Section IV: Schedule of Requirements
Annex – A

Requirement Definition/Terms of Reference

Makroyan Waste Water Treatment Plant Expansion and Rehabilitation Feasibility Study
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List of Acronyms

WWTP: Waste Water Treatment Plant
UNOPS: United Nations Office for Project Services
KM: Kabul Municipality
1. Background

The United Nations Office for Project Services has received funds from the government of Japan for enhancing energy supply and energy security in Afghanistan through Renewable Energy (REN) Solutions. The project will be implemented by UNOPS on behalf of the government of Japan and the Client which is the Kabul municipality.

As part of the project objectives of renewable energy for urban population, the project is aimed to hire a consultant to conduct the Feasibility study for the Makroyan Waste Water Treatment Plant Expansion and Rehabilitation.

The over 30-year war has affected people in Afghanistan. Due to the long-lastted conflict, Afghanistan has been politically and economically unstable and people have been displaced. Afghan people today have a limited access to education and very less employment opportunities and face insecurity, corruption and environmental deterioration. However, Afghanistan Government has played a very minor role in protecting environment especially in highly populated capital city Kabul.

The Kabul Municipality struggles with a fast growing population of approximately 4 million persons. It largely exceeds the original capacity of the city’s planning and infrastructures. A prime example of this neglect is the poor state of the Kabul River, which crosses the city center, and at times resembles an open air sewage. In most places of the city sewage is inexistent. The carts collection and carriage system used traditionally to collect human waste for use as fertilizer in the peripheral agricultural fields has been replaced by a system of tanker trucks which collect blackwater and sludge from pits and septic tanks and transport it to different destinations. Some of it is treated as solid waste and dumped in the landfill, some of it is treated as agricultural fertilizer and given or sold to farmers, and some of it is brought to the Makroyan Waste water treatment facility where joins the sludge issued from from the waste water process, apparently for sun drying.

Kabul however disposes of a series of apartment buildings constructed by the Russians. The largest of such urban development is called Makroyan. At the time of building, these Russian-constructed buildings were modern and of comfortable standards. To this date, they remain fairly sought-after as accommodation apartments due their central location, the spacious and luminous apartments surrounded by trees and public green areas, and the availability of modern facilities such as running water.

This urban development covers an area of approximately 154 ha and is composed of approximately 250 buildings. Most of these are apartment blocks but there are also schools, restaurants and one ministry building. The estimated population of Makroyan is between 65,000 and 100,000 persons.

Makroyan is one of the very few Kabul neighborhoods equipped with both a sewage collection system and of a waste water treatment plant (WWTP).
2. Justification of engagement

The Makroyan WWTP facility was built in the 1970s. It is adjacent to the Kabul River and occupies an area of 5.5 hectare. The facility comprises two distinct waste water treatment plants:

- the old plant with an estimated capacity of 6,000 m³/day and
- the new plant with an estimated capacity of 12,000 m³/day

The facility is connected to the Makroyan sewage collection system via two pumping stations. It receives its sewage water through two pipes of 300 mm diameter.

The plant is also increasingly receiving blackwater (or sludge) originating from other neighborhoods and delivered by individual tanker trucks. In theory, this blackwater is also treated by the plants. However we are not sure what exactly happens in practice, and to what extent sanitary and ecological standards are implemented.

The plants include a number of pits, ponds, basins and lagoons which appear to work in series and seem to ensure water decontamination in different steps. The plants also have vanes, pumps and piping systems which originate from the soviet days and may not all be in working order. The old plant has some sedimentation ponds followed by trickling bed filter on rocks. The new plant seems to have a grit-removal step followed by a sedimentation step with aeration, and then followed by a sand filter and a chlorination step. The plant does not appear to be working optimally. Some pumps are out of service, certain pipes are broken and require replacement or maintenance, and the chlorine manufacturing facility is also not operational. The sand filters in the new plant seem to be clogged and full of sediments to the 6m deep edge. Sediments seem to be removed manually from the primary deposition ponds and dumped to the street outside of the plant.
In addition, due to deterioration, lack of maintenance, broken parts, the plant does not function effectively. It does not appear to accomplish fully its purpose of decontaminating water prior to rejection to the environment.

Furthermore, it is observed that outside operators dump liquid waste and polluted waters at the facility either at the beginning or at the end of the water treatment process. This latter situation would contaminate water, the plant might have managed to treat.

Finally, the current dumping situation seriously pollutes the environment and prevents from any valorization of the waste water sludge whether through manufacture of biogas or as agricultural fertilizer.

In order to improve the environmental impact of this plant, as well as to identify avenues to valorize the waste water flows, we undertake this study to identify the best way(s) to improve the quality of the water treatment whilst simultaneously valorizing it.

3. Location Details

The study will centralize in the Makroyan WWTP. Its coordinates are:

Latitude: 34°32'7.68"N  
Longitude: 69°13'15.07"E

However, investigation of the tanker flow of waste water fluxes will certainly take Consultants to several other locations in and around the city of Kabul.
4. Objectives

4.1. General Objective
The objective of this study is to explore options for improving within the next five years the Kabul water basin environmental sustainability and ecological situation, through bettering sewage waste water treatment practices, and including recycling and valorization of their sub-products.

The United Nations Office for Project Services (UNOPS) is now looking for suitably qualified and experienced company (hereinafter referred to as “Consultant”) toward conducting the subject feasibility study and to propose the best solution with different options to upgrade the system.

4.2. Immediate objective(s)
In order to promote and encourage more sustainable waste water treatment practices for the Kabul Municipality and for the public at large, upgrade and modernization of the Makroyan WWTP facility will be assessed including energy optimization, biogas production, and nutrient recycling.

The study will also investigate the existing tanker-based waste water processes for the Kabul city at large and advise options to secure the triple aims of more eco-friendly effluents, production of bio-energy carriers, and production of a sanitized agricultural fertilizer flow.

A standard WWTP will be designed and costed in the existing area to solve the existing problems which exists in the site.

5. Outputs and reports
To complete a detailed feasibility study report for the Kabul Municipality/ Makroyan Technical Department on rehabilitation or replacement of the Makroyan Waste Water Treatment Plant including generation of biogas and sanitized fertilizer, cost estimates, analysis of environmental aspects, socioeconomic benefits and recommendations including on management of the external black water inflows.

The Consultant will deliver the following outputs:

1. Inception report
2. Regulatory Analysis Report, and exhaustive analysis of the Kabul City tanker transported waste waters report
3. Analysis and report of Kabul city tanker-based wastewater fluxes
4. Review of Existing Technical Conditions and Operations of the Plant report
5. Feasibility study of Rehabilitation and optimization plan of the current facility
6. Design of a standardized WWTP facility adapted to the requirements of Kabul city
7. Report on Carbon Credit Analysis
8. Development and Environmental Impact Analysis
9. Final report
6. Activities

Activities include the following tasks:

- Task 1 - Inception meeting and report
- Task 2 - Regulatory Analysis
- Task 3: Analysis of Kabul wide tanker-based sewage and wastewater fluxes
- Task 4 - Review Existing Technical Conditions and Operations of the Plant
- Task 5 - Rehabilitation and optimization plan of the current facility, including:
  - Task 5.1 - Rehabilitation and repair of the facilities
  - Task 5.2 Extension of the current facility to absorb and treat tanker sewage inflows
  - Task 5.3 - Incorporation of a biomass digester / biogas production into the existing plant
  - Task 5.4 - Production of sanitized fertilizer for agricultural usage
- Task 6 - Design of an alternative WWTP which will be suitable to implement it in the existing area to solve the exist problem
- Task 7 - Carbon Credit Analysis
- Task 8 - Development and Environmental Impact Analysis
- Task 9 - Final report

Task 1: Inception Meeting and Report

The Consultant shall meet with UNOPS to discuss methodologies for the Study, establish professional working relationships and agree with reporting schedule. The Consultant will visit the site, obtain copies of available information, and arrange for field data collection as needed.

Deliverable: Following the above-referenced meeting, the Consultant shall prepare an Inception Report for the Study, documenting attendance at the meeting, topics discussed, future action plans, and other information gained from discussions.

Task 2: Regulatory Analysis

The Consultant shall:

1. Collect all relevant national and local legislation in vigor, and make a summary report on the findings;
   Use the findings on the design of both the rehabilitation and the new plant projects.

Task 3: Analysis of tanker-based wastewater processes at the Kabul city scale

The Consultant shall conduct an investigation of the existing tanker-based wastewater flows and operations in the city of Kabul.

As part of this investigation, the Consultant shall complete the following activities:

Collect data on:

- Number of companies operating tankers
- Number of trucks in operation
- Neighbourhoods of operation per company
- Number of clients
- Volumes handled per day / year
• Number of employed persons
• Places (locations) where the waste is disposed of
• Composition of the waste waters handled, and sanitary condition
• Environmental and social impact notice of these activities
• Make a Statistical analysis of the above,
• Produce a Map of the city with circuits, disposal places,
• Realize the Value chain of the process(es)
• Report providing analysis and recommendations for potential improvement

**Task 4: Review Existing Technical Conditions and Operations of the Plant**

The Consultant shall conduct a detailed technical evaluation of the existing Makroyan WWTP.

As part of the technical assessment, the Consultant shall complete the following activities after visiting the facility site:

• Collect data for the two existing plants.
• Collect plant layout schematics, or draw them if these were not unavailable.
• Collect plant history
• Collect lab water testing records (inflows and effluents) for the above-mentioned years by a certify lab
• Verify the accuracy of the lab water testing
• Assess if the plant been designed appropriately
• Estimate the plant original capacity and performance
• Estimate the current plant capacity and performance
• Estimate efficiency of the technical equipment
• Evaluate of the plant is operated correctly
• Assess if the plant has been regularly and properly maintained
• Assess if synergies within the plant are being exploited
• Investigate if synergies with surrounding industries could be exploited or created
• Determine any malfunctioning plant components.
• Identify any broken equipment that needs replacement
• Identify dysfunctional processes in the plant’s operation
• Identify energy inefficient equipment that deserves replacement.
• Conduct an energy audit of existing operations.
• Model the existing plant process diagram
• Find the maximum capacity of the WWTP
• Future expansion of the plant
• Assess the possibility of other connection other than Macrorayan

All of the above activities shall be documented in writing and later included in the Final Report.
Task 5: Rehabilitation and Optimization Plan of the Current Facility

UNOPS would like to understand the viability and cost implications rehabilitating the current WWTP. To this aim the Consultant should:

Task 5.1: Rehabilitation and repair
- Estimate the cost of replacing all malfunctioning equipment with an applicable WWTP system which should be possible to operate in Afghanistan.
- Estimate the cost and viability of cleaning and repairing all the malfunctioning components,
- Recommend improvements to existing operations modalities and processes,
- Model the revised plant process diagram,
- Prepare Project budget and implementation timeline.

Task 5.2: Extension of the Current Facility to absorb and treat tanker Inflows

The Makroyan WWTP was initially designed to treat exclusively sewage water originating from the Makroyan apartment complex, which is delivered to the plant through two (2) sewage pipes. However, the plant is also increasingly receiving black water originating from other neighborhoods and delivered by individual tanker trucks. Given that the model of individual septic tanks is dominant in Kabul and the population growth is accelerated - as well as the poor environmental status of the river - UNOPS would like to know whether it is possible to expand the WWTP to accept and treat these additional influents, and what the implications might bring. To this aim the Consultant will:

- Analyze typical influents from tanker trucks and determine composition;
- Assess the number of trucks and volume of influents;
- Assess the current truck access and circulation ease;
- Assess fees paid by trick drivers to deposit their sludge;
- Verify in which step of the water treatment process the sludge introduced;
- Evaluate the current plant capacity to treat this type of inflows;
- Model the revised plant process diagram;
- Determine best ways to valorize the flow’s sub-products
- And, assuming a triplication in the number of trucks:
  - Modify the plant design and capacity to enable it to treat three times the current volume of tanker-delivered blackwater;
  - Design a modified access to the plant to facilitate the circulation of tanker trucks;
  - Prepare a project budget and implementation timeline.

Task 5.3: Incorporate a Biomass Digester in the Existing Plant

UNOPS devises to incorporate a biogas - or biocoal - production step at the water treatment facility.

The Consultant shall review, analyze, and advise UNOPS and Kabul municipality management on the preferred technology and equipment and complete the following activities:

- Assess the feasibility of a biomass digester unit incorporation in the WW facility;
- Calculate potential biogas generation and equipment size required;
• Analyze and size appropriate biogas production equipment;
• Identify appropriate biogas sizing as per available operational parameters (e.g., water flow rates, temperature, season, and matter in suspension);
• Model the revised plant process diagram;
• Conduct a site selection for placement of biogas digester by considering current process flow, routing of ducts and relevant losses;
• Provide design and equipment specifications for the recommended biomass digester as well as specifications for the mechanical, electrical, and control system;
• Analyze biogas utilization alternatives and recommend preferred usage;
• Advise on recommended usage of residual sewage sludge;
• Prepare land requirement, plant layout, civil, mechanical, electrical, and equipment layout at the site;
• Economical outcome of the biogas
• Usage of biogas in the treatment plant
• Prepare budget estimate and project implementation timeline.

Task 5.4 production of sanitized fertilizer for agricultural usage
It is a traditional usage in Kabul to recycle human waste and sludge as agricultural fertilizer. We find this practice appropriate and sustainable, but fear that untreated human waste may transport pathogen agents to the agricultural fields. In order to avoid this risk, we ask the Consultant to devise a waste treatment process which sanitizes, i.e., removes pathogen agents from the product, before it is made available to farmers. In addition the consultant shall:

- Estimate volumes of sanitized fertilizer production
- Estimate market value of the same
- Recommend approaches to market and distribution of the fertilizer
- Coordination with potential customers such as Ministry of Agriculture and livestock.

Task 6: Design and Feasibility study of a standard Alternative WWTP
In order to complete the assessment, UNOPS will require the complete design and cost estimate for a new WWTP facility.

The plant should be conceived as a modern recycling facility, preferably incorporating the Dutch concept of “NEW Factory” (nutrient, energy and water factory) where wastewater is considered as a resource of nutrients, energy and clean water, rather than a waste product.

This plant project will be a pilot and to demonstrate excellence, not only in the fine sanitary quality of the residual water rejection but also potentially as a model of a bio-economy precursor.

Plant should be energy efficient and as energy autonomous as possible with production of biofuel, and CHP for example.

However, the plant conception should be compatible with the development level reached by the Afghanistan and expensive high tech with difficult to maintain equipment should be limited.

UNOPS requires a typical design of a plant with the following capacities:
- Waste water from Makroyan through sewage pipes: 18 000 m³/day;
- Waste water from septic pits arriving in tanker trucks: 1 800 m³/day (180 trucks).

For this plant we require:
- Plant and process diagrams;
- Conceptual design;
- Plant layout and detailed plan;
- Efficiency of the plant in cleaning inflow water (effluent water quality)
- Estimated output production (clean water, biogas, fertilizer, sludge)
- Recommendations for the use of output products
- Detailed capital cost for installation the plant
- Operations and Maintenance (O&M) costs
- Estimated Revenues Generated
  - fees from tankers
  - Sales of biogas
  - Carbon credits
  - Sales of sanitized fertilizer

Other Deliverables:
- A complete standard WWT plant design independent of land characteristics;
- Plant and functional diagram,
- Costs
- Capacities;
- Life expectancy;
- Energy consumption estimates.

**Task 7: Carbon Credit Analysis**
Based on the current information from the World Bank and other relevant institutions, the Consultant shall:

- Report on the availability of CERs or any other applicable carbon credits;
- If available, assess the applicability of Clean Development Mechanism (CDM) as partial source of financing for the envisaged projects, which can directly influence the cash flow of the financial model.
- Estimate the quantity and market value of carbon credits based on, displacement of fossil fuel used by the current energy supplier DABS, as well as of methane and CO2 emissions avoided by introduction of the new biomass digester.

**Deliverable:** Upon completion of this task, the Consultant shall provide a written report with conclusions and recommendations.

**Task 8: Development and Environmental Impact Analysis**
The Consultant shall report on project impacts on infrastructure, water and air quality, human health, agriculture and productivity enhancement and human capacity building. The analysis shall focus on the development impacts that are likely to occur if the New Plant Project is implemented according to the study recommendations. While specific attention shall be paid.
to the immediate impacts of the project, the analysis shall also include any additional developmental benefits that may result from the project implementation including spin-off and demonstration effects. Specific issues to be discussed and reported as follows:

(1) Infrastructure: Provide a statement on the infrastructure impact, giving a brief synopsis. For example, “The project would result in the improved sanitation of ____m³ of sewage water. This plant would serve ___[number] additional households in ____ [area].”

(2) Quality of water and air: Provide a description of the improvements in the quality of effluents that would be gained (e.g. “By upgrading the water treatment plant’s equipment, water quality will be increased from x% to y%”).

(3) Human Health and quality of life: Estimate the impact that the New plant would have on neighbors and assess the number of beneficiaries. Describe potential benefits such as reduced mosquito breeding, reduced smell, reduction in truck traffic, etc.

(4) Improvements to the quality of the human waste based fertilizer

(5) Reduction in human health risks

(6) Any other

**Task 9: Final Report**

The Consultant shall prepare and deliver to UNOPS a substantive and comprehensive Final Report and the best solution with the detail design of all work performed under these Terms of Reference (“Final Report’). The Final Report shall be organized according to the above tasks and shall include all deliverables and documents that have been provided to UNOPS.

The Final Report must contain an executive summary and a conclusions and recommendations

### 7. Contract modalities:

#### 7.1. Agreement:

The Consultant will be required to enter into an agreement with UNOPS based on a Lump Sum Contract for Consulting Services. Both parties shall sign a Contract Agreement before commencement of the work.

#### 7.2. Logistics:

The Consultant will be responsible for arranging his own office space and other logistics. The Consultant and its team will be fully responsible for their own security during their services, including field surveys.

#### 7.3. Commencement and Duration of the consultancy service Contract

The Consultant shall commence the services immediately following the signing of a Service Contract with UNOPS, and will complete the services including final report within four (4) months after the contract issuance.
8. Cost and Payment of Consultant’s Services;

The Consultant Proposals shall meet the full operational costs of its field investigation and survey teams including all travels, remuneration, insurance, emergency medical aid, accommodation, offices and facilities, communications and all that is necessary for the proper operation of the teams.

Mode of payment to the Consultant shall be made on the following schedule:

<table>
<thead>
<tr>
<th>Pymnt no.</th>
<th>Pymnt amt</th>
<th>Task no.</th>
<th>Task / deliverable</th>
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<td>1</td>
<td>25%</td>
<td>1</td>
<td>Inception meeting and report</td>
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<td></td>
<td>2</td>
<td>Regulatory Analysis</td>
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<td></td>
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<td>3</td>
<td>Analysis of Kabul city tanker-based wastewater evacuation processes</td>
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<td>4</td>
<td>Review existing technical conditions and operations of the Plant</td>
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<tr>
<td>2</td>
<td>25%</td>
<td>4</td>
<td>Rehabilitation and optimization plan of the current facility, including:</td>
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<td>4.1</td>
<td>Rehabilitation and repair of the facilities</td>
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<td>4.2</td>
<td>Extension of the current facility to absorb and treat tanker sewage inflows</td>
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<td>4.3</td>
<td>Incorporation of a biomass digester / biogas production into the existing plant</td>
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<td>4.4</td>
<td>Production of sanitized fertilizer for agricultural usage</td>
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<td>25%</td>
<td>5</td>
<td>Design of an alternative WWTP</td>
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<td>4</td>
<td>25%</td>
<td>6</td>
<td>Carbon Credit Analysis</td>
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<td>7</td>
<td>Development and Environmental Impact Analysis</td>
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<td>8</td>
<td>Final report (acceptance )</td>
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<tr>
<td>Total</td>
<td>100%</td>
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</table>

9. Minimum qualification requirements for the contractor

In line with its objective, UNOPS intends to sign a Contract for Professional Services (hereinafter referred as “Contract”) for the provision of services under consideration with an Offeror that shall possess the following qualifications and whose proposal shall best meet the requirements, as set out in this Terms of Reference:

Sound general organizational capability and demonstrated ability to provide the services under consideration.

The following statistical data will have to be provided:

- Key clients and their contact details (to be contacted for reference checks);
- Company’s organogram with details of qualifications of management staff;
- Number of technical and support personnel in the organogram of the Offeror;

Litigation and arbitration history of the Offeror does not bear any potential reputational or other risks for UNOPS or other United Nations organizations and specialized agencies.

The Consultant shall provide information with a sufficient level of detail with regards to any suits and arbitral proceedings in which the Consultant was involved for a time period of 3 years prior to the date of the release of this RFP.
Financial indicators prove Offeror's long term sustainability and possession of sufficiently sound financial position to ensure it can meet its financial commitments under the Contract.

The following documents will have to be provided:
- Audited financial statements for a time period of 3 years prior to the date of the release of this RFP; and/or
- Copy of the firm’s bank balance to demonstrate amount of liquid assets and/or credit facilities net of other contractual commitments and exclusive of any advance payments which may be made under the contract.

Relevant specialized knowledge and capacity.

The following information will have to be provided:
- Information about the Offerors capacity to plan and execute the works with the specified timelines;
- Quality control and quality assurance mechanisms and SOPs;
- Approach and methodology for the successful execution of the works;

Experience in similar project(s).

The following statistical data will have to be provided:
- List of references of similar assignments
- Number, value and duration of contracts for similar works over the last 3 years accomplished

Have suitably qualified key-experts for provision of the services.

The following information will have to be provided:
- Number and role of the qualified members of team who will be assigned for this project.
- A short summary of their qualifications, background and experience;
- Areas of specialization;
- Successful projects accomplished;
- Any other relevant facts and information.

10. Composition of the team:

The Consultant’s staff should have extensive experience in such feasibility studies and surveys related to waste water management and valorization of sludge. Minimum requirements for the composition and qualification of the Consultant’s project team are provided in the below table:

<table>
<thead>
<tr>
<th>Position</th>
<th>Level of Qualification (minimum)</th>
<th>Years of professional experience (minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Leader</td>
<td>Master’s degree or higher in engineering, hydraulics, waste water, biological treatments or waste water management alike.</td>
<td>At least 10 years’ experience in sewage and wastewater treatment. Proven ability to plan, organize, and effectively implement activities; Research and analytical skills; Ability to coordinate and work in teams, and in complex environments; Proven experience in participatory processes, and strong</td>
</tr>
</tbody>
</table>
communication skills; experience working in conflict zones and asset.

<table>
<thead>
<tr>
<th>Role</th>
<th>Education/Experience</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil engineer</td>
<td>Master’s Degree in Civil Engineering or Water supply and canalization is preferable</td>
<td>7 years’ experience in wastewater plant design, construction and management, as well as in maintenance. And associated civil engineering works. Should have completed at least one such similar nature of work.</td>
</tr>
<tr>
<td>Biological treatment specialist</td>
<td>Master’s Degree in Micro Biology or equivalent experience in sewage water treatment through biological processes</td>
<td>At least 10 years of substantive experience in waste water quality assessments, and in the design construction and management of biomass digestors. Knowledge on the production of biogas and of bio-fertilizers from nutrient rich wastewater fluxes. Knowledge of water quality analysis and interpretation. Should have completed at least one such similar nature of work.</td>
</tr>
<tr>
<td>Renewable Energy engineer</td>
<td>Bachelor’s Degree in energy, electric or mechanical engineering, HVAC or similar</td>
<td>5 years’ experience in design and development of renewable energy systems, especially of CHP combined heat and power in installations</td>
</tr>
<tr>
<td>Logician</td>
<td>High School graduate</td>
<td>Knowledge of Afghanistan, ability to speak Dari, Pashto is an asset, Ability to organize and manage accommodation, transportation, and security awareness, for the above team.</td>
</tr>
</tbody>
</table>

**Note:** UNOPS reserve the right to conduct interviews for the proposed key personal of the offerors during the evaluation process.

**11. Preliminary action plan/implementation plan**

In addition to the above-mentioned references and curricula, offerors are requested to submit a draft plan of action on how they intend to address the different requirements of this feasibility study. This plan of action will be noted during the evaluation.