TERMS OF REFERENCE (TORs)

CONSULTANCY SERVICES FOR CONSTRUCTION SUPERVISION OF THE PROJECT
"LAHORE WATER AND WASTE WATER MANAGEMENT PROJECT
(CONSTRUCTION OF NEW SYPHON ON RIVER RAVI, INTAKE STRUCTURES,
GATES AND RAW WATER CHANNEL)

1. BACKGROUND

The City of Lahore, situated on the left bank of River Ravi, is the capital city of Punjab Province. Its population is presently 11.13 million and area is about 1,172 sq. km. Drinking water is being provided to the citizens of Lahore by Water and Sanitation Agency (WASA) of the Lahore Development Authority (LDA) from ground water source through tube-wells installed in all parts of the city. About 1,000 cusecs of ground water is being pumped by WASA directly into the distribution system while about 500 cusecs is being extracted by Private housing schemes, Cantonment Boards, Pakistan Railways, Model Town and TMAs etc.

Due to ever increasing number of tube-wells, the water table is depleting rapidly. The current declining rate is more than one-meter per annum. In fact excessive pumping has caused substantial depletion of the ground water aquifer to the extent that on the one hand, extraction of ground water is becoming uneconomical while on the other water quality is also deteriorating. The present source may therefore, not remain sufficient for future water demands. Moreover, arsenic concentration in pumped water is increasing rapidly, which is not desirable from the point of view of population’s health. WASA has therefore requested Punjab Irrigation Department to explore the possibility of providing additional water from a surface water source for augmenting the drinking water supplies to citizens of Lahore city. The estimated water requirement projected at that time by WASA for the year 2035 and onwards was 1,000 cusecs.

Another important problem being faced by the Punjab Irrigation Department was that the canal systems in Lahore and Kasur Irrigation Divisions had been suffering from shortage of water for a long time, due to reduction in capacity of Ravi Syphon (4450 Cs) as compared to design capacity (4853 Cs). Punjab Irrigation Department therefore decided to commission a feasibility study for arriving at a technically viable and economically feasible solution for both the problems. To
meet with the shortage of canal supplies i.e. 900 cusecs for Lahore and Kasur Division and need of drinking water for Lahore City the project has been planned.

As per study of NESPAK (2007), underwater inspection of the syphon was carried out by MRL Consultants in early 1990s with the help of divers. About 33% of the overall length only could be examined due to limited oxygen supply. The results of underwater inspection are as under:

- The concrete face has been eroded at the syphon inlet leaving coarse aggregate exposed and in some places reinforcement steel bars are exposed.
- Many of the barrel joints were found to be leaking. Though the leakage studies carried out during the closure of BRBD Canal in January 1997, revealed that the total losses were only in the order of 0.1 cusec.
- A small gully has developed on the right bank of the Ravi River over the upstream sloping section of the barrels.
- The gates of the syphon require extensive rehabilitation.
- Traverse joints in all five barrels were found to be in poor condition.
- Cracks in the concrete in four of the five barrels were observed.
- Two large holes were found in one of the barrel.
- Water stops are exposed at many places.

It has been observed practicality that Ravi Syphon could not pass discharge over 4450 C.s since last many years against design discharge of 4853 C.s.

WASA Lahore requested Punjab Irrigation Department for augmenting the water supply to Lahore from BRBD Canal. Punjab Irrigation Department intends to restore the Irrigation supplies to Lahore and Kasur Divisions in addition to consideration of WASA demand of drinking water for Lahore City. However these demands cannot be met in the present circumstances, unless the supplies to BRBD canal can be enhanced and capacity of Ravi syphon through which it passes beneath bed of Ravi River is enhanced.
OBJECTIVES OF CONSULTANCY

The main objectives of the Consultancy services under the project "Lahore Water and Waste Water Management Project (Construction of New Syphon on River Ravi, Intake Structures, Gates and Raw Water Channel)" are to help client in procurement and during execution phase supervision of the work and act as a representative of "The Engineer" i.e. client. The major components of the project are:

i) Construction of Bypass Channel

Bypass Channel will off-take from RD 280+000 (Center-line) of BRBD Canal and after conveying the flow through the new Ravi Syphon, it will join the existing BRBD Canal again at its RD 286+000, where the center lines of the two canals will coincide. Total length of the Bypass Channel will be 5,661 ft. It will be a concrete-lined channel with a trapezoidal cross-section, having side slope of 1V:2H. Design discharge of this channel will be 2,500 cusec. Its designed bed width will be 23 ft., while flow depth will be 13.5 ft. Free-board of 2.5 ft is recommended for this channel. PCC lining of 4" thickness is proposed throughout the channel length. Water surface slope throughout the channel length will be 1: 10,000.

ii) Construction of Head Regulator of Bypass Channel

The revised full supply level of the existing BRBD Canal upstream of the proposed cross regulator at RD 280+500 will be 733.17 ft. The same will be the upstream design water level of the proposed head regulator of Bypass Channel as well. A 3.5 feet head is proposed for this regulator. The downstream design water level for this head regulator will therefore be 729.67 ft.

iii) Repair of the Old Ravi Syphon

Ravi Syphon was built in 1952/53 and its condition has considerably deteriorated with passage of almost 66 years of operation. Its renovation is therefore necessary for its continued serviceability. Rehabilitation of the syphon will involve repair of syphon barrels which will result in reduced flow area and consequently reduced conveyance capacity of the syphon.

In the Report prepared by MR Consultants rehabilitation of existing barrels was recommended by using sprayed concrete (shotcreting or guniteing) for the top and sides of the barrel with reinforced concrete at the base. The proposed
thickness of sprayed concrete is 2 inches (50 mm) and that of reinforced concrete is 4 inches (100 mm).

MR Consultants also emphasized that repairing the damaged upstream bed protection is essential and requires that scour holes are rock filled and that the protecting concrete block apron and concrete surfaces are reinstated, replaced or repaired.

According to their evaluation the rehabilitation work on the syphon barrels would reduce the existing capacity of syphon because of reduction of area and also due to increase in roughness because of the use of sprayed concrete.

iv) Construction of New Ravi Syphon

The new Ravi-Syphon will be similar in shape to the existing syphon, having four barrels of 10.25'x10.25' size with corners chamfered by providing 2.5'x2.5' triangular fillets. Cross-sectional area of each barrel will be 92.56 sq. ft. Lengths of all barrels will be 1,770 ft. The design discharge of the new syphon is 2,500 cusec. Keeping in view the water level constraints in the channels upstream and downstream of the new syphon. The result shows that with four barrels and a head loss of 1.97 ft., each barrel will be able to pass a discharge of 625 cusec, the total syphon-discharge capacity being 2,500 cusec and ideally suits the situation.

v) Construction of Head Regulator of the WASA Raw Water Channel

A Head Regulator at RD. 315+000 will be constructed for supply of canal water 100 cusec to the WASA raw Water Channel.

vi) Construction of Raw Water Channel for WASA

It has been proposed to construct RCC raw water channel having length 14760 ft with discharge 100 Cs, design bed width as 9 ft, and design depth as 7 ft.

2. **SCOPE OF SERVICES, TASKS AND EXPECTED DELIVERABLES**

1. The Consultants shall be responsible for help in procurement process, construction supervision of the project during the implementation stage as well as Defect Notification Period (DNP).

2. The Scope of services for consulting services will include, but not limited to the following:
General Scope

(i) Review Detailed Design of the project already finalized by the design consultants.

(ii) Carry out required additional surveys, geotechnical investigations, hydrological analysis and other such activities where necessary to provide a basis for final design of all hydraulic structures.

(iii) Review and update the Contractor's program for implementation of various phases of the project and revise critical path analysis, if necessary.

(iv) Review and update EMP & EIA Reports.

(v) Support PID in monitoring and carrying out activities related to implementation of Environmental Management Plan (EMP) and Resettlement Plans (RP) in line with AADB relevant guidelines;

(vi) Ensure that all project components reviewed and supervised by the Consultants are implemented in an environmentally friendly manner and taking adequate mitigation measures wherever necessary;

(vii) Keep the Client informed of technical and environmental/social issues and progress of all contractual works both by direct contacts and through discussions or correspondence;

(viii) Assume the responsibility to check surveys and benchmarks established by the Contractor at each site of work and ensure accuracy of surveys and benchmarks connecting all components under the works contract;

(ix) Conduct periodic check on record of Contractor's personnel and equipment;

(x) Attend, project level meetings, all Steering Committee meetings and meetings with AADB missions as required;

(xi) Assist the Client in taking over the contract works and prepare list of items of works to be completed by the Contractor during defects
notification period (DNP); also prepare inventory of works/ structures completed and tools/plant/equipment etc;

(xii) Prepare response to audit observations and paras in respect of payments certified by them and assist the Client in getting them resolved;

(xiii) Using the output from the quality control program and the quantity surveying and measurement program, prepare monthly and quarterly progress reports using the latest software acceptable to the Client; for sending to donors and government offices; and

(xiv) Prepare a comprehensive Project Completion Report on completion of the contract, inclusive of as-built.

**Specific Scope**

**Design Review**

- Plan and execute additional surveys, geotechnical investigations and other such activities where necessary to provide a basis for design modifications.

- Review of detailed design including civil and mechanical works and subsequent preparation of construction drawings.

**Contract and Construction Management**

(i) Undertake full administration of construction contract(s) and supervise the Works (including civil and mechanical works) covering also Defects Notification Period (DNP). This shall include on-site supervision of contractors' works for compliance with specifications, review of Contractor's submittals, verification of progress, checking of interim payment requests/certification, checking and approving the quality assurance procedures produced by the contractors;

(ii) Oversee and supervise construction of works ensuring compliance to details provided in the construction (working) drawings and strict adherence to the Specifications;
(iii) Review and confirm or recommend appropriate changes to the construction schedule of the contract keeping in view river flows and seasonal changes;

(iv) Prepare Quality Assurance Plan (QA/QC Plan) including a detailed description of the Contractor's required organization, procedures, facilities proposed to ensure that the construction is carried out in accordance with the Contract, Specifications and Drawings in accordance with modern concepts of project management.

(v) The Plan shall include a system to ensure that the documentation necessary to attest completion of any phase(s) of the works, use of correct materials, completion of required completions and tests, and acceptability of results generated are reviewed, maintained and submitted by the Contractor to the Engineer. The Contractor's test programs shall be suitably documented duly addressing pertinent test pre-requisites parameters;

(vi) Review and process claim for payment by the Contractor, as per the procedures described in the conditions of contracts and advise the Client accordingly;

(vii) In the event of contractual dispute which may result in legal action, adjudication or arbitration between the Contractor and the Client, the consultants will, on the instructions from the Client, collate and prepare factual documentation describing the circumstances of the dispute. If required, the consultants will attend hearings and provide all legal and other support to the client;

(viii) Carry out dispute resolution, as per provisions of the Conditions of Contract;

(ix) Inspect and witness the tests when necessary during manufacture of mechanical materials and machinery for compliance with specifications. The cost of such tests shall be recoverable through the work contract(s);
(x) Witness any acceptance test and advise the Client whether the works or any part thereof have been completed as per specifications and certify outcome of the acceptance test in support of provisional acceptance certificate of completion;

(xi) Testing of materials on-site or off-site when needed and testing and inspection of goods and materials in factory, if needed;

(xii) Carry out measurement of works and agreement of quantities with the contractor(s) and certification of Contractor's statements for progress payments in terms of the conditions specified in the contract. Prepare instructions for permissible variations in the works for approval by the Client.

(xiii) The project will be carried out in compliance with the AllB's Environmental and Social Standards and Environmental and Social Policy. To this end, the consultant will ensure that all works are carried out in accordance with the Environmental Management Plan prepared during the project's Environmental Impact Assessment. The consultant will also assist PID for all the social-safeguard compliance and in implementation of the Resettlement Plan in line with AllB's Social and Environmental Safeguard policy.

(xiv) Consultants shall prepare the O&M Manual, which shall give the nature of periodic physical interventions to be made by way of preventive and curative maintenance to be carried out every year, data to be collected and records maintained and periodic inspections to be made to ensure safety of the syphon.

3. TEAM COMPOSITION & QUALIFICATION REQUIREMENTS FOR THE KEY EXPERTS

(i) The Consultant will maintain Office at Lahore. The cost of renting, furnishing, equipping and maintaining the office will be included in the Consultants' financial proposal.
Indicative Staffing Requirements for Construction Supervision

(ii) Following matrix represents the Client's reflection on the Consultant's team composition and minimum estimation of person-months for project management, feasibility review, detailed design, construction management and other field staffing for performance of the assignment. However, the prospective consultants should propose their own breakdown of staffing and level of effort/staff work based on their own experience and evaluation of the proposed services. The consultants should propose a realistic deployment schedule for all positions depending on the work requirements as all positions listed below would have inputs for different durations.

(iii) The Client estimates about 209 person-months of key staff and 116 person-months of non-key staff to be provided by the Consultants for construction supervision of the Project. The planned completion period for Ravi Syphon Project is thirty six (36) months, three (03) months for invitation of bids, evaluation, twelve (12) months of defect liability period during which the consultants shall maintain a minimum staff to perform the required tasks of finalizing the contract. The estimated duration of consulting services is fifty one (51) months. In order to complete the start-up project review activities well in time, the Consultants will be installed about three (03) months ahead of mobilization of the work contractor and will continue for about three (03) months after the DINP for smooth project close-up and issuance of the Performance Certificate and Final Payment Certificate.
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<tr>
<th>Sr. #</th>
<th>Position</th>
<th>Qualification</th>
<th>General / Overall experience (Years)</th>
<th>Job Specific experience (Years)</th>
<th>Indicative Input of Experts (Months)</th>
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<tbody>
<tr>
<td>1</td>
<td>Project Manager / Team Leader</td>
<td>M.Sc. Construction Management or M.Sc. Civil / hydraulic Engineering with B.Sc. Civil Engineering.</td>
<td>22</td>
<td>15 years' professional experience in planning, designing and construction supervision management of major water sector projects on large river systems including 15 years' specific experience in construction supervision of major dams/barrages/major canal projects at similar position in renowned Consultancy firm / Government organization.</td>
<td>42</td>
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<td>2</td>
<td>Principal Structure Engineer</td>
<td>M.Sc. Structural Engineering with B.Sc. Civil Engineering.</td>
<td>17</td>
<td>12 Years' professional experience in construction of bridges and other major structures including 10 years' specific experience in structural design of river control structures, and other major hydraulic structures on large canals at similar position in renowned Consultancy firm / Government organization.</td>
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<tr>
<td>3</td>
<td>Structure Engineer</td>
<td>M.Sc. Structural Engineering with B.Sc. Civil Engineering.</td>
<td>12</td>
<td>10 Years' professional experience in construction of bridges and other major structures including 10 years' specific experience in structural design of river control structures and other major hydraulic</td>
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<td>structures on large canals at similar position in renowned Consultancy firm / Government organization.</td>
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<td>4</td>
<td>Principal Hydraulic Engineer</td>
<td>M.Sc. Hydraulics Engg with B.Sc. Civil Engineering</td>
<td>17</td>
<td>10 years' experience in construction of civil works in major hydraulic projects.</td>
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<tr>
<td>5</td>
<td>Hydraulic Engineer</td>
<td>M.Sc.: Hydraulics Engg with B.Sc. Civil Engineering</td>
<td>12</td>
<td>08 years' experience in construction of civil works in major hydraulic projects.</td>
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<td>6</td>
<td>Procurement Contract &amp; Claim Expert</td>
<td>B.Sc. Civil Engineering. An additional Master's degree in Construction Management is preferable and would be rated higher.</td>
<td>17</td>
<td>12 years' professional experience in the procurement of civil works, contract management and processing of contractors' claims including 05 years specific experience related to contract administration and claim handling on large water sector projects.</td>
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<td>7</td>
<td>Planning and Scheduling Engineer</td>
<td>Master's degree in Construction Management with B.Sc. Civil Engineering</td>
<td>12</td>
<td>10 years' experience in planning and scheduling of large construction projects including 04 years' specific experience in reporting, planning, scheduling and document cataloging on major water sector projects on rivers and large canals.</td>
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<td>Sr. #</td>
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<td>8</td>
<td>Mechanical Engineer</td>
<td>B.Sc. Mechanical Engineering.</td>
<td>12</td>
<td>10 years' experience in design/ fabrication and installation of gates/ gearings and hoisting arrangements on large water/ hydel sector projects including 05 years' specific experience in similar position on dams/ barrages/ headworks and other major hydraulic structures on large canals.</td>
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<td>9</td>
<td>Resident Engineer</td>
<td>B.Sc. Civil Engineering and M.Sc. Construction Management or M.Sc. Civil Engineering.</td>
<td>17</td>
<td>15 years' experience in construction planning and supervision of large water/ hydel sector projects on major rivers including 05 years' specific experience in similar position on dams/ barrages/ headworks and other major hydraulic structures on large canals in renowned Consultancy firm / Government organization.</td>
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| 10   | Environmental & Social Safeguards Expert | Master degree in Environmental Sciences from a recognized university or BSc Civil or Environmental Engineering with Masters in Environmental engineering or science | 15                                | • Fully conversant with Environmental Impact Assessment (EIA) and resettlement issues relating to water sector projects and of international donor's requirements / guidelines in this regards.  
• Experience in handling the environmental and social safeguards related concerns of Mega projects | 38                                  |
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<td>executed under national as well as international donor agencies conditions / guidelines.</td>
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<td>• Knowledge in laws, rules, regulations, policies issued by Environmental Protection Agencies (EPAs) as well as international donor agencies.</td>
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<td>• Capable of settling the complaints and concerns of stakeholders related to environment and safeguarded in particular to re-settlement &amp; re-location.</td>
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<td>• Capable of understanding and implementing IEE, EIA, EMP, EMMP specially in water sector projects</td>
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<td>• Be fully aware of all environmental protocols, rules regulations as required in the national and international contracts.</td>
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<td>• Should be capable to act as Project's Spokesperson to keep stakeholders informed regarding project intervention on a regular basis.</td>
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<td>• Experience—of more than 20 years in case of</td>
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<td>11</td>
<td>Geo-technical / Grouting Specialist</td>
<td>Geologist with Master's degree in Geology or B.Sc. Civil Engineering with Master's degree in Geo-tech Engineering.</td>
<td>15 Environmental Engineering or 20 years in case of Environmental Sciences.</td>
<td>10 years' professional experience related to construction of geotechnical works on major structures including 05 years' specific experience in supervision of grouting operations on dams / barrages / head works and other major hydraulic structures on large canals.</td>
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### II: Non-Key Expert

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<tr>
<th>Sr. #</th>
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<tr>
<td>1</td>
<td>Assistant Resident Engineer</td>
<td>B. Sc. Civil Engineering. An additional Master's degree in Construction Management is preferable and would be rated higher.</td>
<td>12</td>
<td>07 years' professional experience in construction supervision of large water / hydel sector projects on major rivers and canals.</td>
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<tr>
<td>2</td>
<td>Junior Engineers (2 No)</td>
<td>Bachelor degree in Civil Engineering</td>
<td>05</td>
<td>03 years' professional experience in production of drawings of civil engineering projects in particular hydraulic structures. Experience in production of water sector project drawings. Computer literate having experience of</td>
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<td>Sr. #</td>
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<td>3</td>
<td>Site Inspector / Surveyor</td>
<td>B.Sc Civil / 3 years Diploma in Civil Engineering</td>
<td>10</td>
<td>02 Years professional experience for BSc Engineer and 10 years experience for Diploma Engineer.</td>
<td>36</td>
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<tr>
<td>4</td>
<td>Quantity Surveyor</td>
<td>B.Sc Civil / 3 years Diploma in Civil Engineering</td>
<td>10</td>
<td>02 Years professional experience for BSc Engineer and 10 years experience for Diploma Engineer.</td>
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<td>Total:-</td>
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<td>G. Total:-</td>
<td>325</td>
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**Notes:**

(i) **Maximum age limit for field staff is 55 year and for design office is 65 years.**

(ii) **The above-mentioned person-months include Consultant's professional input only. The total person-month requirement for professional staff is 325 i.e. (Key Staff: 209 + Non-Key Staff: 116 person-months).**

(iii) **The above positions do not include miscellaneous contract / support staff (non-technical, semi-technical and technical input) like office manager, accounts manager, accountant, surveyors, quantity surveyors, inspectors, social enumerators, auto-CAD operators, draftsmen, laboratory technicians, guards, drivers and office boys etc who are used for costing purposes, but not included in summaries of person-months of Consultants input which refers only to professional man-months of input.**

(iv) **All support staff in the project office will be provided by the Consultants who are required to include cost of such support staff in the Reimbursable Expenses items.**

1. **In the evaluation of technical proposals, the Key staff will be evaluated individually. The Consultants should submit CVs for all positions of Key staff (only one CV for each Expert position and comprising not more than five pages printed on one side of A4 size paper in font size of 11). Any TBN position in the key staff will be marked zero. As the CVs of Key Staff will form the basis of technical evaluation, the Consultants should note that under normal circumstances, barring resignation or serious health problems/ death of any of the nominated staff, no substitution of key staff will be allowed during the first year of the assignment.**
2. The Non-key personnel will be evaluated collectively as a team for adequacy of the nominated staff and consultants’ ability to provide all required staffing. Therefore, Consultants are required to provide CVs of all nominated staff against non-key positions. The CVs should contain information, in sufficient detail, about position title, name, date of birth, citizenship, CNIC number, education, PEC registration, professional memberships, trainings, employment record and work experience in the relevant assignments (One CV shall not comprise more than five pages printed on one side of A4 size paper in font size of 11). The Consultants shall bear full responsibility for correctness of the submitted CVs.

Job Description and Qualifications of Consultants’ Staff

3. The detailed job description of Consultant’s staff (Professionals) is as shown below:

A. KEY STAFF

1. Project Manager / Team Leader: Responsibilities of the Construction Management Specialist/ Team Leader will include but not limited to the following:
   i. Assist the PID in Project implementation;
   ii. Assume full responsibility for the consultants’ team and performance of services under the consultancy contract;
   iii. Ensure that the consultants’ team undertakes comprehensive review of detailed designs and specifications which were prepared by the Design Consultants
   iv. Ensure that the consultants’ team undertakes comprehensive construction supervision and contract administration of civil, mechanical and electrical works for Ravi Syphon Project where the Consultants will act as representative of "The Engineer".
   v. Oversee the consultants’ team activities and supervise construction of works ensuring compliance to details provided in the construction drawings and strict adherence to construction specifications;
   vi. Ensure preparation of detailed and quantitative progress reports to support the contractor’s requests for progress payments;
   vii. Keep the Client informed of technical issues and progress of all works both by informal and formal meetings and correspondence and assist in any project issue which the Client may require;
   viii. Take overall responsibility for preparation of Operational Manual for the Project. Also, jointly review the draft in detail with PID prior to finalization and printing;
   ix. Participate in the Dispute Board meetings to explain and discuss issues raised by the Contractor/ Client or DB;
x. Assist the Client in preparing responses to audit objections and queries of the donors or other Government Authorities;

xi. Coordinate with all Client's concerned organizations on project issues; and

xii. At the end of the construction activities, guide and ensure that the team prepares a comprehensive Construction Completion Report inclusive of "as-built drawings" as appropriate.

2. Principle Structure Engineer: Responsibilities of the Principle Structural Engineer will include but not limited to the following:

i. Review all relevant technical documents;

ii. Review design parameters and design criteria viz-a-viz Client's requirements;

iii. Review design calculations, check for accuracy and see that appropriate standards were adopted. In case of disagreement, refresh and update the design;

iv. Organize, supervise and carry-out any additional investigations deemed necessary for structural aspects of any feature to be included in the Project;

v. Analyse structural design options where changes are required;

vi. Coordinate with the team for detailed design of all structural aspects of works including preparation of relevant additional construction drawings and specifications which may be required; and

vii. Assist in drafting relevant portions of O&M Manual for the Project with emphasis on procedures/practices to ensure long term structural stability of structures.

3. Structure Engineer: Responsibilities of the Structural Engineer will include but not limited to the following:

i. Prepare all relevant technical documents;

ii. Prepare design parameters and design criteria viz-a-viz Client's requirements;

iii. Prepare design calculations, check for accuracy and see that appropriate standards were adopted. In case of disagreement, refresh and update the design;

iv. Organize, supervise and carry-out any additional investigations deemed necessary for structural aspects of any feature to be included in the Project;

v. Analyse structural design options where changes are required;
vi. Coordinate with the team for detailed design of all structural aspects of works including preparation of relevant additional construction drawings and specifications which may be required; and

vii. Assist in drafting relevant portions of O&M Manual for the Project with emphasis on procedures/practices to ensure long term structural stability of structures.

4. Principle Hydraulic Engineer: Responsibilities of the Principle Hydraulic Engineer will include but not limited to the following:
   i. Review all relevant technical documents;
   ii. Review design parameters and design criteria viz-a-viz Client’s requirements;
   iii. Review design calculations, check for accuracy and see that appropriate standards were adopted. In case of disagreement, refresh and update the design;
   iv. Organize, supervise and carry out any additional investigations deemed necessary for structural aspects of any feature to be included in the Project;
   v. Analyse structural design options where changes are required;
   vi. Analyze hydraulic design options for the spillway, divide walls, head regulators and downstream scour protection with a view to cost effective rehabilitation, including but not limited to hydraulic optimization of the spillway and head regulator parameters and ensuring adequate sediment transport during flushing operations employing the new divide walls.
   vii. Assist in drafting relevant portions of O&M Manual for the Project with emphasis on procedures/practices to ensure long term hydraulic stability of structures.

5. Hydraulic Engineer: Responsibilities of the Hydraulic Engineer will include but not limited to the following:
   i. Prepare all relevant technical documents;
   ii. Prepare design parameters and design criteria viz-a-viz Client’s requirements;
   iii. Prepare design calculations, check for accuracy and see that appropriate standards were adopted. In case of disagreement, refresh and update the design;
   iv. Organize, supervise and carry out any additional investigations deemed necessary for structural aspects of any feature to be included in the Project;
v. Analyse structural design options where changes are required;

vi. Analyze hydraulic design options for the spillway, divide walls, head regulators and downstream scour protection with a view to cost effective rehabilitation, including but not limited to hydraulic optimization of the spillway and head regulator parameters and ensuring adequate sediment transport during flushing operations employing the new divide walls.

v. Assist in drafting relevant portions of O&M Manual for the Project with emphasis on procedures/practices to ensure long term hydraulically stability of structures.

6. **Contract & Claims Expert**: Responsibilities of the Contract & Claims Expert will include but not limited to the following:

i. Review all relevant technical documents;

ii. Assist the Team leader in ensuring that the consultants’ team undertakes comprehensive review of designs and specifications and carries out construction supervision and contract administration of the civil works for the Project.

iii. Assist the team leader in overseeing the consultants’ team activities ensuring compliance to details provided in the construction drawings and strict adherence to construction specifications;

iv. Assist the Team Leader in overseeing quality control methodology put in place, confirming its adequacy and ensuring that its employment is satisfactorily carried out;

v. Render necessary advice and assist the Team Leader in contract administration and procurement issues/assignments/contractual claims;

vi. Assist the Team Leader in resolving any contractual issue which the Team Leader may refer;

vii. Determine extension of time for completion and other claims in accordance with the conditions of contract in consultation with the Team Leader and Resident Engineer;

viii. Provide assistance to the Client in dispute resolution as per provisions in the conditions of contract;

ix. Assist the Team Leader in keeping the Client informed of contractual and claims issues by direct contacts and through discussions or correspondence;

x. Assist the Team Leader/Resident Engineer in holding meetings with the Contractor on contract and claims issues; and
xi. Assist the team leader in preparing a comprehensive Project Completion Report (PCR), Operational Manual and any other duty/assignment the Team Leader may entrust.

7. Planning & Scheduling Engineer: Responsibilities of the Planning and Scheduling Engineer will include but not limited to the following:

i. Report to the Team Leader;

ii. Take the overall responsibility for project planning, scheduling, reporting and project costing including preparation of engineer estimate/ revised PC-1;

iii. Analysis and approval of Tender Schedule, Baseline Schedule, Revised Baseline Schedule and Recovery Schedule submitted by the contractor on a computerized system Primavera Enterprise for Engineering & Construction (P6) software;

iv. Assist the Team Leader in determining extension of time for completion from the Contractor's Work Schedule;

v. Furnish progress schedules and Earned Value Reports to the Team Leader;

vi. Monitor that the Contractor adheres to the contractual requirements of Construction Schedule mentioned in the Special Provisions; and

vii. Monitoring of various activities shown on the Baseline schedule.

8. Mechanical Engineer: Responsibilities of the Mechanical Engineer will include but not limited to the following:

(i) Design/fabrication and operation of gates, hoists, lift irrigation and mechanical equipment for irrigation and water sector projects.

(ii) Design and installation of radial gates including hosting arrangements & superstructures.

(iii) Instrumentation / Automation-In regulation of gates through local and central control system.

(iv) Review the adequacy of the Mechanical design of hydraulic / radial gates, hoist machines and its automation.

(v) Review electrical design of gates regulation system through local control and central control system and suggests any improvements / changes required for proper functioning of the hydraulic gates.

(vi) Review the O&M plans for construction activities.

(vii) Assist in preparation of Operation and Maintenance
9. **Resident Engineer:** Responsibilities of the Resident Engineer will include but not limited to the following:

i. Assist the Team Leader in carrying out all aspects of his TOR;

ii. Assume the responsibility for effective supervision and contract administration of all civil, mechanical and electrical works during the period of construction supervision;

iii. Ensure that the consulting team under his/her control undertakes comprehensive construction supervision and contract administration of all Works required to be carried out by the Consultant in the role as representative of "The Engineer".

iv. Oversee activities of the teams under his/her control related to supervision of construction works ensuring compliance to details provided in the construction drawings and strict adherence to construction specifications;

v. Prepare an appropriate Quality Assurance Plan (QA/QC Manual) for construction supervision of the Project. The Manual will describe the testing requirements during construction;

vi. Advise on suitability of various construction materials proposed to be used in construction;

vii. Ensure that the Quality Assurance Plan (QA/QC Manual) is strictly followed by the Project team and bring out all deficiencies to the notice of Team Leader/ Deputy Team Leader/ Resident Engineer promptly;

viii. Evaluate contractor's proposal for establishing the field laboratory and approve other laboratories for testing;

ix. Ensure that the routine detailed quantitative progress reporting is adequate to support the contractor's requests for progress;

x. Establish and oversee appropriate standards and quality control procedures;

xi. Ascertaining that construction Inspectors are fully cognizant of all required density testing during construction and the methodology to be employed there-on;

xii. Prepare a comprehensive Construction Completion Report including as-built drawings as appropriate;

xiii. Ensure that the contractor follows the implementation schedule;

xiv. Review the plan for execution of critical activities and arrange timely completion there-of; and

xv. Ensure effective implementation of EMP.

10. **Environmental & Social Safeguards Expert:** Responsibilities of the environmentalists & Social Safeguards Expert will include but not limited to the following:

i. Assist and report to Team Leader / Chief Design Engineer
Review all relevant documents including those prepared previously, particularly relating to the environmental and social aspects;

Ensure compliance with Donors and local environmental safeguards.

Carry out IEE of project by using the Environmental Assessment and Review Procedures (EARF) of the Project along with Preparation of EMPs.

Coordinate concurrence of the IEEs from relevant Government agencies and ensure public disclosure.

Prepares formats / templates for monthly progress report during design and construction phase.

Attends all site and home office meetings which involve socio-environmental issues.

Attends all site and home office meetings which involve socio-environmental issues.

To prepare/update a cost effective management and monitoring plan for the rehabilitation and upgrading of the works so as to ensure minimal environmental effects both during and following the construction period.

Prepare and execute required appropriate actions to mitigate any negative environmental impacts associated with construction activities in collaboration with all concerned stakeholders.

Prepare a detailed reforestation plan at the work sites.

Develop methodology and instruments for social assessment for the potentially affected people and areas.

Assess the indirect impacts of project operations on people such as loss of temporary or permanent access to markets, services and social relations.

Organize series of consultations meetings with communities to create awareness about the project activities, and to ensure public participation.

Preparation of documents of agreements and other necessary instruments to help in negotiations with the beneficiaries and in obtaining of local permits, etc.

11. Geotechnical Engineer: Responsibilities of the Geo-Tech. Engineer will include but not limited to the following:

(i) To select the best suitable site between the different alternative;

(ii) Monitor the subsurface geological investigation and provide necessary guidance in field data collection;

(iii) Carry out (organize and oversee) a comprehensive review of foundation conditions at each of the existing features and ensure
conditions are such to ensure the long-term integrity water storage structure;

(iv) Identify any remedial foundation stabilization work to be included in the package of works for the construction of water storage structure;

(v) Formulate plans for and carry out detailed foundation investigations for each of the new works;

(vi) Supervise the work of the sub-contracted drilling, sampling and testing services to ensure compliance with best geotechnical practice;

(vii) Subsequent to the required sub-surface investigations and required laboratory testing, work with the Structural Engineer in preparing detailed designs and specifications for the foundation treatment/features of the works and any identified remedial work if required;

(viii) Assist in the preparation of the tender documents as required;

B. **NON-KEY STAFF**

1. **Assistant Resident Engineer**: Responsibilities of the Assistant Resident Engineer within his/her own discipline will include but not limited to the following:

   i. Report to the Resident Engineer;

   ii. Assist the Resident Engineer in carrying out all aspects of his/her TOR;

   iii. Assume the responsibility for effective supervision and contract administration of civil/mechanical/electrical works, as the case may be, during the period of construction supervision;

   iv. Undertake comprehensive construction supervision and contract administration of the Works required to be carried out by the Consultant in the role of "Assistant to the Engineer".

   v. Supervise the construction works ensuring compliance to details provided in the construction drawings and strict adherence to construction specifications;

   vi. Ensure that the quality control methodology is strictly followed;

   vii. Advise on suitability of various construction materials proposed to be used in construction;

   viii. Ensure that the Quality Assurance Plan (QA/QC Manual) is strictly followed by the Project team and bring out all deficiencies to the notice of Team Leader/Deputy Team Leader/Resident Engineer promptly;

   ix. Evaluate contractor's proposal for establishing the field laboratory and approve other laboratories for testing;
x. Ensure that the routine detailed quantitative progress reporting is adequate to support the contractor's requests for progress;

xi. Establish and oversee appropriate standards and quality control procedures; and

xii. Ascertain that construction inspectors are fully cognizant of all required density testing during construction and the methodology to be employed there-on

xiii. Ensure preparation of detailed and quantitative progress reports to support the contractor's requests for progress payments; and

xiv. Assist in the preparation of Construction Completion Report including "as-built" drawings as appropriate.
REPORTING REQUIREMENTS AND TIME SCHEDULE FOR DELIVERABLES

Reporting Requirements:

The consultants will have a dual reporting function to the Executing Agency (EA) and AlIB. The consultants will prepare the following reports in English with Arial font (12 for headings and 11 for body text). The tables should use 10 Arial. The consultant will submit Table of Contents (TOC) for each report for prior approval of the client. A brief description of some important reports is given below.

i) **Bid Evaluation**: The Consultants will prepare bid evaluation reports.

ii) **Monthly Progress Report**: Monthly Progress Reports shall be prepared on regular basis. The report shall indicate progress of execution of works required under the consulting assignment. The progress reports shall detail progress under the civil works contract. The issues that may hinder the planned implementation shall be flagged in these reports along with suggested remedial measures.

iii) **Quality Assurance Plan (QA/QC Manual)**: QA/QC Manual shall be presented by the consultants before start of construction works. The Manual shall include comprehensive quality control program including detailed methodology for inspection, sampling and testing besides confirming its adequacy in the field.

iv) **PPMS Baseline (Baseline / Benchmark) Report**: The Baseline Information Report should be based on DMF requirements of inputs, outputs, outcome and impacts and provide clear baseline indicators/software modules for future comparison.

v) **Operation and Maintenance Manual**: Both draft and final versions of the O&M Manual shall be prepared for Ravi Syphon separately. The O&M Manual shall give the nature of periodic inspections to be made, physical interventions to be enforced by way of preventive and curative maintenance to be carried out every year and data to be collected and records maintained. The O&M procedures should be described in detail and should be "do-able" to maintain integrity of structures for their designed life. Resultantly, yard stick for the Maintenance Intervention Works need to be prepared, both in physical and financial terms, to facilitate planning of annual O&M activities.

vi) **Quarterly Financial Reviews**: Quarterly Financial Review shall be prepared and submitted on regular basis. The Reviews shall indicate revised cost estimates for each component of the project compared with the original budgetary provisions and recommendations for actions needed to control expenditure or seek additional funding, if so required.
vii) **Quality Control and Assurance Report:** The Quality Control and Assurance Report shall consist of periodic inspections, results of testing and sampling etc. which were done in order to ensure quality assurance of works.

viii) **Mid-Term Evaluation Report:** The Mid-term Evaluation Report shall consist of: (i) impact assessment of project activities; and (ii) organized monitoring database.

ix) **Project Completion Report:** Both draft and final versions of the Project Completion Report (PCR) shall be prepared for Ravi Syphon separately. The report shall: describe civil works and operational procedures highlighting any specific requirements, listing up major problems encountered and actions taken besides including review of training needs for operational staff and making appropriate recommendations. It shall also summarize the final quantities and financial statement and give a resume of (i) project implementation experience; (ii) suggestions for improvement, sustainability and exit strategy; and (iii) impact assessment. The PCR shall include “as-built drawings” based on the “as constructed” drawings prepared by the Contractor.

x) **Resettlement Plan:** The project is category "B" under AIB's Resettlement Guidelines meaning thereby that there may be some impacts due to the project. The AIB and Government of Punjab have agreed to the following principles with regard to resettlement under the project (i) the approach to resettlement under the project should be not to remove all persons who have encroached on the right of way(s), but to remove only those ones who will be directly affected; (ii) design have been drafted with the objective of minimizing the resettlement activities; and (iii) the contract package and execution of civil works has been designed to minimize resettlement activities. The Consultants would assist PID in updating the Land Acquisition and Resettlement Plan (LARP).

xi) **Minimizing Environmental impact and implementation of Environmental Management Plan:** An Environmental and Social Impact Assessment Examination (ESIA) has been conducted as the project is category "B" for the environment. The EISA indicates that no significant adverse environmental impacts will be caused by the Project, and the Project should actually result in improved environmental conditions. The Consultants would assist PID in updating the EISA Report in light of comments by the AIB. The Consultants recruited under these TORs shall ensure that construction of all project components for which they are responsible for supervision shall fully comply with the EMP and SSEMP-provisions, also following the EISA recommendations. The consultants shall
update the Client on the progress of EMP related activities regularly in the progress reports and shall also prepare the quarterly and bi-annual environmental monitoring reports for accuracy based on the contractor's monthly reports.

Deliverable:

The schedule for various reports and documents that are likely to be generated has been prepared. Additional reports shall be developed as required. The consultants will supply the deliverables as per schedule given below along with the respective soft copy thereof:

<table>
<thead>
<tr>
<th>Report</th>
<th>No. of Copies</th>
<th>Submission deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Progress Report</td>
<td>10</td>
<td>10th of the following month</td>
</tr>
<tr>
<td>Quarterly Progress Report</td>
<td>10</td>
<td>10th of the following quarter</td>
</tr>
<tr>
<td>Quality Assurance Plan (QA/QC Manual)</td>
<td>10</td>
<td>One (01) month after the consultants’ mobilization and before start of construction</td>
</tr>
<tr>
<td>PPMS Baseline (Baseline/Benchmark) Report</td>
<td>10</td>
<td>Six (06) months after the commencement of services</td>
</tr>
<tr>
<td>Monthly Internal Monitoring Report of EMP and Resettlement Plan</td>
<td>5</td>
<td>10th of the following month</td>
</tr>
<tr>
<td>Quarterly Progress Report of EMP, RP and GAP</td>
<td>2</td>
<td>10th of the following quarter</td>
</tr>
<tr>
<td>Bi-Annually Environmental Report</td>
<td>2</td>
<td>10th. Of the following bi-annual period</td>
</tr>
<tr>
<td>Draft O&amp;M Manual</td>
<td>15</td>
<td>One (01) year after the construction starts</td>
</tr>
<tr>
<td>Final Modified O&amp;M Manual</td>
<td>15</td>
<td>One (01) month after the review of Draft O&amp;M Manual by the Client, but before substantial completion of works</td>
</tr>
<tr>
<td>Quarterly Financial Reviews</td>
<td>25</td>
<td>10th of the following quarter</td>
</tr>
<tr>
<td>Measurement Register/ Record in support of IPC's as per agreed methodology</td>
<td>2</td>
<td>With each Contractor's verified monthly statement</td>
</tr>
<tr>
<td>Quality Control and Assurance Report</td>
<td>10</td>
<td>One (01) month after start of the following construction year</td>
</tr>
<tr>
<td>Mid-Term Evaluation Report</td>
<td>25</td>
<td>Mid-way of the project</td>
</tr>
<tr>
<td>Revised Planning Commission Proforma–I (PC-I)</td>
<td>50</td>
<td>As and when required</td>
</tr>
<tr>
<td>Revised Engineer's Estimate</td>
<td>05</td>
<td>As and when required</td>
</tr>
<tr>
<td>Draft Project Completion Report</td>
<td>25</td>
<td>Two (02) months before the anticipated completion date of the project</td>
</tr>
<tr>
<td>Final Project Completion Report</td>
<td>25</td>
<td>One (01) month after the review of Draft Project Completion Report by the Client</td>
</tr>
<tr>
<td>Planning Commission Proforma–IV (PC-IV)</td>
<td>50</td>
<td>At completion of works</td>
</tr>
<tr>
<td>Complete Inventory of works/structures completed and tools/plants/equipment</td>
<td>10</td>
<td>At completion of the project</td>
</tr>
</tbody>
</table>
Program

The supervision Consultants will assume the role of a representative of "The Engineer" during implementation of the project Lahore Water and Waste Water Management Project (Construction of New Syphon on River Ravi, Intake Structures, Gates and Raw Water Channel).

The planned completion period for Ravi Syphon Project is thirty six (36) months, three (03) months for invitation of bids, evaluation, twelve (12) months of defect liability period during which the consultants shall maintain a minimum staff to perform the required tasks of finalizing the contract. The estimated duration of consulting services is fifty one (51) months. In order to complete the start-up project review activities well in time, the Consultants will be installed about three (03) months ahead of mobilization of the work contractor and will continue for about three (03) months after the DNP for smooth project close-up and issuance of the Performance Certificate and Final Payment Certificate. The Construction Supervision Consultants shall begin the assignment not later than two (02) weeks after signing the Consulting Services Agreement. The Consultants should note that work contract for the Project is likely to be awarded shortly after mobilization of the Construction Supervision Consultants. Therefore, the Consultants are required to complete the review of detailed design, drawings and specifications in such a manner that the scheduled start of construction is not jeopardized. Any changes required as a result of this review will be brought to the notice of the Client and will be incorporated in the designs as necessary.

The proposed project implementation schedule is shown in the following chart.
<table>
<thead>
<tr>
<th>Indicative Activities</th>
<th>Project Implementation Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51</td>
</tr>
<tr>
<td></td>
<td>Due Period</td>
</tr>
</tbody>
</table>
CLIENT'S INPUT AND COUNTERPART PERSONNEL

The Client shall make available to the Consultants at no charge the following facilities:

i. Access to all reports, studies, data, photographs, maps, and institutions relating to the works, access to all sites for surveys and investigations.

ii. Assistance to procure all necessary administrative documents including but not limited to visas, exchange control documentation, import licences, exemption certificates, work permits, driving licences, resident visas.

iii. Permission to use facilities such as Guest Houses, payable at the official rates, will be granted where possible, to members of the Consultants' staff in connection with their official duties.

INFORMATION TO FACILITATE PROPOSAL PREPARATION

The information on engineering design of the project is open/available to all shortlisted firms for fair competition and can be obtained from the Project Manager / Executive Engineer, Chakbandi Division Office at the address indicated in Clause 2.1 of Data Sheet, RFP.

PROFESSIONAL LIABILITY OF CONSULTANT: As Per PPRA Rule 54

1. The Consultant selected and awarded a contract shall be liable for consequence of errors or omissions on the part of the Consultant.

2. The extent of liability of the Consultant shall form part of the contract and such liability shall not be less than remunerations nor it shall be more than twice the remunerations.

3. The procuring agency may demand insurance on part of the Consultant to cover the liability of the consultant and necessary cost shall be borne by the consultant.

4. The consultant shall be held liable for all losses or damages suffered by the procuring agency on account of any misconduct by the consultants in performing the consulting services.