**TERMS OF REFERENCE**

BUSINESS CASE DEVELOPMENT FOR WESTERN AREA PENINSULAR WATER FUND

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| **CONSULTATION** | Business Case Development for the Creation of a Water Fund for Western Area Peninsular |
| **LOCATION** | Home-based with travel to Western Area Peninsular, Sierra Leone |
| **PROVISIONAL START DATE** | As soon as possible |
| **ESTIMATED DURATION** | 6 months |

# Background

Catholic Relief Services (CRS) in partnership with the Nature Conservancy (TNC) through the *Replenish Africa Initiative* funding by the Coca Cola Foundation have initiated a programme aimed at improving drinking water and flood resilience for Freetown, Sierra Leone by promoting collective investment in nature-based solutions (NBS). In Freetown, as elsewhere, the lack of information of possible NBS solutions, their associated costs and beneficiaries’ needs are principal barriers for mainstreaming these investments (UNEP, 2014).

Freetown faces a myriads of water security challenges, including water shortages and flooding. The city is in the Western Area of the country and serves as Sierra Leone's major urban, economic, financial, cultural, educational and political center. The city perches on steep slopes on the north end of the anvil-shaped peninsula and is around 38 km long and 16 km wide with the city mainly occupying the northern and eastern areas. The peninsular has a very high annual rainfall –more than 4000 mm – and is characterized by a high surface runoff, particularly in the months of June to September. As the city grows, people are pushing into the Western Area Peninsula Forest Reserve (WAPRF) causing massive deforestation and degradation.

Considering the socio-economic importance of the WAPFR in the context of being the only fresh water source for the city and its environs, there is an urgent need to address the deforestation and degradation to safeguard water supply and build flood resilience for the city, not only for the current generation but for generations to come. To achieve this, effective mobilization of stakeholders is needed, including upstream and downstream communities as well as strengthening of governance and structures. This comes with investment needs which must be met through a well-structured collaboration of different stakeholders with interest in the sector.

A consortium bringing together CRS, Ministry of Water Resources (MoWR), Ministry of Agriculture and Forestry (MoAF, Ministry of Land and Housing (MoLH), National Water Resources Management Agency (NWRMA), National Protected Area Authority (NPAA), Environment Protection Agency (EPA), Guma Valley Water Company (GVWC), Freetown City Council (FCC), and Western Area Rural District Council (WARDC) have determined a need for cost-benefit analysis of possible NBS investment portfolios. CRS seeks to hire a contractor to complete this “Business Case” analysis. The analysis should include the following components and be based on an analytical framework developed by TNC (see Appendix, fig. 1).

# Section A: Western Area Peninsular Water Fund Business Case components

The contractor will assess projected catchment degradation of the Sierra Leonean Western Area Peninsula Forest Reserve (WAPRF) and the resulting effect on ecosystem functions related to water supply and flooding in the absence of a Water Fund (“business-as-usual [BAU] scenario”). Through stakeholder engagement, refine and assess a set of conservation measures to address water supply challenges (“Conservation scenario”). Compare the change in ecosystem function and resulting priority ecosystem services flows between “business as usual” and “conservation” scenarios. Assess the economic value associated with the differences in priority ecosystem services flows between the BAU and Conservation scenarios. Analyze the project finance cost of the conservation scenario over time. Compare benefits and costs of the Conservation scenario to quantify the present value (PV) return on investment (ROI), net benefits, and cost-effectiveness of the Conservation scenario.

## 1. Business as usual (BAU) scenario

1. *Land use/land cover (LULC)*
2. Analyze patterns and rates of change in land use and land cover (LULC) change compared with a somewhat recent reference time period (pre-1991, depending upon satellite image availability) across the WAPFR and buffer area and nearby urbanized areas. The scale of the analysis will be determined by the size of observed actual LULC changes during the reference period. Special focus will be on selected present and potential reservoirs for Freetown and Western Area Rural District.
3. Project future LULC changes thru the year 2050, based on i) extrapolation of observed changes since the reference period and ii) any expected future changes in relevant laws and regulations or their enforcement. Depending on the complexity of LULC change and the importance of adequately capturing the locations of future LULC changes for purposes of hydrologic (for analysis of impacts of LULC change on water yield or its timing or on water quality) or hydraulic modeling (for analysis of LULC changes in flooding or sediment generation), this will require remote sensing analysis, and may or may not require a formal modeling approach using specialized software (e.g., Land Change Modeler [LCM]).
4. *Priority ecosystem services flows*
5. *Identify a hydrologic/hydraulic modeling approach suitable to quantifying the effect of LULC changes on priority ecosystem services flows.*

Water **quality** (sediment concentrations at drinking water reservoirs and source water intakes); **supply** (volumetric storage capacity loss of water supply reservoirs); and **flooding** (inundation risk outside of WAPFR boundary). The modeling approach is determined by the temporal (annual, monthly, daily, or hourly) and spatial resolution (at specific points in the catchment) of model outputs required for the analysis of priority ecosystem services flows, as well as by model data needs and the extent to which they can be satisfied with available data or data that can be generated through field experiment during the duration of this project.

1. *Build, calibrate and test the hydrologic model*

Apply established minimum best-practice guidelines for hydrologic model development and evaluation (e.g., split-sample approach). Model performance on key outputs (e.g., discharge; TSS or total sediment load) should meet established criteria for at least fair model performance to ensure credibility of the overall ROI analysis.

1. *Run the hydrologic model on the BAU scenario to generate outputs of the priority ecosystem services flows in each scenario. Build the linked hydraulic and morphologic model*

The hydraulic model should be probabilistic in nature to accommodate different event sizes and their likelihood in any given year (return periods). For modeling of flooding, digital elevation models (DEMs) with a vertical resolution sufficiently high to reflect local morphological characteristics in the area of flood concern are needed (at least 1 m; preferably finer in densely-developed areas). The models should be run on return periods of 1, 5, 20, and 100 years . Model calibration should use available data from recent flood events (rainfall, flood footprints).

Model outputs must be generated for the specific locations at which ecosystem services are used (“beneficiary locations”) and hence generate economic benefits, and at the required temporal resolution to assess benefits (see point *a)* above).

* + 1. *Water supply during periods of concern*
    2. *Suspended sediment and sediment accumulation in reservoirs during periods of concern*
    3. *Flow volumes during periods of concern for flooding*

1. *Run the hydraulic model on the BAU scenario* *for each of the included recurrence intervals (event sizes) to assess the mean expected annual inundation area.*

Combine these outputs with current and projected future maps of building and infrastructure assets density of structures (residential homes; businesses; industry; schools; hospitals; transport and other infrastructure) to develop and estimate of the number of flooded structures (by type) in the BAU scenario*.*

## 2. Conservation scenario

1. *Evaluate potential conservation interventions*

Based on recent discussions with stakeholders in the Freetown area, the following conservation interventions proposed:

* + - * 1. Greenbelt in priority areas of WAPRF: extent of intervention: unit cost
        2. Park Guards training and resources: extent of intervention: unit cost
        3. Reforestation of degraded areas of WAPFR: extent of intervention: unit cost
        4. Alternative livelihoods to illegal charcoal, agriculture and marijuana production within WAPER: extent of intervention: unit costs
        5. Policy measure to curb issuance of land title within WAPFR: est. cost
        6. Education and communication campaign water value of WAPFR: est. costs
        7. Low Impact Development Designs for sediment capture. This would likely be the development of upstream wetlands, sand plugs or linear parks to protect reservoir capacity, improve water quality, and mitigate flooding

Prior to step B below, the contractor will meet with relevant stakeholders in the Freetown area to define the unit costs and relatively priority of these interventions for modeling purposes. This will also be an opportunity to identify alternative, conventional intervention options and have these validated by local stakeholders

1. *Select Conservation scenario intervention portfolio*

Using the integrated spatial model and intervention costs and subject to identified feasibility constraints (legal, political-institutional, social), identify priority intervention sites – those that, compared to the BAU scenario, would yield the highest avoided loss (or largest gain) in priority ecosystem services per unit cost. Using this cost-effectiveness selection criteria, select a Conservation scenario intervention portfolio subject to expected budget constraints.

1. *Run the integrated spatial models on the Conservation scenario to generate outputs of the priority ecosystem services flows* 
   1. Water supply during periods of concern
   2. Sediment deposition and suspended sediment during periods of concerns
   3. Flow volumes during periods of concern for flooding

Compare outputs with those under the BAU scenario to quantify changes in water supply and sediment between the two scenarios.

1. *Run the hydraulic/morphologic model*

Compare outputs with those under the BAU scenario to quantify changes in expected mean annual inundation area between the two scenarios, and differences in the expected mean number of structures (by type) flooded.

## 3. Cost of conservation scenario

1. Compile the total cost of the evaluated natural infrastructure interventions in watershed health. This total cost entails several discrete components: 1) the *implementation* *cost* incurred in the design and installation of interventions (e.g., of a riparian forest buffer, a flood retention wetland, or fencing, signage and enforcement mechanism for protected areas); in addition to design and installation costs, these implementation costs must include the typical overhead expenses associated with the respective installations, as well as typical management and maintenance costs associated with monitoring and maintaining interventions in good working condition, including replacement in case of loss or failure (e.g., replanting riparian vegetation after bank erosion events); 2) the *opportunity* *cost* landowners incur as a result of the interventions, which is the difference between the profits they realize under business-as-usual land management and under conservation management (e.g., annual profit losses if an area is converted from timber use or mining to forest conservation); 3) any incentive or compensation payments paid to land owners, managers or users, if applicable; and 4) the *transaction cost* (TAC) needed to bring about the change in land management (e.g., costs associated with landowner outreach; with drawing up, monitoring and enforcing agreements with land users or owners; dispute resolution; or with establishment and operation of any compensation schemes).

## 4. Return on Investment analysis of Conservation scenario/Water Fund

* 1. *Calculation of cost-effectiveness metrics*

1. *Single-objective cost-effectiveness metrics*

Assess the cost-effectiveness (units of target output per USD invested in Conservation scenario) of the Conservation scenario for each target output (cubic meter of additional water supply during times of scarcity; reduction in sediment concentrations in water abstracted directly by households and by the public utility; reduced number of flooded structures). This will result in one cost-effectiveness metric for each target outcome, with all Conservation scenario costs assigned to that outcome. These metrics are primarily of interest to evaluate whether conservation is cost-competitive with alternative, conventional solutions to provide a given target output, as it allows compare the cost-effectiveness of the Conservation scenario with that of a conventional alternative.

1. *Multi-objective (integrated) cost-effectiveness metrics*

For a more holistic, multi-objective comparison of the cost-effectiveness of the Conservation scenario with that of alternative, conventional solutions to water supply, sediment and flood challenges, multi-objective cost-effectiveness metrics are needed. These metrics permit comparison of the cost-effectiveness of the Conservation scenario in achieving the full suite of target outcomes, with the cost-effectiveness of a bundle of alternative, conventional interventions that provide this suite of target outcomes. Since the target outcomes have different units (cubic meter of additional water supply during times of scarcity; reduction in sediment concentrations in water abstracted directly by households and by the public utility; reduced number of flooded structures), no single cost-effectiveness metric can be calculated for a multi-objective intervention suite. Rather, individual cost-effectiveness metrics for each outcome are calculated by assigning a share of the total cost of the Conservation scenario to each of its target outcomes. One way of determining these shares is to base them on the relative costs of an alternative, conventional intervention portfolio that produces similar quantities of the suite of target outcomes (e.g., water storage infrastructure combined with sediment removal and floodwater retention infrastructure). Other rationales for deriving cost shares for target outcomes should be explored.

* 1. *Costs of alternative, conventional interventions*

Compile information on cost and output levels alternative, conventional projects that produce the target outcomes produced by the Conservation scenario: increased water supply during times of scarcity; reduced sediment concentrations in source water; and reduced number of flooded structures. Where possible, this information should be used to construct estimates of the costs of projects that are similar in target output levels as the Conservation scenario. In short, what would the least-costly conventional project cost that increases water supply during times of water scarcity by a similar amount as the Conservation scenario? What would the least-cost project cost that achieves a comparable sediment concentration reduction in source water? What would the least-costly comparable flood reduction project cost?

* 1. *Choice of discount rate*

Costs and benefits must be converted to their present value (PV) equivalents using appropriate discount rates. For private individuals and private companies, these rates should be based on the private rate of pure time preference (individuals) and the private cost of capital (companies), respectively. Public investments in long-lived conservation projects should be discounted using the long-term social discount rate.[[1]](#footnote-1)

## 5. Co-benefits of Conservation scenario/Water Fund

*Identify the additional benefits the Conservation scenario would provide above and beyond the target outcomes*, such as biodiversity, carbon sequestration and storage, or food security.

# Section B: Contractor Deliverables

The contractor will provide the following deliverables produced from the components of a Business Case described in Section A. The deliverables will require the approval of Catholic Relief Services and The Nature Conservancy. As such, a consultation meeting with will be required upon first showing of each milestone noted in the timeline. In some cases, these consultations will convene external strategic partners. The review process seeks to assure the quality of the products for the satisfaction of the final beneficiary.

Table 1, below, references the deliverables and timeline for receipt, review and adjustment. All days provided refer to working days (Monday – Friday, excluding holidays).

**Table 1.** Contractor deliverables and timeline of production

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| --- | --- | --- | --- | --- | --- |
| **Product** | **First Showing** | **Delivery of Draft** | **Review**  **Period** | **Adjustment Period** | **Final Delivery** |
| **First product**: Presentation, LULC model results and underlying assumptions  Description: present the land use land cover change results and projections to 2050 along with the underlying assumptions used to create the model | At day 12 | At day 14 | 5 days | 5 days | **At day 24** |
| **Second product:** Presentation, Proposed hydrologic, hydraulic, morphologic modeling approach  Description: present the proposed approaches used for the hydrologic, hydraulic, morphologic modeling | At day 20 | At day 25 | 5 days | 5 days | **At day 35** |
| **Third product:** Document, hydrologic, hydraulic, and morphologic models  Description: present the hydrologic, hydraulic, and morphologic models to be used to generate the BaU scenario to generate outputs for service flows; | At day 35 | At day 40 | 5 days | 5 days | **At day 50** |
| **Fourth product**: Document hydrologic, hydraulic, and mophologic model outputs for BaU Scenario  Description: hydrologic, hydraulic, and mophologic models on the BaU scenario to generate outputs of target service flows; BaU+ target outputs | n/a | At day 60 | 5 days | 5 days | **At day 70** |
| **Fifth product:** Document, unit cost of conservation interventions  Description: generate itemized list costing out potential interventions (total cost). | At day 45 | At day 60 | 5 days | 5 days | **At day 70** |
| **Sixth product**: Document, conservation intervention portfolio  Description: With input from CRS and TNC, produce a document listing the conservation intervention portfolio – and their costs – that will be used to generate a model of the conservation scenario | n/a | At day 75 | 5 days | 2 days | **At day 82** |
| **Seventh product:** Document, conservation scenario model & difference from BaU  Description: using conservation intervention portfolio, generate conservation scenario model output for priority ecosystem service flows and quantify changes b/w BaU and the conservation scenario; | n/a | At day 90 | 10 days | 10 days | **At day 110** |
| **Eighth product:** Document, preliminary ROI calculations  Description: produce a document summarizing single & multi-objective cost-effectiveness metrics. Explicitly state the cost and output levels of alternative, conventional interventions and the proposed discount rate.Summarize calculations and related uncertainty. | At day 122 | At day 127 | 5 days | 5 days | **At day 137** |
| **Ninth product:** Document, draft technical report  Description: report should be organized by components outlined in Section A, summarizing methodology & findings. Draft should be provided in editable format, e.g. Microsoft Word document. | At day 147 | At day 152 | 5 days | 10 days | **See Eleventh Product** |
| **Tenth product:** Document, draft executive summary  Description: executive summary should summarize methodology and main findings of the Business Case, including co-benefits. Draft provided in editable format, e.g. Microsoft Word document. | n/a | At day 152 | 5 days | 10 days | **See Eleventh Product** |
| **Eleventh product:** Document, presentation, final report & executive summary  Description: final report, presentation and executive summary will incorporate previous notes from TNC & WF Operational Team. Draft provided in pdf and editable format, e.g. Microsoft Word and Power Point |  |  |  |  | **At day 167** |
| **Twelfth product:** Hi-res JPEG & native files, visuals  Description: all final and native design files should be uploaded to the appropriate Box folder. TNC will pass this box folder along to the designer for the final business case report. | At day 147 | At day 152 | 5 days | 10 days | **At day 167** |
| **13th product:** Geodatabase  Description: contains all spatial data used, the inputs of the models and the resulting products. Must follow the technical criteria specified by TNC (Datum, Projection, Metadata). | n/a | At day 160 | 5 days | 5 days | **At day 170** |

# Section C: Additional information

## 1. Reporting and payment schedule

The consultant will report to Simon Okoth, Programme Manager for Urban Resilience at CRS Sierra Leone and work in close collaboration with CRS’ partners at The Nature Conservancy. The CRS regional technical advisor for Water, Environment and Sanitation will provide technical guidance as required.

The payment schedule is structured as 30:30:40% according to the following: (i) workplan submission and acceptance, (ii) conservation scenario model document submission and (iii) final report submission.

The consultancy is home-based with travel to Freetown, Sierra Leone as required. Meetings and surveys with key informants will take place in Freetown. CRS will provide round-trip flights in economy, lodging and logistic support for the time spent in Sierra Leone. However, the consultant is responsible for own vaccinations, travel insurance and medevac coverage.

## 2. Qualifications

Minimum qualifications for Business Case Consultant shall include:

- Master’s degree in Environmental Economics, Geography, Environmental Engineering, or related field.

- Proficient in GIS and hydrologic model development and evaluation

- Knowledge of conservation intervention costs

- Past experience developing Water Funds business cases and conducting Return on Investment analysis

- Experience working with a broad range of stakeholders

- Exceptional writer with expert command of English grammar

## 3. Application Procedure

If you meet the entry qualifications and are interested and available to undertake the consultancy assignment, please submit you application to Simon Okoth ([simon.okoth@crs.org](mailto:simon.okoth@crs.org)). Please include an Expression of Interest letter, CV, technical proposal (describing how deliverables in Section B will be produced) and an all-inclusive financial proposal detailing your professional fees and other miscellaneous consultancy costs for delivery the assignment. The selection process will be competitive.

CRS’ talent acquisition procedures reflect our commitment to protection children and vulnerable adults from abuse and exploitation.

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# Section C: APPENDIX

### ROI FRAMEWORK Figure 1. ROI framework for GI assessments (adapted from Kroeger et al., 2017)

### *Phases of Water Fund Development*

Water Funds are organizations that design and promote financial and governance mechanisms, articulating public, private and civil society stakeholders with the goal of contributing to water security and the sustainable management of a certain basin. Water Funds help strengthen the integrated management of water basins and the management of water resources, through the funding of conservation actions in the long term, such as reforestation, better agricultural and livestock practices, the protection of riverside areas, education, control and monitoring, studies relevant to water security and other actions. Furthermore, Water Funds provide useful tools to plan and identify solutions to tackle climate change.

The general phases of the Water Fund approach are:

1. **Feasibility.** This phase assesses the eligibility of an area for a Water Fund by quickly and efficiently determining if there are water security challenges in a certain area or region, as well as the potential for a Water Fund to help address these challenges. If this potential exists, at this stage, feasibility is assessed (understanding the situation more deeply) and, in general, how a Water Fund could make a positive contribution to Water Security in a certain area/region is determined.
2. **Design.** In this phase, a Water Fund is designed to be used as a platform for regional collective action, where stakeholders from all sectors can gather, coordinate and collaborate to help improve water security through a systemic change based on science. The two main objectives of this phase are:
   1. Having a convincing and actionable Strategic Plan that articulates how the Water Fund will contribute to improving water security in the region;
   2. Having leaders (Director, Council/Trustees and advisors of the Water Fund) committed to the strategy and plans for the Water Fund, with sufficient support from critical/priority stakeholders, donors/investors, and resources and/or commitments to move the Water Fund towards the Creation and Operational phases.
3. **Creation.** The Water Fund is prepared for operation and the institution is officially launched.
4. **Operation.** An operational Water Fund seeks stability in this phase, by developing/implementing a comprehensive work plan that guides the systematic execution of activities, measurement, assessment and communication of progress (towards predefined objectives for the Water Fund) and continuous improvement through corrective actions, refinements and innovation.
5. **Consolidation - Maturity.** This fifth phase is a continuation of the previous one, with a focus on ensuring the long-term viability of the Water Fund to create a lasting and significant impact with a positive contribution to water security.

1. A recent study estimates the long-term social discount rate for Sierra Leone at 3.99 percent. See Kottchen, M. et al., (2019), Even the representative agent must die: Using demographics to inform long-term social discount rates. *Journal of the Association of Environmental and Resource Economists* <https://www.journals.uchicago.edu/doi/pdfplus/10.1086/706885> [↑](#footnote-ref-1)