The Programme Board will coordinate and liaise with the Client – under the leadership of the Project Director. The Programme Board will meet at least monthly. The Programme board is accountable to the Water Steering Committee for project outputs and performance. In conjunction, with the Committee it will take remedial action where necessary to address any performance concerns which arise.

- **Project Boards**. Each works package will have a Project Board with a remit to focus on project related activities – i.e. the day-to-day running of projects.

10 Duties of the EPC Contractor

The EPC will primarily be responsible for:

Engineering

- Managing the project for the Client, with the intention of achieving the intended objectives;
- Reporting to the Client through weekly project progress meetings for the proper management and execution of the works;
- Reporting to the Water Steering Committee (through the Guma Project Management Unit) at each month on technical progress, budget execution, significant events and risks;
- Reviewing and checking compliance of all proposed construction work packages submitted to the Client for approval;
- Administering change control procedures and issuing and approving instructions such as variations, or relating making good defects and notifying the Client;
- Preparing environmental and social safeguards, including for any resettlement, disconnections and new connections to the rehabilitated system;
- Preparing detailed design drawings, specifications, bills of quantities and contract documentation for the works;
- Preparing detailed project implementation plans for each Works Package prior to construction.
- Preparing Programme Plan – incorporating the project implementation plans for each works package. The first version should be provided to the PMU within 2 weeks of contract signing.
- The EPC's programme manager will be a key member of the Programme Board and proactively engage and coordinate with other members of the Board to ensure effective day to day running of the overall programme.

Procurement

- Preparing the programme, method statements and risks schedule;
- Procuring plant, supplies, materials and equipment where appropriate;
- Procuring the services of contractors to constructing the works to acceptable quality standards;

Construction

- Managing the service of contractors to construct the works to acceptable quality standards
- Preparing and monitoring construction payment schedules;
- Managing risk including fraud and corruption from sub-contractors.
- Preparing and issuing variations, considering contractors' claims and resolving disputes;
- Ensuring health and safety during construction and minimal disruption to water supplies;

- Issuing works completion certificates, and evaluating invoices prior to payment;

Commissioning and Handover

- Managing project delays and correcting notified defects;
- Preparing as-built drawings and handing over the works to the Client;
- Preparing Process and Instrumentation Diagrams and handing over to the Client as part of the commissioning and handover process;
- Agreeing and commissioning testing procedures;
- Providing maintenance schedules for all installed equipment;
- Providing operation and maintenance training for the Client's staff for the rehabilitated works;
- Undertake commissioning in partnership with the Client's representative (GVWC Project Management Unit).
- Handover of construction and rehabilitation works to the Client.

11 Institutional Sustainability

The Millennium Challenge Corporation (MCC) have a $16 million, 5 year programme to provide institutional strengthening to GVWC. The programme covers:

- A System Condition Assessment;
- System mapping;
- System modelling;
- Pilot DMA and kiosk sales trials;
- General strengthening of GVWC functions;
- Support with Business Planning and tariff setting.

The MCC programme clearly complements the DFID interventions but raises a risk of overlaps in scope, duplication and programming conflicts which will need careful coordination if they are to be avoided. Other aspects such as those to support the pro-poor initiatives and connection policy are needed fairly urgently.

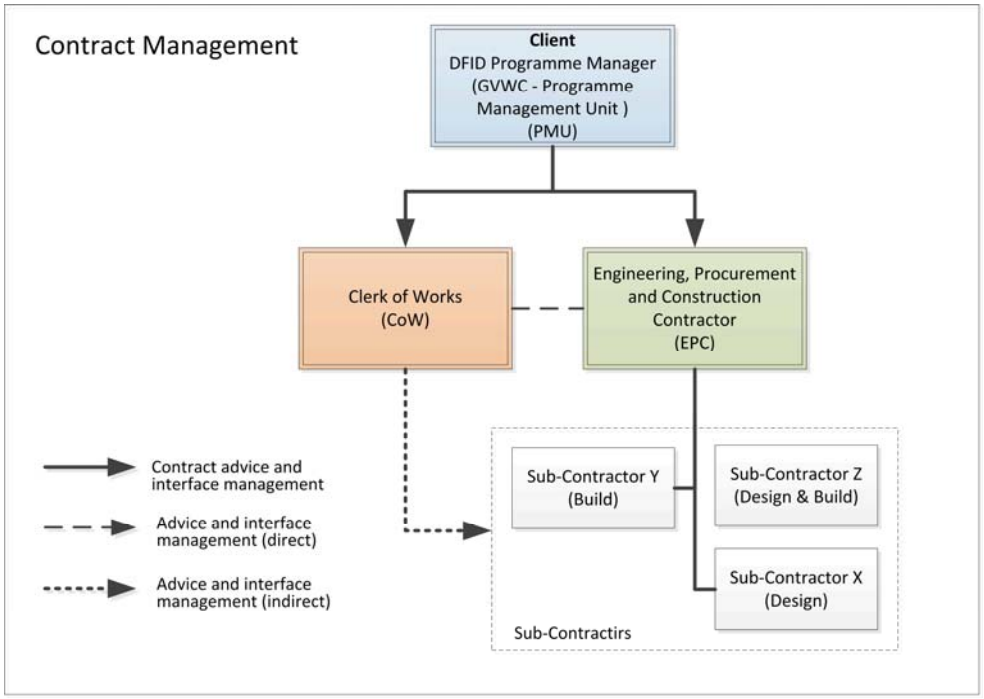
The EPC is to ensure that the processes, systems and works undertaken within the DFID project are aligned to those being developed through the MCC programme as much as possible. The MCC programme is not likely to start delivering an effect until Jan/Feb 2018. As such, whenever possible the EPC should identify lessons learnt to the MCC project team.

12 Contracting Strategy – Progressive Lump Sum

The diagram below illustrates the contracting strategy that will be used to deliver the overall programme and constituent works packages. Two contractors will work to the Client in order to deliver the programme:

- Engineering, Procurement and Construction Contractor (EPC) – formerly known as the Engineering Construction Manager (ECM)
- Clerk of Works – undertaking the role of Owners Engineer/Supervisor.

It is expected that the CoW will provide the resources necessary to ensure the Client can manage the project and deliver effective project and contract management.



The contract strategy recognises that there are currently shortfalls in the information available to successfully deliver the programme objectives. The shortfalls mainly being the level of front end engineering and design undertaken for each of the works packages. For this reason we have chosen to adopt a Progressive Lump Sum contract strategy which is illustrated in the schematic at Annex E.

Each works package will be separated into four pre-agreed stages:

- Stage 1 - Feasibility
- Stage 2 - Front End Engineering and Design
- Stage 3 - Detailed Design
- Stage 4 - Engineering, Procurement and Construction

We recognise that it is extremely difficult to provide a cost for the EPC works without having undertaken the necessary design work. For this reason, potential suppliers are asked to provide a cost for design work only and an indicative fee for the management of the works (Stage 3). Stages 1-3 are the Design phase.

Potential suppliers are expected to provide the following for each works package:

1. Design fees – stages 1-3
2. Design expenses – stages 1-3
3. Project Management Fee for Stage 4 - Engineering, Procurement and Construction.
4. Indicative Target Price for Stage 4.

Bidders are not expected to provide a cost for the construction elements of the EPC works.

Project Commencement

Following contract award, the budget for the total contract limit for the programme will be established, based on the Target Price of each Works Package set at the tender stage. It is expected that some but not all Works Packages will be undertaken concurrently. An estimate will be undertaken at the end of Project stage 1 (Feasibility) - for each works package. Following a process of review and value engineering, the Programme Board will reassess the Target Price (TP) for the Works Package. At the Programme level, this will be an iterative process as the target price for each works package is evolved.

At the end of Phase 2 (FEED) for each works package, the EPC will undertake a second estimate and the Programme Board will reassess the Target Price based on a second round of value engineering and reviews.

At the end of Phase 3 (Detailed Design) the EPC will undertake a third estimate, and following another round of value engineering and reviews, the Programme Board will agree and set a Guaranteed Maximum Price (GMP) for the Works Package – with an associated budget.

The Programme Board will seek approval for the GMP from the Water Steering Committee. Once approved, the EPC will deliver the works in line with the GMP and revised budget. The contract will be delivered on a Lump Sum basis with a gain/pain share mechanism incorporated alongside Key Performance Indicators (KPIs). KPIs will be used to enhance or reduce the gain/pain as appropriate. When the GMP has been established for all works packages the Total Project Cost will be established.

This is an iterative process that will allow the cost of EPC works to be developed incrementally with more precision because of increased project process and cost knowledge. Furthermore, the overall programme cost is progressively adjusted for variations and changes in scope and extent.

13 Budget

The provisional budget for the Works is up to GBP £37 million (including taxes). This budget will be managed directly by the EPC and it includes the costs of construction as well as the engineering contract management services provided by the EPC.

The EPC will be responsible for paying all duties associated with the import of equipment and supplies.

14 Timing

This assignment is scheduled to begin in January 2017 and will last for a maximum of **28 months**. Construction will take place predominantly during the dry season, between November and June. The construction works should be substantially completed by April 2018 and handed over to the Client by April 2019.

There will be an inception period of 3 months at the start of the assignment during which the EPC will mobilise team resources, confirm the scope of Works, prepare a Programme Plan, Project Implementation Plans, agree milestones and key performance indicators and agree the payment schedule with the Client.

15 Deliverables

The EPC will provide the necessary designs, specifications, bills of quantities, tender documents and contractual agreements to procure and construct the agreed Works. The EPC will provide regular progress and financial reports to the Client. On completion of the Works, the EPC will hand over to GVWC the rehabilitated infrastructure, along with complete as-built drawings and operation and maintenance manuals and schedules. The EPC will ensure that GVWC staff receive training in the operation and maintenance of the rehabilitated system.

16 Consultancy Structure

The EPC services will be provided by a commercial company with international experience of construction management, detailed design and construction of water treatment and water supply works. The EPC will have proven experience of procuring and installing plant, supplies and equipment for water utilities, and of contracting and managing the services of local sub-contractors. In addition to financial, managerial and technical engineering skills, the EPC will need to demonstrate competencies in environmental management, health and safety and public relations. Academic institutions are not eligible to apply for this contract.

The EPC will be expected to use national contractors where appropriate in order to improve the sustainability of the programme.

The EPC will consist of a core senior project management team, led by an internationally experienced team leader to represent the Client as Engineer, and a team of design engineers and construction supervisors to oversee and quality assure the implementation of the Works. The EPC will establish an office in the GUMA Valley Water Company Headquarters in Freetown and will work closely with the GVWC PMU and engineers assigned to oversee the project. The EPC will need to maintain the Client's interests as Engineer throughout construction of the works.

17 Reporting

The EPC contract will be awarded by the UK Department for International Development (DFID), on behalf of the GoSL. For contractual matters, the EPC will report to DFID's Senior Infrastructure Adviser, based in Freetown, who will also be a member of the Water Steering Committee.

The EPC will report directly to the Head of the Guma Valley Water Corporation PMU for all technical matters related to the design and construction of the rehabilitation works packages. It is envisaged that the EPC will present weekly progress updates to GVWC PMU. Progress reports will provide evidence of achievement against the work schedule and agreed milestones, variations in design and/or construction, issues arising for the period ahead and mitigating measures to manage risk

GVWC will monitor the EPC's performance and submit authorisation of payment for achievement of agreed milestones to DFID, who will pay the EPC directly. DFID will sit on the Water Steering Committee, which will arbitrate in case of disagreements and or changes to the EPC's scope of work.

The EPC will be produce and update an Exit Plan.

DFID requires Suppliers receiving and managing funds, to release open data on how this money is spent, in a common, standard, re-usable format and to require this level of information from immediate sub-contractors, sub-agencies and partners. It is a contractual requirement for all Suppliers to comply with this, and to ensure they have the appropriate tools to enable routine financial reporting, publishing of accurate data and providing evidence of this DFID – further IATI information is available from http://www.aidtransparency.net.

18 Special Conditions

The existing Freetown Water system (particularly the spaghetti network of service pipes) is in very poor condition and has been expanded in an uncontrolled manner. As such, the engineering review report does not provide a complete assessment of the condition of the

distribution network. Much of the detailed design work will only be possible once the EPC has mobilised and surveyed the supply areas in detail. The EPC will therefore need to be flexible in designing and contracting engineering solutions in these areas.

Similarly, due to uncontrolled population growth and physical planning in Freetown, there are widespread instances of domestic encroachment onto GVWC land and illegal connections into bulk transfer and distribution system. The EPC will need to liaise closely with the GVWC team in managing cases of re-settlement and disconnection.

19 Duty of Care

The EPC is responsible for ensuring that appropriate arrangements, processes and procedures are in place for their personnel, taking into account the environment they will be working in and the level of risk involved in delivery of the Contract.

The EPC is responsible for ensuring appropriate safety and security briefings for personnel working under this contract and ensuring that personnel register and receive briefing as outlined above. The EPC must ensure they (and their Personnel) are up to date with FCO travel advice to Sierra Leone. DFID will share available information with the EPC on security status and developments in-country where appropriate. A Duty of Care Risk Assessment Matrix for Sierra Leone is attached at annex F.

The EPC is responsible for all acts and omissions of their personnel and for the health, safety and security of such persons and their property. The provision of information by DFID shall not in any respect relieve the EPC from responsibility for its obligations under this Contract. Positive evaluation of proposals and award of this Contract (or any future Contract Amendments) is not an endorsement by DFID of the EPC's security arrangements". Note that the term "EPC's Personnel" is defined under the Contract as "any person instructed pursuant to this Contract to undertake any of the EPC's obligations under this Contract, including the EPC's employees, agents and sub-contractors.

The EPC will need to confirm that:

- They fully accept responsibility for Security and Duty of Care.
- They understand the potential risks and have the knowledge and experience to develop an effective risk plan.
- They have the capability to manage their Duty of Care responsibilities throughout the life of the contract.

Annexes:

A. Guma Water Supply – Network Description
B. Freetown Water Supply Complications
C. Atkins Engineering Report
D. Scope of Works – Works Packages

Appendix 1 – Works Package 1
Appendix 2 – Works Package 2
Appendix 3 – Works Package 3
Appendix 4 – Works Package 4
Appendix 5 – Works Package 5
Appendix 6 – Works Package 6
Appendix 7 – Works Package 7
Appendix 8 – Works Package 8

Appendix 9 – Works Package 9

E. Progressive Lump Sum Contract

F. Duty of Care assessment – Sierra Leone

Annex A
Guma Water Supply - Network Description

1 Guma Dam

The existing water supply to Freetown currently relies, to a large extent, on supplies from Guma Dam. Built in the mid 1960s Guma Dam is situated on the coast to the west of the Peninsula Mountains approximately 20 km from Freetown. Its catchment is high in the peninsular forest and is currently protected from development. The dam and treatment works are above 200m elevation, and supplies a deployable output of some 77 Mld. Yield, an increase from the original 69 Mld following the raising of the spillway and diversion of the Little Guma river in 2002. The capacity of the treatment works and transmission systems from Guma are higher at c 90 Mld which allows releases to be maintained above the deployable output of the dam, which have the potential to cause serious dry season shortages if not carefully managed.

2 Guma Water Treatment Plant

The works were initially constructed at the same time as the Guma Dam; the Stage 1 works was commissioned in 1965 with a capacity of 27 Ml/d. The plant was a conventional clarification/filtration/disinfection plant using eight conical upflow clarifiers and six filters. Electrical power was provided by routing the water from the dam through a turbine generator. The works was extended in 1973 and 1983 (Stages 2 and 3) with each extension having a capacity of 27 Ml/d, giving a total capacity of 81 Ml/d. The Stage 2 and 3 extensions both used Degremont pulsators for clarification and Aquazur T filters. There is a total of four pulsators and eight filters in Stages 2 and 3.

In 2000/2002 the Guma plant was extensively rehabilitated and modifications were made. The most significant modification was to convert the Stage 1 filters to Aquazur T filters, fitting them within the original filter structure. This resulted in six Aquazur T filters of a very similar filter area to the filters in Stages 2 and 3. Over 90% of the total water supply to Freetown is supplied from Guma WTP, effective operation of the system is therefore essential for effective water distribution throughout the Freetown area, and any prolonged failure would have immediate and far reaching consequences for public health.

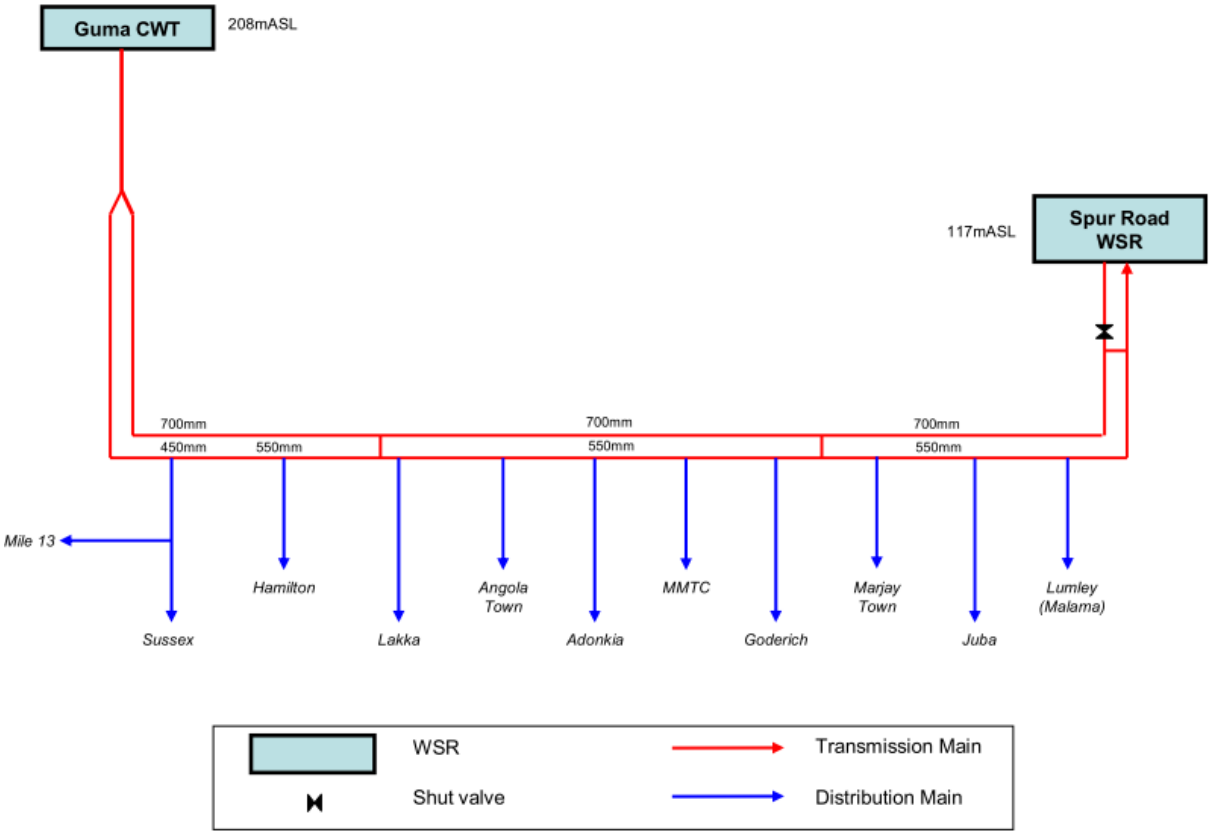
3 Transmission

The Guma transmission main system conveys water using gravity flow over a distance of approximately 16km from Guma Water Treatment Plant to the Spur Road Water Suppply Reservoirs (WSR). The transmission system comprises the original 550 mm steel main and a more recent 700 mm ductile iron main. The 550 mm main supplies the communities along the route of the main through a number of takeoffs from air valves and washouts. The mains are cross connected at 2 points along the route and at each end. The theoretical capacity of the pipes is in excess of 90 Mld.

Key elements of the transmission system are as follows:

- A single 800mm main leaves the Clear Water Tank at Guma WTP and runs for approximately 200m, as far as the main outlet meter house for the works. Just after the meter house, the main splits into parallel 450mm and 700mm mains.
- The 450mm main runs northwards for approximately 3.6km before increasing in diameter to 550mm and continuing as far as Spur Road WSR. There are 11 offtakes along the length of the 450/550mm main.

- The 700mm main then runs northwards as far as Spur Road WSR. There are no offtakes from the main, although it is cross-connected to the 450/550mm main at several locations. These cross-connections are non-functional with all cross-connections currently open.



Transmission System

4 Distribution System

The distribution system is divided into the low and high level areas.

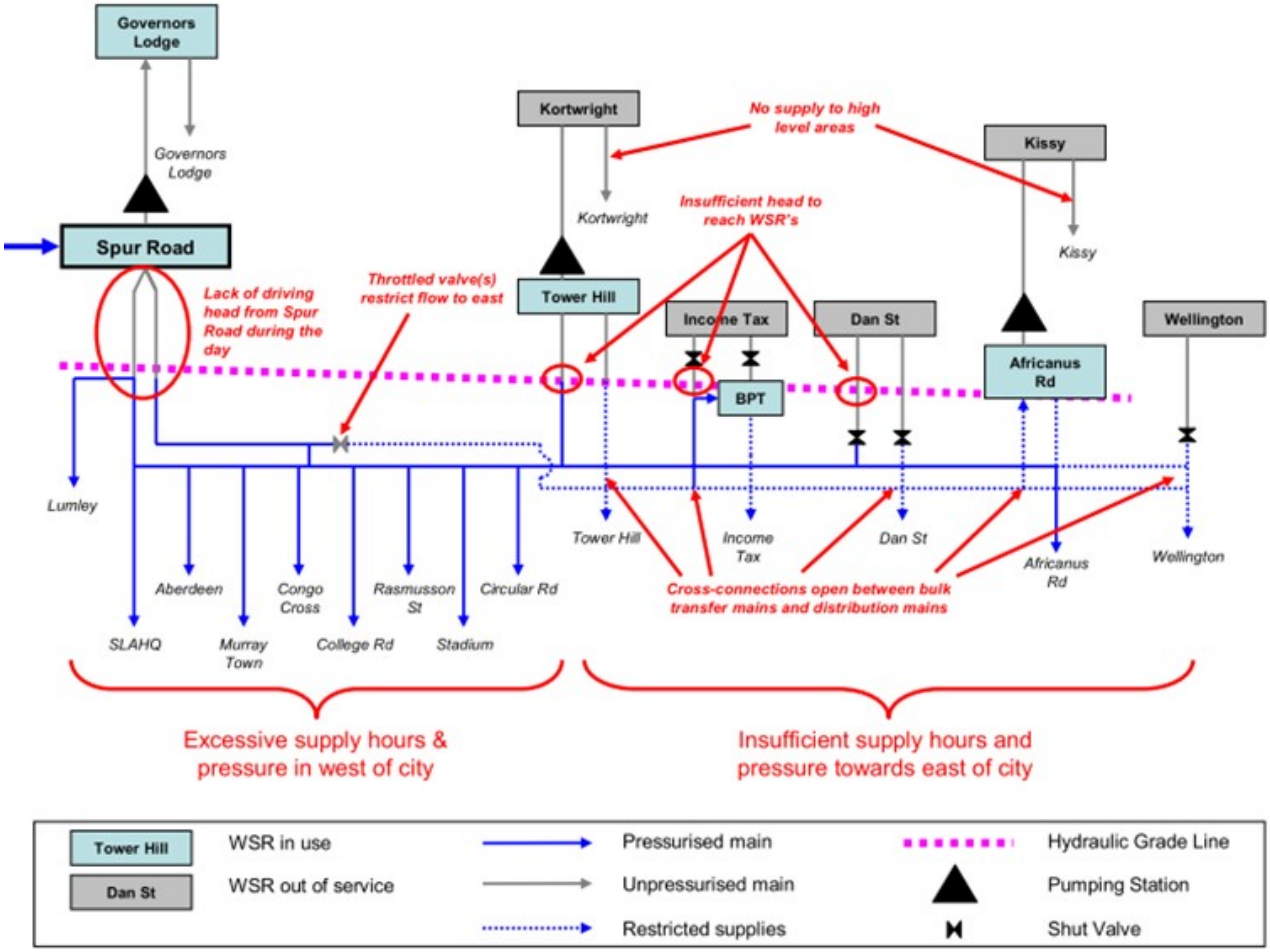
Low Zone

The low level system comprises primarily the water network at or below 100mOD and currently accounts for almost 90% of Freetown's demand. The low zone is fed by gravity from Spur Road reservoir, and incorporates the Bulk Transfer ystem, which runs as far east as Wellington WSR, as well as local distribution networks that are designed to be fed from the following Water Service Reservoirs: -

- Tower Hill
- Income Tax
- Dan Street
- Africanus Road
- Wellington

Unfortunately, the proposed Bulk Transfer System (BTS) conveying water from west to east through the city is cross connected into the zonal distribution systems, which prevent pressures in the BTS from building up to the level where water will fill the service reservoirs. Bulk Transfer System (BTS) was proposed to create a pipe system to convery water from west to east through

the city. The BTS is separate from the distribution network, and should feed water to each of the service reservoirs outlined above. Although there is insufficient water to meet the full demand of the city, using the BTS it would in theory be possible to equitably supply all parts of the network with water. Formal rationing would be required to overcome the supply demand deficit.



Unfortunately, although the mains were constructed, the system was never properly commissioned. Cross-connections between the distribution network and the bulk transfer system were opened preventing pressures in the BTS from building up to the level where water will fill the service reservoirs, and so the old supply problems were perpetuated.

High Zone

The high level system comprises the mountain region of the Freetown peninsula and it relies primarily on Babadori WTW for its limited supply – via gravity feed. The limited capacity of that source has now been supplemented by pumping systems principally from Spur Road to Governor's Lodge. Recent problems with power supplies have severely limited the pumping in recent times.

Secondary Distribution Network

The secondary distribution network comprises a mixture of formal network as well as a 'spaghetti' mains. The spaghetti lines are long surface-laid polythene spaghetti service pipes that connect properties to the network. As a result of a rapid increase in the population of Freetown during the last 10-15 years, and GVWC's shortage of working capital, the distribution network has not been expanded to keep pace with the city's development. A large percentage

of customers rely on stand-posts for their water; some 1300 exist throughout the city. Although mechanisms were in place to collect revenue from standposts these were abandoned some 5 years ago and water is now dispensed free with no control exercised over the standposts.

Annex B
Freetown Water Supply Complications

1 Overview

The eastern end of the city is particularly poorly supplied with water. High consumption and leakage in the better served western area uses a high proportion of the water before it reaches the city centre let alone the east. The BTS was designed to assist to overcome this deficiency and it needs to be reinstated as soon as practical. However, there is insufficient water to meet the demands of a 24 hour supply so some form of rationing must be adopted. Networks will also need to be expanded into unfed areas.

2 Guma Water Treatment Plant

Intake Tower

Several attempts have been made to seal the ground around the intake tower against the ingress of water, to date all have failed including resin grouting. Following the most recent attempt, contractor submitted a proposal backed by Sika products for sealing the tower but this was not adopted because the cost was considered excessive at some $350,000 – this proposal has not been located. However, the tower still leaks and corrosion to the ladder and platforms has rendered them unsafe and requiring replacement.

Plant Flow Metering

There is no functioning metering at the water treatment plant, flow control is done by ‘rules of thumb’ - a concern bearing in mind the importance of controlling reservoir draw-off. 3 new Endress Hauser electro-magnetic meters were purchased under the previous project but not installed, apparently because only the meters were supplied without the necessary flange adaptors and display units. These were for the inlet (2 nr) and outlet. The meters have been stored in the open since they were delivered so their condition is unknown. GVWC have been requested to move them to more protective storage.

Plant Structures

GVWC report problems with some of the launder channels and some filter floors. The filter floors have been problematic since the plant was constructed with leakage between (poorly) precast floor panels and clogging of the filter nozzles. It is difficult to assess the extent of the refurbishment currently required as inspections would require removing filters from service and excavating the media.

Electrical and Control Installations

The observed environment of electric pump/motors within the chemical dosing and stirrer area was of concern. Some pump/motors were not working. Hence we have recommended that all motors in this section be replaced. Regular cleaning of the chemical areas and improved extraction of fumes would also help. Hence new and extra extraction fans are included in the proposed works. The situation in the chlorine room was alarming - corrosion is serious in this room. The chlorine control panel was not functioning, the extractor fan exhibited evidence of extreme corrosion and there are numerous other electrical problems.

Scour Valve

A legacy problem remains from the last DFID project. New Larner-Johnson scour and guard valves were purchased from Blackhall Engineering in UK to replace the existing valves at Guma Dam that are leaking significantly, effectively reducing the deployable output from the dam. The valves were not installed due to the difficulties in sealing the scour pipe safely. Failure of the

scour system will empty the dam leaving Freetown with no formal water supply. Losses through the valves have increased significantly from the estimates made under the Atkins' study. It is now a matter of high priority to stop the leakage from the valves.

3 Transmission System

Current operation and condition of the Guma transmission main system falls well short of what would be required to deliver a satisfactory and equitable water supply to the Freetown area. Firstly, there is no flow metering in place on the transmission main system. Despite detailed data not being available, limited field testing carried out by Atkins in 2008 suggests that water losses between Guma WTP and Spur Road Reservoir are extremely high. Atkins estimated that "nearly 30% (25Ml/d) of the water leaving Guma WTP may not reach Spur Road WSR. Consumption of all types, including unauthorised, is considered to account for 8 Ml/d, suggesting that real losses could therefore be as high as 17 Ml/d". Anecdotal evidence would suggest that this situation has not improved since 2008.

Losses from the 550mm main should be highly visible as it runs above ground for almost its entire length between Guma WTP and Spur Road Reservoir. Two non-exhaustive drive-by inspections of the 550mm transmission main (carried out on 6th April and 8th May 2016) revealed no signs of leakage/seepage from the main (apart from 2 obvious bursts which were repaired on 7th April). The Atkins Report of 2008 came to a similar conclusion, stating that "little loss directly from this main was observed during the project". It therefore concluded that "the great majority of water loss directly from the transmission mains must occur on the 700mm main." Atkins noted that anecdotal evidence suggested "that construction of the final leg of the 700mm main to Spur Road WSR was poorly executed" and that "this may contribute to very high levels of water loss" on the transmission system. However GVWC noted that there is no evidence to support this, with the team saying they have never had an issue with any visible bursts or leakage on this section.

The loss of water between Guma WTP and Spur Road Reservoir appears to be as a result of the following:

- Losses on the distribution network (primarily the spaghettis) from the transmission main offtakes. The pressure at these offtakes is quite considerable in most circumstances. For example if the clear water tank at Guma WTP were full you would expect pressures in excess of 135m at the Sussex, Hamilton, Lakka Hospital and Angola Town offtakes and pressures of approximately 115m at Adonkia, MMTC and Goderich offtakes. Even with the mains exiting the CWT in Guma WTP not running full bore, Atkins found pressures at Sussex and Hamilton of 108m and at Lakka of 120m back in 2008. Most of the offtakes from the 550mm transmission main have had PRVs installed on them but it is understood that none of them are currently functioning/operational. These very high pressures no doubt contribute to significant losses and excess usage in the communities served from these offtakes.

- Loss from damaged valves on the cross connections is also a contributory factor. While bursts identified on the transmission mains are repaired by GVWC, they do not appear to have the expertise/equipment/materials necessary to fix more complicated problems on the cross-connections. Our field visit of 6th April revealed significant losses from 2 valves at either side of the cross-connection near Lakka (see Figure 7). From observation, the losses at this cross-connection are likely to be in excess of 4 litres/sec (350m3/day).

- It is also possible that leakage on the 700mm main as well as the buried section of the 550mm main, contributes notably to the overall losses between Guma WTP and Spur Road; however no data currently exist to support this theory, although one major leak was visible under the new road near to a bridge.

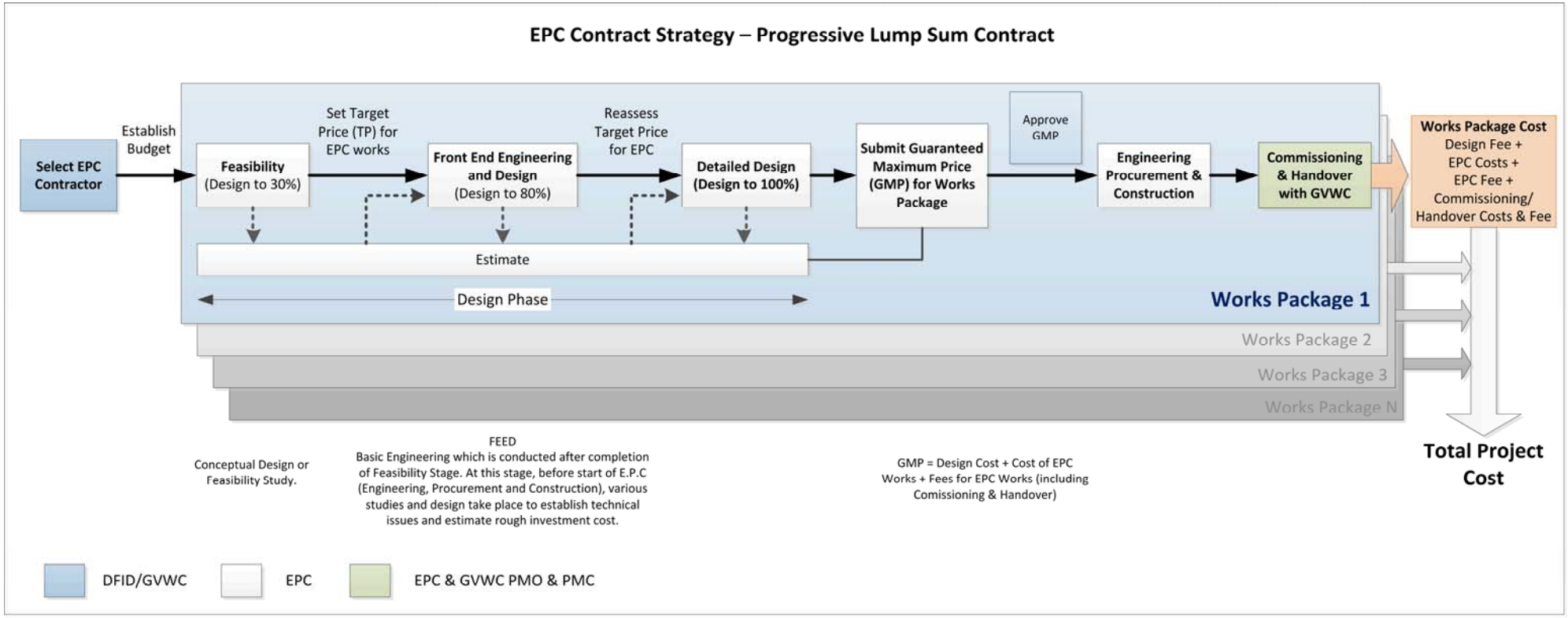
4 Distribution Network

Due to a severe lack of investment in the water network in recent years and rapid expansion of the city, the current distribution network is in very poor condition with high losses - estimated at round 50% of the water produced. Extensive use of long individual ‘spaghetti’ connections has occurred due to the lack of proper water mains and losses from such pipe are considerable and these pipes are vulnerable to damage and vandalism.

The Bulk Transfer System (BTS) but has never been operational. While operation of the BTS is dependent on operational procedures such as valve throttling and water rationing, it is made more difficult as a result of the significant leakage losses in the distribution (and transmission) network. Reducing leakage losses in the network should assist in raising the hydraulic gradient downstream of Spur Road and making more water available to supply to the east of the city.

The eastern end of the city is particularly poorly supplied with water. High consumption and leakage in the better served western area uses a high proportion of the water before it reaches the city centre let alone the east. The BTS was designed to assist to overcome this deficiency and it needs to be reinstated as soon as practical. However, there is insufficient water to meet the demands of a 24 hour supply so some form of rationing must be adopted. Networks will also need to be expanded into unfed areas.

Annex E – Progressive Lump Sum



Annex F - Duty Of Care Assessment DFID Sierra Leone

The supplier is responsible for the safety and well-being of their personnel (as defined in Section 2 of the Contract) and Third Parties affected by their activities under this contract, including appropriate security arrangements. They will also be responsible for the provision of suitable security arrangements for their domestic and business property.

All supplier personnel must register with their respective Embassies to ensure that they are included in emergency procedures.

The supplier is responsible for ensuring appropriate safety and security briefings for all of their personnel working under this contract and ensuring that their personnel register and receive briefing as outlined above. Travel advice is also available on the FCO website and the supplier must ensure they (and their personnel) are up to date with the latest position.

The supplier is responsible for ensuring that appropriate arrangements, processes and procedures are in place for their personnel, taking into account the environment they will be working in and the level of risk involved in delivery of the contract (such as working in dangerous, fragile and hostile environments etc.). The supplier must ensure their personnel receive the required level of training.

Suppliers must develop their Response on the basis of being fully responsible for Duty of Care in line with the details provided above and the initial risk assessment matrix prepared by DFID (see Annexes of this ToR). They must confirm in their Response that:

a. They fully accept responsibility for Security and Duty of Care.

b. They understand the potential risks and have the knowledge and expertise to develop an effective risk plan.

c. They have the capability to manage their Duty of Care responsibilities throughout the life of the contract.

If suppliers are unwilling or unable to accept responsibility for Security and Duty of Care as detailed above, your tender will be viewed as non-compliant and excluded from further evaluation.

Acceptance of responsibility must be supported with evidence of Duty of Care capability and DFID reserves the right to clarify any aspect of this evidence.

DFID Sierra Leone Summary Risk Assessment Matrix

Theme	DFID Risk score
Country/Region	**June 2016 assessment**
OVERALL RATING[1]	**3**
FCO travel advice	3
Host nation travel advice	N/A
Transportation	4
Security	3
Civil unrest	3
Violence/crime	3
Terrorism	2
War	1
Hurricane	1
Earthquake	1
Flood	2
Medical Services[2]	3

1 Very Low risk	2 Low risk	3 Med risk	**4** **High risk**	5 Very High risk

[1] The Overall Risk rating is calculated using the MODE function which determines the most frequently occurring value.

[2] In Freetown only. Outside of Freetown the risk rating is a 4

June 2016 assessment