GOVERNMENT OF TRIPURA
OFFICE OF THE PROJECT DIRECTOR
STATE INVESTMENT PROGRAMME MANAGEMENT AND IMPLEMENTATION UNIT
ASIAN DEVELOPMENT BANK ASSISTED NERCCDI PROJECT
Urban Development Department, 2nd floor of Khadya Bhawan.
Pandit Nehru Complex, Agartala. PIN -799007
Phone 0381-232-0174/Fax No – 0381-2329301 email – sipmiutripura@gmail.com.


Project Director, SIPMIU (NERCCDIP) Agartala, Tripura invite sealed Bid for the following work:-

1. Procurement of Works for Septage Management (Civil Works)

   Contact package No:- AGT/SM/NCB/SM-02(R)

A. Bid Security:- INR 0.124 Million.
B. Cost of Bid Document:- INR 5000.00.
C. Time of Completion:- 12 (Twelve) Months
D. Pre Bid Meeting:- 23.07.2018 at 3.00 Pm
E. Last Date of Submission of Bid:- 08-08-2018 upto 3.00 Pm.
   For details please visit :http://www.udd.tripura.gov.in

( Er. D Chakraborty)
Project Director
SIPMIU,( NERCCDIP)
Agartala, Tripura.

( Downloaded documents from the web site will not be considered for bidding and will be cancelled)
SIPMIU URBAN DEVELOPMENT DEPARTMENT
GOVERNMENT OF TRIPURA

NORTH EASTERN REGION CAPITAL CITIES DEVELOPMENT
INVESTMENT PROGRAMME

ADB Loan No- 3337-IND

Tranche III

Bidding Document

Procurement of Works for Septage Management

(Civil Works)

Contract No. AGT/SM/NCB/SM-02 (R)

Single-Stage: Two-Envelope Bidding Procedure under
National Competitive Bidding

Volume – I.

Issued by:

Project Director, SIPMIU,
Urban Development Department,
Government of Tripura,
2nd Floor, Khadya Bhavan, Pandit Nehru Complex,
Agartala-799007.
Invitation for Bids
1. India has received a Loan from the Asian Development Bank (ADB) towards the cost of the Proposed North Eastern Region Capital Cities Development Investment Program (Project-3). Part of this Loan will be used for payments under the contract named above. Bidding is open to bidders from eligible source countries of the ADB. This invitation for bids follows the General Procurement Notice for this project that appeared in the “ADB Business Opportunities” on 31st October 2011.

2. The State Investment Program Management and Implementation Unit, Urban Development Department, Government of Tripura (The Purchaser) for Procurement of works for Septage Management (Civil Works) for Agartala City, Tripura, now invites sealed Bids from eligible Bidders i.e. Manufacturer or authorised dealers with minimum ten (10) years experience in this field for supply, delivery, testing and

**Procurement of Works for Septage Management (Civil Works)**

(a) Deep tub well & RCC elevated reservoir.
(b) Rest Room For O & M Workers and Toilet Block
(c) Septage collection chamber

Bidding on an individual item basis is not permitted. The works shall be completed in all respect within a period of 09 (Nine) months.

3. National Competitive Bidding will be conducted in accordance with ADB’s Single Stage Two Envelope Bidding procedure and is open to all bidders from eligible source countries.
4. Interested eligible bidders may obtain further information from the purchaser and inspect the Bidding Document at the address given below.

5. The Bidding Document in English language may be purchased by interested Bidders by writing to the address below and upon payment of a nonrefundable fee of **INR. 5,000/- (Indian Rupees Five Thousand only)** or equivalent amount in a freely convertible currency, from the date of publication of the advertisement up to the last date of submission of Bids. Those who desire to receive the document by courier shall pay **INR 500/- (Indian Rupees Five Hundred only)** extra for delivery within India. The fee shall be paid in the form of demand draft favoring **Project Director SIPMIU, Agartala**. No liability will be accepted for loss or late delivery.

6. Bidders should satisfy the following qualification requirement:
   - The bidder’s net worth is positive.
   - Minimum average annual turnover of **INR.9.5 Million**, calculated as total certified payments received for contracts in progress or completed, within the last 3 (Three) years.
   - The Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet the overall cash flow requirement: of **INR 1.6 Million**.
   - Experience in construction contracts in the role of contractor or sub-contractor for at least the last 5 (Five) years prior to the application submission deadline
   - Participation as Contractor/Sub-contractor/ Joint venture partner in execution of at least 1 (one) construction contract within the last 5 (five) years, with a value of at **INR 5.0 Million** that have been successfully or is substantially completed (80%). The contract must be similar to the proposed works.

7. Bids must be delivered to the address below on all working days on or before **3.00 P.M. Indian Standard Time (IST) on 08.08.2018**. All bids must be accompanied by a Bid Security in the amount as specified in the Bidding Document (Data Sheet). Late bids shall summarily be rejected.

8. Technical Bids will be opened in the presence of the bidders’ representatives who choose to attend at the address below immediately after bid submission. At the end of the evaluation of Technical Proposals purchaser will invite technically qualified bidders to attend the opening of the price proposal at the date and time determined.

9. Pre bid meeting shall be held in the office of the Project Director, SIPMIU at **03.00 Noon. (IST) on 23.07.2018**. Bidders are encouraged to participate in this meeting and it is desirable that bid documents are studied thoroughly before this meeting. Non-attendance at the pre- bid meeting will not be a cause for disqualification of a bidder.
10. The Director / SIPMIU, Urban Development Department, Government of Tripura, will not be responsible for any costs or expenses incurred by Bidders in connection with the preparation or delivery of Bids.

11. Deliver your bid to the address below:

Office of the Project Director, SIPMIU, Urban Development Department, Government of Tripura, 2nd Floor, Khadya Bhavan, Pandit Nehru Complex, Agartala- 799 007, Phone: 0381-2329301
Email : sipmiutripura@gmail.com
Web site : www.tripura.nic.in, www.tenders.gov.in

- On or before the deadline **08.08.2018. up to 3.00 P.M**
- Together with a bid security as specified in the bidding document.
- Bids will be opened at **3.00 P.M** (IST) on **08.08.2018.** in the presence of bidders representatives who choose to attend.

12. Completion Period: The work shall be completed within a period of: **9 months.**

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Project Director

Project Director, SIPMIU
Urban Development Department, Government of Tripura, 2nd Floor, Khadya Bhavan, Pandit Nehru Complex, Agartala- 799 007
# Section 1 - Instructions to Bidders

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Section 1 - Instructions to Bidders

A. General

1. Scope of Bid
   1.1 The Employer, as indicated in the BDS, issues this Bidding Document for the procurement of the Works as specified in Section 6 (Works Requirements). The name, identification, and number of contracts of this bidding are provided in the BDS.

   1.2 Throughout this Bidding Document:
      (a) the term “in writing” means communicated in written form and delivered against receipt;
      (b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and
      (c) “day” means calendar day.

2. Source of Funds
   2.1 The Borrower or Recipient (hereinafter called “Borrower”) indicated in the BDS has applied for or received financing (hereinafter called “funds”) from the Asian Development Bank (hereinafter called “ADB”) toward the cost of the project named in the BDS. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.

   2.2 Payments by the ADB will be made only at the request of the Borrower and upon approval by the ADB in accordance with the terms and conditions of the financing agreement between the Borrower and the ADB (hereinafter called the Loan Agreement), and will be subject in all respects to the terms and conditions of that Loan Agreement. No party other than the Borrower shall derive any rights from the Loan Agreement or have any claim to the funds.

3. Fraud and Corruption
   3.1 ADB’s Anticorruption Policy requires borrowers (including beneficiaries of ADB-financed activity), as well as bidders, suppliers, and contractors under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the ADB:
      (a) defines, for the purposes of this provision, the terms set forth below as follows:
         (i) “corrupt practice” means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
         (ii) “fraudulent practice” means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
         (iii) “Coercive practice” means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
         (iv) “Collusive practice” means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;
(b) will reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract;

(c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, or coercive practices during the procurement or the execution of that contract, without the borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;

(d) will sanction a party or its successor, including declaring ineligible, either indefinitely or for a stated period of time, to participate (Whether as a contractor, nominated subcontractor, consultant, manufacturer or supplier, or service provider; or in any other capacity (different names are used depending on the particular bidding document). A nominated subcontractor is one which either has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that are accounted for in the evaluation of the bidder’s pre-qualification application or the bid; or (ii) appointed by the Purchaser.) in ADB-financed activities if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for, or in executing, an ADB-financed contract; and

(e) will have the right to require that a provision be included in bidding documents and in contracts financed by ADB, requiring bidders, suppliers and contractors to permit ADB or its representative to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

3.2 Furthermore, Bidders shall be aware of the provisions of GCC 22.2, and 56.2 (h).

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, government-owned entity – subject to ITB 4.5 – or any combination of them with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture (JV). In the case of a JV:

(a) all partners shall be jointly and severally liable, and

(b) the JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.

4.2 A Bidder, and all parties constituting the Bidder, shall have the nationality of an eligible country, in accordance with Section 5 (Eligible Countries). A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.

4.3 ADB considers a conflict of interest to be a situation in which a party has interests that could improperly influence that party’s performance
of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations, and that such conflict of interest may contribute to or constitute a prohibited practice under ADB’s Anticorruption Policy. In pursuance of ADB’s Anticorruption Policy’s requirement that Borrowers (including beneficiaries of Bank-financed activity), as well as bidders, suppliers, and contractors under Bank-financed contracts, observe the highest standard of ethics, ADB will take appropriate actions, which include not financing the contract, if it determines that a conflict of interest has flawed the integrity of any procurement process. Consequently all Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if, including but not limited to:

(a) they have controlling shareholders in common; or
(b) they receive or have received any direct or indirect subsidy from any of them; or
(c) they have the same legal representative for purposes of this bid; or
(d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or
(e) a Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the party is involved. However, this does not limit the inclusion of the same subcontractor in more than one bid; or
(f) a Bidder participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid; or
(g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer or Borrower as Engineer for the contract.

4.4 A firm that is under a declaration of ineligibility by the ADB in accordance with ITB 3, at the date of the deadline for bid submission or thereafter, shall be disqualified.

4.5 Government-owned enterprises in the Employer’s country shall be eligible only if they can establish that they are legally and financially autonomous and operate under commercial law, and that they are not a dependent agency of the Employer.

4.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.

4.7 Firms shall be excluded if by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower’s country prohibits any import of goods or contracting of works or services from that country or any payments to persons or entities in that country.

4.8 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.
5. Eligible Materials, Equipment and Services

5.1 The materials, equipment and services to be supplied under the Contract shall have their origin in eligible source countries as defined in ITB 4.2 above and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.

5.2 For purposes of ITB 5.1 above, “origin” means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 The Bidding Document consist of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART I Bidding Procedures
- Section 1 - Instructions to Bidders (ITB)
- Section 2 - Bid Data Sheet (BDS)
- Section 3 - Evaluation and Qualification Criteria (EQC)
- Section 4 - Bidding Forms (BDF)
- Section 5 - Eligible Countries (ELC)

PART II Requirements
- Section 6 – Works Requirements (WRQ)

PART III Conditions of Contract and Contract Forms
- Section 7 - General Conditions (GCC)
- Section 8 - Particular Conditions (PCC)
- Section 9 - Contract Forms (COF)

6.2 The Invitation for Bids issued by the Employer is not part of the Bidding Document.

6.3 The Employer is not responsible for the completeness of the Bidding Document and their Addenda, if they were not obtained directly from the source stated by the Employer in the Invitation for Bids.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

7.1 A prospective Bidder requiring any clarification of the Bidding Document shall contact the Employer in writing at the Employer’s address indicated in the BDS or raise his inquiries during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received no later than twenty-one (21) days prior to the deadline for submission of bids. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB...
7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder’s own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 The Bidder’s designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 The Bidder is requested, as far as possible, to submit any questions in writing, to reach the Employer not later than one week before the meeting.

7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.

7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Document by issuing addenda.

8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 22.2

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall not be responsible or
liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language specified in the BDS. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the BDS, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid containing the documents listed in ITB 11.2 and the other the Price Bid containing the documents listed in ITB 11.3, both envelopes enclosed together in an outer single envelope.

11.2 The Technical Bid shall comprise the following:

(a) Letter of Technical Bid;
(b) Bid Security or Bid Securing Declaration, in accordance with ITB 19;
(c) alternative bids, if permissible, in accordance with ITB 13;
(d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;
(e) documentary evidence in accordance with ITB 17 establishing the Bidder’s qualifications to perform the contract;
(f) Technical Proposal in accordance with ITB 16;
(g) Any other document required in the BDS.

11.3 The Price Bid shall comprise the following:

(a) Letter of Price Bid;
(b) completed Price Schedules, in accordance with ITB 12 and 14, or as stipulated in the BDS;
(c) alternative price bids, at Bidder’s option and if permissible, in accordance with ITB 13;
(d) Any other document required in the BDS.

11.4 In addition to the requirements under ITB 11.2, bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all partners and submitted with the bid, together with a copy of the proposed agreement.

12. Letters of Bid and Schedules

12.1 The Letters of Technical Bid and Price Bid, and the Schedules, and all documents listed under ITB 11, shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1 Unless otherwise indicated in the BDS, alternative bids shall not be considered.

13.2 When alternative times for completion are explicitly invited, a statement to that effect will be included in the BDS, as will the method of
evaluating different times for completion.

13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the Bidding Document must first price the Employer’s design as described in the Bidding Document and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.

13.4 When specified in the BDS, Bidders are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be identified in the BDS and described in Section 6 (Works Requirements). The method for their evaluation will be stipulated in Section 3 (Evaluation and Qualification Criteria).

14. Bid Prices and Discounts

14.1 The prices and discounts quoted by the Bidder in the Letter of Price Bid and in the Schedules shall conform to the requirements specified below.

14.2 The Bidder shall submit a bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section 4 (Bidding Forms). In case of admeasurement contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.

14.3 The price to be quoted in the Letter of Price Bid shall be the total price of the Bid, excluding any discounts offered.

14.4 The Bidder shall quote any discounts and the methodology for their application in the Letter of Price Bid, in accordance with ITB 14.1.

14.5 Unless otherwise provided in the BDS and the Conditions of Contract, the prices quoted by the Bidder shall be fixed. If the prices quoted by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data in Section 4 (Bidding Forms) and the Employer may require the Bidder to justify its proposed indices and weightings.

14.6 If so indicated in ITB 1.1, bids are being invited for individual contracts or for any combination of contracts (packages). Bidders wishing to offer any price reduction for the award of more than one Contract shall specify in their bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Price reductions or discounts shall be submitted in accordance with ITB 14.4, provided the bids for all contracts are submitted and opened at the same time.

14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of bids, shall be included in the rates and
15. **Currencies of Bid and Payment**

15.1 The currency(ies) of the bid and payment shall be as specified in the BDS.

15.2 Bidders may be required by the Employer to justify, to the Employer’s satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the prices shown in the appropriate form(s) of Section 4 (Bidding Forms), in which case a detailed breakdown of the foreign currency requirements shall be provided by Bidders.

16. **Documents Comprising the Technical Proposal**

16.1 The Bidder shall furnish, as part of the Technical Bid, a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders’ proposal to meet the work requirements and the completion time.

17. **Documents Establishing the Qualifications of the Bidder**

17.1 To establish its qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).

17.2 Domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility in accordance with ITB 35.

18. **Period of Validity of Bids**

18.1 Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.

18.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 19, it shall also be extended twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its Bid.

19. **Bid Security**

19.1 Unless otherwise specified in the BDS, the Bidder shall furnish as part of its bid, either a Bid Securing Declaration or a bid security as specified in the BDS, in original form. In the case of a bid security, the amount and currency shall be as specified in the BDS.

19.2 A Bid Securing Declaration shall use the form included in Section 4 (Bidding Forms).

19.3 The bid security shall be, at the Bidder’s option, in any of the following forms:

   (a) an unconditional bank guarantee;

   (b) an irrevocable letter of credit; or
(c) a cashier’s or certified check;

all from a reputable bank from an eligible country. In the case of a bank guarantee, the bid security shall be submitted either using the Bid Security Form included in Section 4 (Bidding Forms) or in another substantially similar format approved by the Employer prior to bid submission. In either case, the form must include the complete name of the Bidder. The bid security shall be valid for twenty-eight days (28) beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 18.2.

19.4 Any bid not accompanied by a substantially compliant bid security in accordance with ITB 19.3, or Bid Securing Declaration in accordance with ITB 19.2, if required in accordance with ITB 19.1 shall be rejected by the Employer as non-responsive.

19.5 If a bid security is specified pursuant to ITB 19.1, the bid security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder’s furnishing of the performance security pursuant to ITB 42.

19.6 If a bid security is specified pursuant to ITB 19.1, the bid security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.

19.7 The bid security may be forfeited or the Bid Securing Declaration executed:

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letters of Bid, except as provided in ITB 18.2 or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 41;

(ii) furnish a performance security in accordance with ITB 42; or

(iii) accept corrections of arithmetic errors pursuant to ITB 33.

19.8 The Bid Security or the Bid Securing Declaration of a JV shall be in the name of the JV that submits the Bid. If the JV has not been legally constituted at the time of bidding, the Bid Security shall be in the names of all future partners as named in the letter of intent mentioned in ITB 4.1.

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original of the Technical Bid and one original of the Price Bid comprising the Bid as described in ITB 11 and clearly mark it “ORIGINAL - TECHNICAL BID” and “ORIGINAL - PRICE BID”. Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked “ALTERNATIVE”. In addition, the Bidder shall submit two (2) copies of the Bid, as prescribed in the BDS, and clearly mark each of them “COPY.” In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid,
except for unamended printed literature, shall be signed or initialed by the person signing the bid.

20.3 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.

D. Submission and Opening of Bids

21. Sealing and Marking of Bids

21.1 Bidders may always submit their bids by mail or by hand. When so specified in the BDS, bidders shall have the option of submitting their bids electronically. Procedures for submission, sealing and marking are as follows:

(a) Bidders submitting bids by mail or by hand shall enclose the original of the Technical Bid, the original of the Price Bid, and each copy of the Technical Bid and each copy of the Price Bid, in separate sealed envelopes, duly marking the envelopes as “ORIGINAL - TECHNICAL BID”, “ORIGINAL - PRICE BID” and “COPY NO... - TECHNICAL BID” and “COPY NO.... - PRICE BID.” These envelopes, the first containing the originals and the others containing copies, shall then be enclosed in one single envelope per set. If permitted in accordance with ITB 13, alternative bids shall be similarly sealed, marked and included in the sets. The rest of the procedure shall be in accordance with ITB 21.2 and 21.3.

(b) Bidders submitting bids electronically shall follow the electronic bid submission procedures specified in the BDS.

21.2 The inner and outer envelopes shall:

(a) bear the name and address of the Bidder;
(b) be addressed to the Employer in accordance with BDS 22.1; and
(c) bear the specific identification of this bidding process indicated in the BDS 1.1.

21.3 The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid, in accordance with ITB Sub-Clause 25.1.

21.4 The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB Sub-Clause 25.7.

21.5 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

22. Deadline for Submission of Bids

22.1 Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.

22.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.
23. Late Bids

23.1 The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 22. Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.

24. Withdrawal, Substitution, and Modification of Bids

24.1 A Bidder may withdraw, substitute, or modify its Bid – Technical or Price – after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.2, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the bid must accompany the respective written notice.

All notices must be:

(a) prepared and submitted in accordance with ITB 20 and ITB 21 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked “WITHDRAWAL,” “SUBSTITUTION,” “MODIFICATION;” and

(b) received by the Employer prior to the deadline prescribed for submission of bids, in accordance with ITB 22.

24.2 Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders.

24.3 No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof.

25. Bid Opening

25.1 The Employer shall open the Technical Bids in public at the address, date and time specified in the BDS in the presence of Bidders’ designated representatives and anyone who choose to attend. Any specific electronic bid opening procedures required if electronic bidding is permitted in accordance with ITB 21.1, shall be as specified in the BDS. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening.

25.2 First, envelopes marked “WITHDRAWAL” shall be opened and read out and the envelope with the corresponding bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening.

25.3 Second, outer envelopes marked “SUBSTITUTION” shall be opened. The inner envelopes containing the Substitution Technical Bid and/or Substitution Price Bid shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Bid, if any, shall be opened, read out, and recorded. Substitution Price Bid will remain unopened in accordance with ITB Sub-Clause 25.1. No envelope shall be substituted unless the corresponding Substitution Notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.

25.4 Next, outer envelopes marked “MODIFICATION” shall be opened. No Technical Bid and/or Price Bid shall be modified unless the corresponding Modification Notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened, read out, and recorded at the opening.
Price Bids, both Original and Modification, will remain unopened in accordance with ITB Sub-Clause 25.1.

25.5 All other envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:

(a) the name of the Bidder;
(b) whether there is a modification or substitution;
(c) the presence of a Bid Security, if required; and
(d) any other details as the Employer may consider appropriate.

Only Technical Bids and alternative Technical Bids read out and recorded at bid opening shall be considered for evaluation. No Bid shall be rejected at the opening of Technical Bids except for late bids, in accordance with ITB Sub-Clause 23.1.

25.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; alternative proposals; and the presence or absence of a bid security, if one was required. The Bidders’ representatives who are present shall be requested to sign the record. The omission of a Bidder’s signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

25.7 At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice for the opening of Price Bids.

25.8 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially non-responsive to the requirements of the Bidding Document and return their Price Bids unopened.

25.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders’ representatives who choose to attend at the address, date and time specified by the Employer. The Bidder’s representatives who are present shall be requested to sign a register evidencing their attendance.

25.10 All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded:

(a) the name of the Bidder;
(b) whether there is a modification or substitution;
(c) the Bid Prices, including any discounts and alternative offers; and
(d) any other details as the Employer may consider appropriate.

Only Price Bids, discounts, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Price Bids.
25.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum: the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative offers. The Bidders’ representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

E. Evaluation and Comparison of Bids

26. Confidentiality

26.1 Information relating to the examination, evaluation, comparison, and postqualification of bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders.

26.2 Any attempt by a Bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its Bid.

26.3 Notwithstanding ITB 26.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.

27. Clarification of Bids

27.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, the Employer may, at its discretion, ask any Bidder for a clarification of its bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer’s request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bids, in accordance with ITB 33.

27.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its bid may be rejected.

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of bids, the following definitions apply:

(a) “Deviation” is a departure from the requirements specified in the Bidding Document;

(b) “Reservation” is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and

(c) “Omission” is the failure to submit part or all of the information or documentation required in the Bidding Document.

29. Preliminary Examination of Technical Bids

29.1 The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB Sub-Clause 11.2 have been provided, and to determine the completeness of each document submitted.

29.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected.
30. Responsiveness of Technical Bid

30.1 The Employer’s determination of a Bid’s responsiveness is to be based on the contents of the bid itself, as defined in ITB 11.

30.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would:
   (i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or
   (ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer’s rights or the Bidder’s obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.

30.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section 6 (Works Requirements) have been met without any material deviation or reservation.

30.4 If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

31. Nonconformities, Errors, and Omissions

31.1 Provided that a bid is substantially responsive, the Employer may waive any nonconformities in the Bid that do not constitute a material deviation, reservation or omission.

31.2 Provided that a Technical Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Technical Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

31.3 Provided that a Technical Bid is substantially responsive, the Employer shall rectify nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method indicated in Section 3 (Evaluation and Qualification Criteria).

32. Qualification of the Bidder

32.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether Bidders meet the qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).
32.2 The determination shall be based upon an examination of the documentary evidence of the Bidder’s qualifications submitted by the Bidder, pursuant to ITB 17.1.

32.3 An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder’s Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.

33. Correction of Arithmetical Errors

33.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:

(a) if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;

(b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

33.2 If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its Bid shall be disqualified and its bid security may be forfeited.

34. Conversion to Single Currency

34.1 For evaluation and comparison purposes, the currency(ies) of the bid shall be converted into a single currency as specified in the BDS.

35. Margin of Preference

35.1 Unless otherwise specified in the BDS, a margin of preference shall not apply.

36. Evaluation of Price Bids

36.1 The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.

36.2 To evaluate the Price Bid, the Employer shall consider the following:

(a) the bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities for admeasurement contracts, or Schedule of Prices for lump sum contracts, but including Daywork items, where priced competitively;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 33.1;

(c) price adjustment due to discounts offered in accordance with ITB 14.4;

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 34;

(e) adjustment for nonconformities in accordance with ITB 31.3;

(f) application of all the evaluation factors indicated in Section 3
(Evaluation and Qualification Criteria);

36.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

36.4 If this Bidding Document allows Bidders to quote separate prices for different contracts, and the award to a single Bidder of multiple contracts, the methodology to determine the lowest evaluated price of the contract combinations, including any discounts offered in the Letter of Price Bid, is specified in Section 3 (Evaluation and Qualification Criteria).

36.5 If the Bid in an admeasurement contract, which results in the lowest Evaluated Bid Price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated Contract payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

37. Comparison of Bids

37.1 The Employer shall compare all substantially responsive Bids to determine the lowest evaluated bid, in accordance with ITB 36.2.

38. Employer’s Right to Accept Any Bid, and to Reject Any or All Bids

38.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

F. Award of Contract

39. Award Criteria

39.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.

40. Notification of Award

40.1 Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, via the Letter of Acceptance included in the Contract Forms, that its bid has been accepted.

40.2 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.

40.3 At the same time, the Employer shall also notify all other Bidders of the results of the bidding, and shall publish in an English language newspaper or well-known and freely accessible website the results identifying the bid and contract numbers and the following information: (i) name of each Bidder who submitted a Bid; (ii) bid prices as read out at Bid Opening; (iii) name and evaluated prices of each Bid that was evaluated; (iv) name of bidders whose bids were rejected and the reasons for their
rejection; and (v) name of the winning Bidder, and the Price it offered, as well as the duration and summary scope of the contract awarded. After publication of the award, unsuccessful bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, after publication of contract award, requests a debriefing.

41. **Signing of Contract**

41.1 Promptly after notification, the Employer shall send the successful Bidder the Contract Agreement.

41.2 Within twenty-eight (28) days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.

42. **Performance Security**

42.1 Within twenty-eight (28) days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the performance security in accordance with the conditions of contract, subject to ITB 36.5, using for that purpose the Performance Security Form included in Section 9 (Contract Forms), or another form acceptable to the Employer. If the institution issuing the performance security is located outside the country of the Employer, it shall have a correspondent financial institution located in the country of the Employer to make it enforceable.

42.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security. In that event the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.

42.3 The above provision shall also apply to the furnishing of a domestic preference security if so required.
## Section 2 - Bid Data Sheet

### A. Introduction

**ITB 1.1**

The Employer is:
Project Director, SIPMIU,
Urban Development Department,
2nd Floor, Khadya Bhavan, Pandit Nehru Complex
Government of Tripura,
Agartala – 799007. India

**ITB 1.1**

The name of the NCB is: AGT/SM/NCB/SM-02

Procurement of Works for Septage Management (Civil Works) comprising
(a) Deep tub well & RCC elevated reservoir.
(b) Rest Room For O & M Workers and Toilet Block
(c) Septage collection chamber

: The number and identification of Lots comprising this bidding process is: One.

**ITB 2.1**

The Borrower is: India

**ITB 2.1**

The name of the Project is:
, NORTH EASTERN REGION CAPITAL CITIES DEVELOPMENT INVESTMENT PROGRAMME
Loan No.3337-IND

### B. Bidding Documents

**ITB 7.1**

For clarification purposes only, the Employer’s address is:

Attention:
Project Director, SIPMIU,
Urban Development Department,
2nd Floor, Khadya Bhavan, Pandit Nehru Complex
Government of Tripura,
Agartala - 799007
Country: India
Telephone: 0381-2320174
Facsimile number: 0381-2329301
Electronic mail address: sipmiutripura@gmail.com

Requests for clarification should be received by the Employer no later than:
Ten (10) days prior to the dead line for submission of bids.

**ITB 7.4**

A Pre-Bid meeting shall take place on 23/07/2018 at 3.00 PM
A site visit conducted by the Employer shall be organized on 2305/07/2018 at11.30 AM.
C. Preparation of Bids

<table>
<thead>
<tr>
<th>ITB 10.1</th>
<th>The language of the bid is: English</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 11.2 (g)</td>
<td>The Bidder shall submit with its Technical Bid the following additional documents: None</td>
</tr>
<tr>
<td>ITB 11.3 (d)</td>
<td>The Bidder shall submit with its Price Bid the following additional documents: None</td>
</tr>
<tr>
<td>ITB 13.1</td>
<td>Alternative bids shall not be permitted.</td>
</tr>
<tr>
<td>ITB 13.2</td>
<td>Alternative times for completion shall not be permitted.</td>
</tr>
<tr>
<td>ITB 13.4</td>
<td>Alternative technical solutions shall be permitted for the following parts of the Works: Not applicable</td>
</tr>
<tr>
<td>ITB 14.5</td>
<td>The prices quoted by the Bidder shall not be subject to adjustment during the performance of the Contract.</td>
</tr>
<tr>
<td>ITB 15.1</td>
<td>The currency of the Bid shall be: Currency of the Bidder’s home country, i.e. Indian National Rupees. The prices shall be paid in: Indian Rupees</td>
</tr>
<tr>
<td>ITB 15.4</td>
<td>The exchange rate to be used in conversion of the bid security amount to another freely convertible currency shall be the selling exchange rate published by the Reserve Bank of India on the date 28 days prior to the date for the dead line for bid submission.</td>
</tr>
<tr>
<td>ITB 18.1</td>
<td>The bid validity period shall be 120 days.</td>
</tr>
<tr>
<td>ITB 19.1</td>
<td>The Bidder shall furnish a bid security in the amount of INR 0.124 Million. The Bid security shall be denominated in Indian Rupees and shall be valid up to 28 days after expiry of Bid validity period (total 148 days). The Bid Security issued by reputable international bank or a bank in the Employer’s country including a nationalized or scheduled bank or financial institution selected by the contractor. If the institution issuing the security is located outside the country of the Employer, it shall have a correspondent financial institution located in the country of the Employer to make it enforceable.</td>
</tr>
<tr>
<td>ITB 20.1</td>
<td>In addition to the original of the bid, the number of copies is: One</td>
</tr>
</tbody>
</table>
| ITB 20.2 | The written confirmation of authorization to sign on behalf of the Bidder shall consist of: 
(a) The name and description of the documentation required to demonstrate the authority of the signatory to sign the Bid such as a Power of Attorney. 
(b) Bids submitted by an existing or an intended JV shall include an undertaking signed by all parties (i) stating that all parties shall be jointly and severally liable, and (ii) nominating a Representative, who... |
shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.

### D. Submission and Opening of Bids

<table>
<thead>
<tr>
<th>ITB 21.1</th>
<th>Bidders <em>shall not</em> have the option of submitting their bids electronically.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 21.1 (b)</td>
<td>If bidders have the option of submitting their bids electronically, the electronic bidding submission procedures shall be: <strong>Not applicable</strong></td>
</tr>
<tr>
<td>ITB 22.1</td>
<td>For <strong>bid submission purposes</strong> only, the Employer’s address is:</td>
</tr>
<tr>
<td></td>
<td>Attention: Project Director, SIPMIU, Urban Development Department, Govt. of Tripura</td>
</tr>
<tr>
<td></td>
<td>Street Address: Khadya Bhawan Pandit Nehru Complex</td>
</tr>
<tr>
<td></td>
<td>Floor/Room number: 2nd Floor</td>
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<td></td>
<td>City: Agartala</td>
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<td></td>
<td>ZIP Code: 799007</td>
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<td></td>
<td>Country: India</td>
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<tr>
<td></td>
<td><strong>The deadline for bid submission is:</strong></td>
</tr>
<tr>
<td></td>
<td>Date: <strong>08/25/087/2018</strong></td>
</tr>
<tr>
<td></td>
<td>Time: <strong>3.00 PM</strong></td>
</tr>
<tr>
<td>ITB 25.1</td>
<td>The opening of the Technical Bid shall take place at/on:</td>
</tr>
<tr>
<td></td>
<td><strong>Office of the Project Director SIPMIU</strong></td>
</tr>
<tr>
<td></td>
<td>Street Address: Khadya Bhawan Pandit Nehru Complex</td>
</tr>
<tr>
<td></td>
<td>Floor/Room number: 2nd floor</td>
</tr>
<tr>
<td></td>
<td>City: Agartala</td>
</tr>
<tr>
<td></td>
<td>Country: India</td>
</tr>
<tr>
<td></td>
<td><strong>Date</strong>: <strong>08/08/201825/07/2018</strong></td>
</tr>
<tr>
<td></td>
<td>Time: <strong>3.00 PM</strong></td>
</tr>
<tr>
<td></td>
<td>If electronic bid submission is permitted in accordance with ITB 21.1, the specific bid opening procedures shall be: <strong>Not applicable</strong></td>
</tr>
</tbody>
</table>
### E. Evaluation and Comparison of Bids

| ITB 34.1 | The currency that shall be used for bid evaluation and comparison purposes to convert all bid prices expressed in various currencies into a single currency is: **INR**.  
The source of the selling exchange rate shall be: Reserve Bank of India  
The date for the selling exchange rate shall be: 28 days prior to the deadline for submission of Bids. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 35.1</td>
<td>No margin of preference shall apply.</td>
</tr>
</tbody>
</table>
Section 3 - Evaluation and Qualification Criteria

- Postqualification -

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   2.1.3 ADB Eligibility ................................................................................................................................... 3
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1. **Evaluation**
   
   In addition to the criteria listed in ITB 36.2 (a) – (f) the following criteria shall apply:

1.1 **Adequacy of Technical Proposal**

   Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 6 (Work's Requirements).

1.2 **Multiple Contracts**

   Not applicable

1.3 **Completion Time**

   An alternative Completion Time, if permitted under ITB 13.2, will be evaluated as follows:

   No alternative completion schedule shall be allowed.

1.4 **Technical Alternatives**

   Technical alternatives, if permitted under ITB 13.4, will be evaluated as follows:

   No technical alternatives shall be allowed.

1.5 **Margin of Preference (Applicable for ICB only)**

   Margin of preference under ITB 35.1 will be as follows as:

   Margin of preference will not be allowed.

1.6 **Quantifiable Nonconformities, Errors and Omissions**

   The evaluated cost of quantifiable non-conformities, errors and/or omissions are determined as follows:

   The cost of any item not quoted by the bidder in the Bill of Quantities will be added to the bid price to allow for bid comparison on an equal basis. The price adjustment may be done on the basis of highest price quoted for the same item by the other bidders.
2. Qualification

2.1 Eligibility

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
</tr>
</tbody>
</table>

2.1.1 Nationality
Nationality in accordance with ITB Sub-Clause 4.2.
- must meet requirement
- existing or intended JV must meet requirement
- must meet requirement
- not applicable
- Forms ELI - 1; ELI - 2 with attachments

2.1.2 Conflict of Interest
No conflicts of interest in accordance with ITB Sub-Clause 4.3.
- must meet requirement
- existing or intended JV must meet requirement
- must meet requirement
- not applicable
- Letter of Technical Bid

2.1.3 ADB Eligibility
Not having been declared ineligible by ADB, as described in ITB Sub-Clause 4.4.
- must meet requirement
- existing or intended JV must meet requirement
- must meet requirement
- not applicable
- Letter of Technical Bid

2.1.4 Government-owned Entity
Bidder required to meet conditions of ITB Sub-Clause 4.5.
- must meet requirement
- must meet requirement
- must meet requirement
- not applicable
- Forms ELI - 1; ELI - 2 with attachments

2.1.5 UN Eligibility
Not having been declared ineligible based on a United Nations resolution or Employer’s country law, as described in ITB Sub-Clause 4.8.
- must meet requirement
- existing or intended JV must meet requirement
- must meet requirement
- not applicable
- Letter of Bid
## 2.2 Pending Litigation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2.1 Pending Litigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All pending litigation shall be treated as resolved against the Bidder and so shall in total not represent more than 50 percent of the Bidder’s net worth.</td>
<td>must meet requirement by itself or as partner to past or existing JV</td>
<td>not applicable</td>
</tr>
</tbody>
</table>

## 2.3 Financial Situation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.1 Historical Financial Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submission of audited financial statements or, if not required by the law of the Bidder’s country, other financial statements acceptable to the Employer, for the last three (3) years to demonstrate the current soundness of the Bidder’s financial position. As a minimum, the Bidder’s net worth for the last year calculated as the difference between total assets and total liabilities should be positive</td>
<td>must meet requirement</td>
<td>not applicable</td>
</tr>
</tbody>
</table>
### 2.3.2 Average Annual Construction Turnover

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Single Entity</th>
<th>Joint Venture</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum average annual construction turnover of INR <strong>9.5</strong> Million calculated as total certified payments received for contracts in progress or completed, within the last three (3) years..</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
<td>must meet 25% of the requirement</td>
</tr>
</tbody>
</table>

### 2.3.3 Financial Resources

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Single Entity</th>
<th>Joint Venture</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet the overall cash flow requirement: of the bid : The overall cash flow requirement of INR <strong>1.6 Million</strong></td>
<td>must meet requirement</td>
<td>must meet requirement</td>
<td>must meet 25% of the requirement</td>
</tr>
</tbody>
</table>

### 2.4 Experiences

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.4.1 General Construction Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience under construction contracts in the role of contractor, subcontractor, or management contractor for at least the last Five (5) years prior to the applications submission deadline.</td>
<td>must meet requirement</td>
<td>not applicable</td>
</tr>
</tbody>
</table>
### 2.4.2 Specific Construction Experience

#### (a) Contracts of Similar Size and Nature

<table>
<thead>
<tr>
<th>Participation as contractor, management contractor, or subcontractor, in at least One contract within the last five (5) years of 2 to 3 yrs years duration with a value of at least INR 5.0 million that have been successfully substantially completed (80%) and is are similar to the proposed work. The similarity shall be based on the physical size, complexity, methods, technology or other characteristics as described in Section 6 (Works Requirements) shall be considered.</th>
<th>must meet requirement</th>
<th>must meet requirement</th>
<th>Not applicable</th>
<th>Not applicable</th>
<th>Form EXP - 2(a)</th>
</tr>
</thead>
</table>

#### (b) Construction Experience in Key Activities

<table>
<thead>
<tr>
<th>For the above or other contracts executed during the period stipulated in 4.2(a) above, a minimum construction experience in the Construction of at least one . Tube well of minimum capacity of 15000 GPH is desired.</th>
<th>must meet all requirements</th>
<th>must meet all requirements</th>
<th>not applicable</th>
<th>not applicable</th>
<th>Form EXP - 2(b)</th>
</tr>
</thead>
</table>
2.5 Personnel

The Bidder must demonstrate that it has the personnel for the key positions that meet the following requirements for each Lot.

<table>
<thead>
<tr>
<th>No.</th>
<th>Position</th>
<th>Total Work Experience [years]</th>
<th>for each Lot (Lot 1&amp;Lot-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Manager BE(Civil)</td>
<td>5 yr. (Particular experience in similar work for 3 years)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Construction Engineer BE(CIVIL)/ Diploma(Civil)</td>
<td>3 years for BE / 7 years for Diploma (Particular experience in similar work for 3 years)</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Quantity Surveyor cum Diploma in Civil-Engineer</td>
<td>1 (Particular experience in similar work for 2 years)</td>
<td>1</td>
</tr>
</tbody>
</table>

The Bidder shall provide details of the proposed personnel and their experience records in the relevant Information Forms included in Section 4 (Bidding Forms).

The Bidder should normally be required to name a principal candidate and an alternate candidate for each key position.
2.6 Equipment

The Bidder must demonstrate that it has the key equipment listed hereafter for this work.

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment Type and Characteristics</th>
<th>Min. Number Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Back Hoe Excavator machine</td>
<td>1 no.</td>
</tr>
<tr>
<td>2</td>
<td>Weigh Batch Concrete Mixer and Vibrators</td>
<td>1 Batch mixer and 2 Vibrator (for each site)</td>
</tr>
<tr>
<td>3</td>
<td>Electric Tower crane</td>
<td>Optional</td>
</tr>
</tbody>
</table>

The Bidder shall provide further details of proposed items of equipment using the relevant Form in Section 4 (Bidding Forms)

These are minimum requirement as per Employer's estimate. The bidder is to provide their own estimate commensurate with their work plan and their methodology.
Section 4 - Bidding Forms

- Post-qualification -

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<tr>
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<th>Page</th>
</tr>
</thead>
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<td>3</td>
</tr>
<tr>
<td>Letter of Price Bid</td>
<td>5</td>
</tr>
<tr>
<td>Bid Security</td>
<td>7</td>
</tr>
<tr>
<td>Technical Proposal</td>
<td>9</td>
</tr>
<tr>
<td>Personnel</td>
<td>10</td>
</tr>
<tr>
<td>Form PER – 1: Proposed Personnel</td>
<td>10</td>
</tr>
<tr>
<td>Form PER – 2: Resume of Proposed Personnel</td>
<td>11</td>
</tr>
<tr>
<td>Equipment</td>
<td>12</td>
</tr>
<tr>
<td>Site Organization</td>
<td>13</td>
</tr>
<tr>
<td>Method Statement</td>
<td>14</td>
</tr>
<tr>
<td>Mobilization Schedule</td>
<td>15</td>
</tr>
<tr>
<td>Construction Schedule</td>
<td>16</td>
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<tr>
<td>Bidders Qualification</td>
<td>17</td>
</tr>
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<td>Form ELI - 1: Bidder’s Information Sheet</td>
<td>18</td>
</tr>
<tr>
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<td>19</td>
</tr>
<tr>
<td>Form LIT - Pending Litigation</td>
<td>20</td>
</tr>
<tr>
<td>Form FIN - 1: Financial Situation</td>
<td>21</td>
</tr>
<tr>
<td>Form FIN - 2: Average Annual Construction Turnover</td>
<td>22</td>
</tr>
<tr>
<td>Form FIN – 3: Financial Resources</td>
<td>23</td>
</tr>
<tr>
<td>Form FIN- 4: Current Contract Commitments / Works in Progress</td>
<td>24</td>
</tr>
<tr>
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</tr>
</tbody>
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Letter of Technical Bid

Date: ..................................................

NCB No.: ..................................................

Invitation for Bid No.: ..................................................

To:
Project Director, SIPMIU
Urban Development Department,
Government of Tripura,
2nd Floor, Khadya Bhavan, Pandit Nehru Complex,
Agartala- 799 007

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8;

(b) We offer to execute in conformity with the Bidding Documents the following Works:

(c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of . . . . . days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(d) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries [insert the nationality of the Bidder, including that of all parties that comprise the Bidder if the Bidder is a consortium or association, and the nationality of each Subcontractor and Supplier];

(e) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 4.3;

(f) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB 4.3, other than alternative offers submitted in accordance with ITB 13;

(g) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by ADB, under the Employer’s country laws or
(h) We are not a government owned entity / We are a government owned entity but meet the requirements of ITB4.5; *

(i) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Bank.

Name ..................................................................................................................................................
In the capacity of ..................................................................................................................................
Signed ..................................................................................................................................................
Duly authorized to sign the Bid for and on behalf of ..........................................................................
Date ..................................................................................................................................................

* Use one of the two options as appropriate
Letter of Price Bid

Date: ..................................................
NCB No.: ..................................................
Invitation for Bid No.: ..................................................

To
Project Director, SIPMIU
Urban Development Department,
Government of Tripura,
2nd. Floor, Khadya Bhavan, Pandit Nehru Complex,
Agartala- 799 007

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8;

(b) We offer to execute in conformity with the Bidding Documents the following Works:

(c) The total price of our Bid, excluding any discounts offered in item (d) below is:

(d) The discounts offered and the methodology for their application are:

(e) Our Bid shall be valid for a period of . . . . . days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Documents;

(g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract:

<table>
<thead>
<tr>
<th>Name of Recipient</th>
<th>Address</th>
<th>Reason</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>...................</td>
<td>..........</td>
<td>..........</td>
<td>..........</td>
</tr>
<tr>
<td>...................</td>
<td>..........</td>
<td>..........</td>
<td>..........</td>
</tr>
</tbody>
</table>

Procurement of Works for Septage Management 5 of 33
(h) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed; and

(i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(j) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Bank.

(k) If awarded the contract, the person named below shall act as Contractor's Representative.

Name ................................................................................................................................................
In the capacity of ................................................................................................................................
Signed ...............................................................................................................................................
Duly authorized to sign the Bid for and on behalf of ...........................................................................
Date ....................................................................................................................................................

** If none has been paid or is to be paid, indicate "none"
Bid Security

Bank Guarantee

Bank's Name, and Address of Issuing Branch or Office

Beneficiary: Project Director, SIPMIU

Project Director, SIPMIU
Urban Development Department,
Government of Tripura,
2nd Floor, Khadya Bhavan, Pandit Nehru Complex,
Agartala- 799 007

Date

We have been informed that . . . . . name of the Bidder . . . . . (hereinafter called "the Bidder") has submitted to you its bid dated . . . . . . . . . (hereinafter called "the Bid") for the execution of . . . . . . name of contract . . . . . . . under Invitation for Bids No. . . . . . . (. . . . . . . (. . . . . . . ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

At the request of the Bidder, we . . . . . name of Bank . . . . hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of . . . . . . . amount in figures . . . . . . . ( . . . . amount in words . . . . . . ) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

(a) has withdrawn its Bid during the period of bid validity specified by the Bidder in the Form of Bid;

(b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or

(c) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the Performance Security, in accordance with the ITB.

This guarantee will expire: (a) if the Bidder is the successful Bidder, upon our receipt of copies of the Contract Agreement signed by the Bidder and the performance security issued to you upon the instruction of the Bidder; and (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy your notification to the Bidder of the name of the successful Bidder; or (ii) twenty-eight days after the expiration of the Bidder's bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458.

Bank's seal and authorized signature(s)

Note: All italicized text is for use in preparing this form and shall be deleted from the final document

Note 1: In case of domestic bidders, the Bank Guarantee should be on a non-judicial stamp paper for Bank Guarantee issued by a bank in India.
Bid Securing Declaration

Not Applicable

Date: ________________

Bid No.: ________________

Alternative No.: [insert identification No if this is a Bid for an alternative]

To:

Project Director, SIPMIU
Urban Development Department,
Government of Tripura,
2nd. Floor, Khadya Bhavan, Pandit Nehru Complex,
Agartala- 799 007

We, the undersigned, declare that:

We understand that, according to your conditions, bids must be supported by a Bid Securing Declaration.

We accept that we will automatically be suspended from being eligible for bidding in any contract with the Borrower for the period of time of [insert number of months or years] starting on [insert date], if we are in breach of our obligation(s) under the bid conditions, because we:

(a) have withdrawn our Bid during the period of bid validity specified in the Form of Bid; or

(b) having been notified of the acceptance of our Bid by the Employer during the period of bid validity, (i) fail or refuse to execute the Contract, if required, or (ii) fail or refuse to furnish the Performance Security, in accordance with the ITB.

We understand this Bid Securing Declaration shall expire if we are not the successful Bidder, upon the earlier of (i) our receipt of your notification to us of the name of the successful Bidder; or (ii) twenty-eight days after the expiration of our Bid.

Signed: ________________________________

In the capacity of ________________________________

Name: ________________________________

Duly authorized to sign the bid for and on behalf of: [insert complete name of Bidder]

Dated on __________ day of ______________, _______

Corporate Seal [where appropriate]

-- Note --

In case of a Joint Venture, the Bid-Securing Declaration must be in the name of all partners to the Joint Venture that submits the bid.
Technical Proposal

Personnel

Equipment

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

Others
Personnel

Bidders should provide the names of suitably qualified personnel to meet the requirements specified in Section 3 (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

Form PER – 1: Proposed Personnel

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
</tr>
</tbody>
</table>

*As listed in Section 3 (Evaluation and Qualification Criteria).
Form PER – 2: Resume of Proposed Personnel

<table>
<thead>
<tr>
<th>Personnel information</th>
<th>Name</th>
<th>Date of birth</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional qualifications</td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Present employment</th>
<th>Name of employer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address of employer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>Contact (manager / personnel officer)</td>
<td></td>
</tr>
<tr>
<td>Fax</td>
<td>E-mail</td>
<td></td>
</tr>
<tr>
<td>Job title</td>
<td>Years with present employer</td>
<td></td>
</tr>
</tbody>
</table>

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Company / Project / Position / Relevant technical and management experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Procurement of Works for Septage Management

Page 11 of 33
Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section 3 (Evaluation and Qualification Criteria). A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

<table>
<thead>
<tr>
<th>Item of Equipment</th>
<th>Equipment Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name of manufacturer</td>
</tr>
<tr>
<td></td>
<td>Model and power rating</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
</tr>
<tr>
<td></td>
<td>Year of manufacture</td>
</tr>
<tr>
<td>Current Status</td>
<td>Current location</td>
</tr>
<tr>
<td></td>
<td>Details of current commitments</td>
</tr>
<tr>
<td>Source</td>
<td>Indicate source of the equipment</td>
</tr>
<tr>
<td></td>
<td>☐ Owned</td>
</tr>
<tr>
<td></td>
<td>☐ Rented</td>
</tr>
<tr>
<td></td>
<td>☐ Leased</td>
</tr>
<tr>
<td></td>
<td>☐ Specially manufactured</td>
</tr>
</tbody>
</table>

Omit the following information for equipment owned by the Bidder.

<table>
<thead>
<tr>
<th>Owner</th>
<th>Name of owner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address of owner</td>
</tr>
<tr>
<td></td>
<td>Telephone</td>
</tr>
<tr>
<td></td>
<td>Contact name and title</td>
</tr>
<tr>
<td></td>
<td>Fax</td>
</tr>
<tr>
<td></td>
<td>Telex</td>
</tr>
<tr>
<td>Agreements</td>
<td>Details of rental / lease / manufacture agreements specific to the project</td>
</tr>
</tbody>
</table>

---

Procurement of Works for Septage Management
Site Organization
Method Statement
Mobilization Schedule
Construction Schedule
Bidders Qualification

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.
Form ELI - 1: Bidder's Information Sheet

<table>
<thead>
<tr>
<th>Bidder’s Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidder’s legal name</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>In case of JV, legal name of each partner</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Bidder’s country of constitution</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Bidder’s year of constitution</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Bidder’s legal address in country of constitution</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Bidder’s authorized representative</td>
</tr>
<tr>
<td>(name, address, telephone numbers, fax numbers, e-mail address)</td>
</tr>
</tbody>
</table>

Attached are copies of the following original documents.

- 1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2.
- 2. Authorization to represent the firm or JV named in above, in accordance with ITB 20.2.
- 3. In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1.
- 4. In case of a government-owned entity, any additional documents not covered under 1 above required to comply with ITB 4.5.
**Form ELI - 2: JV Information Sheet**

Each member of a JV must fill in this form

<table>
<thead>
<tr>
<th><strong>JV / Specialist Subcontractor Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidder’s legal name</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>JV Partner’s or Subcontractor’s legal name</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>JV Partner’s or Subcontractor’s country of constitution</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>JV Partner’s or Subcontractor’s year of constitution</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>JV Partner’s or Subcontractor’s legal address in country of constitution</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>JV Partner’s or Subcontractor’s authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)</td>
</tr>
</tbody>
</table>

*Attached are copies of the following original documents.*

- 1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2.
- 2. Authorization to represent the firm named above, in accordance with ITB 20.2.
- 3. In the case of government-owned entity, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5.
Form LIT - Pending Litigation

Each Bidder or member of a JV must fill in this form

<table>
<thead>
<tr>
<th>Year</th>
<th>Matter in Dispute</th>
<th>Value of Pending Claim in US$ Equivalent</th>
<th>Value of Pending Claim as a Percentage of Net Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Form FIN - 1: Financial Situation

Each Bidder or member of a JV must fill in this form

<table>
<thead>
<tr>
<th>Financial Data for Previous 3 Years [US$ Equivalent]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1:</td>
</tr>
</tbody>
</table>

**Information from Balance Sheet**

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Liabilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Worth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Liabilities</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Information from Income Statement**

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits Before Taxes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits After Taxes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last three years, as indicated above, complying with the following conditions.
- All such documents reflect the financial situation of the Bidder or partner to a JV, and not sister or parent companies.
- Historic financial statements must be audited by a certified accountant.
- Historic financial statements must be complete, including all notes to the financial statements.
- Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).
Form FIN - 2: Average Annual Construction Turnover

Each Bidder or member of a JV must fill in this form

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount Currency</th>
<th>Exchange Rate</th>
<th>US$ Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Average Annual Construction Turnover

The information supplied should be the Annual Turnover of the Bidder or each member of a JV in terms of the amounts billed to clients for each year for work in progress or completed, converted to US Dollars at the rate of exchange at the end of the period reported.
**Form FIN – 3: Financial Resources**

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as indicated in Section 3 (Evaluation and Qualification Criteria)

<table>
<thead>
<tr>
<th>No.</th>
<th>Source of financing</th>
<th>Amount (US$ equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Form FIN- 4: Current Contract Commitments / Works in Progress

Bidders and each partner to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Contract</th>
<th>Employer’s Contact Address, Tel, Fax</th>
<th>Value of Outstanding Work [Current US$ Equivalent]</th>
<th>Estimated Completion Date</th>
<th>Average Monthly Invoicing Over Last Six Months [US$/month]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
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<tr>
<td>5</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Form EXP – 1: General Construction Experience

Each Bidder or member of a JV must fill in this form

<table>
<thead>
<tr>
<th>Starting Month Year</th>
<th>Ending Month Year</th>
<th>Years</th>
<th>Contract Identification and Name</th>
<th>Name and Address of Employer</th>
<th>Brief Description of the Works Executed by the Bidder</th>
<th>Role of Bidder</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>
Form EXP – 2(a): Specific Construction Experience

Fill up one (1) form per contract.
<table>
<thead>
<tr>
<th><strong>Contract of Similar Size and Nature</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contract No</strong></td>
</tr>
<tr>
<td>Award Date</td>
</tr>
<tr>
<td>Role in Contract</td>
</tr>
<tr>
<td>Contractor</td>
</tr>
<tr>
<td>Total Contract Amount</td>
</tr>
<tr>
<td>If partner in a JV or subcontractor, specify participation of total contract amount</td>
</tr>
<tr>
<td>Employer’s Name</td>
</tr>
</tbody>
</table>

**Description of the similarity in accordance with Criteria 2.4.2(a) of Section 3**
Tables of Adjustment Data -

Table A - Local Currency

<table>
<thead>
<tr>
<th>Index Code</th>
<th>Index Description</th>
<th>Source of Index</th>
<th>Base Value and Date</th>
<th>Bidder's Local Currency Amount</th>
<th>Bidder's Proposed Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonadjustable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labour</td>
<td>RBI Index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Material</td>
<td>RBI Index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bitumen</td>
<td>Ex-Refinery Price</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diesel</td>
<td>Ex –Depot Price</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

Note: As per GCC Sub clause no 1.1.3.1 ‘Base date’ means the date 28 days prior to the latest date for submission of the bid.

Table B - Foreign Currency

*Name of Currency:*

If the Bidder wishes to quote in more than one foreign currency, this table should be repeated for each foreign currency.

<table>
<thead>
<tr>
<th>Index Code</th>
<th>Index Description</th>
<th>Source of Index</th>
<th>Base Value and Date</th>
<th>Bidder's Currency in Type/Amount</th>
<th>Equivalent in FC1</th>
<th>Bidder's Proposed Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonadjustable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labour</td>
<td>Central Bank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Material</td>
<td>Central Bank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bitumen</td>
<td>Ex-Refinery Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diesel</td>
<td>Ex –Depot Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Procurement of Works for Septage Management
Schedules
Bill of Quantities

PREAMBLE TO THE BILL OF QUANTITIES

1.0 General

1.1 The Contractor shall be deemed to have read and examined the Tender Documents before completing the Bill of Quantities and the Schedule of Rates. The Drawings, Specifications, Schedules etc. are to be considered as explanatory of each other and no advantage shall be taken of any omission in tender documents.

1.2 The Contractor shall be deemed to be fully conversant with and to have made full allowance in his Tender for the site conditions, the nature and complexity of the work to be undertaken, the other extensive development and construction work currently being or which may be executed on and around the Site and all changes in the nature and condition of the Site from that existing at the time of Tender.

The following shall be designed by the Contractor:

*The detail design of the 4 Nos. Overhead reservoirs (OHSR s). One reservoir to be executed as per the design to be given by the deptt. (foundation work and column up to 1st tie beam has already been completed).*

1.3 General directions and descriptions of scope of work and materials given in the Specification or shown on the Drawings are not necessarily repeated in the Bill of Quantities and reference is to be made to the Specification and the Drawings for this information.

1.4 The rates quoted in the schedule shall be the all inclusive value for the work described and be deemed to include for all the Contractor’s liabilities and obligations and all risks set forth or implied in the document and all matters and things necessary for the proper construction, of the Works including surveying, setting out, plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes and duties together with all general risks liabilities and obligations set out or implied in the Contract. The Charge for any obligation of the Contractor for which apparently no corresponding item is given in the Bills of Quantities shall be deemed to be included in the Contract Rates and Prices entered against the billed items.

1.5 Extra items of work shall not vitiate the Contract. The Contractor shall be bound to execute extra items of work as directed by the Engineer. The rates for extra items of works will be as per rates decided under Contract Conditions.

1.6 It is to be expressly understood that the measured work is to be taken net (not withstanding any system or practice to the contrary) according to the actual quantities wherein finished according to the Drawings or as may be ordered from time to time by the Engineer and the cost calculated at the respective prices, without any additional charges for any necessary or contingent works connected therewith. The rates quoted are for works in situ and complete in every respect. The constructional plant and temporary works will not be measured.
1.7 All items are measured net and no allowance will be made for wastage, working space, bulking or shrinkage, overlaps etc.

1.8 The unit rate should be entered against each item in the Bill of Quantities and shall be written in ink in figures. Any item left unpriced will be deemed to be included for elsewhere in the Bill of Quantities or the Schedule and hence the rate for that item will be taken as NIL.

1.9 In case any discrepancy is found between the quoted rates and the amounts, the unit rates will be taken as correct.

2.0 **Safety**

The contract rates shall be deemed to include all costs of compliance with safety requirements in the Specification.

3.0 **Preparation of “As-built” Drawings**

Contractor will prepare ‘As Built’ drawings for each OHSR containing details foundation and equipments installed.

The date by which operating and maintenance manuals are required is 2 months before the completion period. The date by which “as built” drawings are required is 1 month after the completion period. The amount to be withheld for failing to produce “as built” drawings and/or operating and maintenance manuals by the date required in GCC 55.1 is Rs 1,00,000.00 (0.1 millions INR)

4.0 **Provisional Sums:**

SIPMIU may make the payment for the work under provisional item shall be payable for statutory requirements by other agencies namely TSECL, UDD, PHE, BSNL, PWD, AMC and specialized agencies or the like. Payment will be as per the bill raised by the agencies. The contractor shall pay the connection charges under provisional sum. Inspection charges if required to pay to the third party inspecting agency shall also be paid by the contractor. The Contractor will be reimbursed for such charges on the basis of actual charges and +7.5% extra for such costs paid under provisional sums.

5.0 **Deviation from Specification:**

Any deviations from the specifications mentioned in the Bid document shall not be accepted.

6.0 **Pipeline:**

Under contract, it may be required to lay the pipeline from the reservoir/ sump, or to connect with existing transmission/distribution system etc. Such pipeline work will include cost of excavation of trenches, laying of pipelines, jointing material, specials, refilling of trench etc. No extra cost will be paid for excavation, specials and connections etc.

7.0 **Construction of OHSR:**

Contractor will construct fencing with gate for protection of the area and arrangement of lightning arrester, RCC stair case and water level indicator which have been included in the construction of OHSR. Outlet arrangements and overflow and washing cleaning
arrangements should be included in the scope of work. The work will include excavation in all type of strata, dismantling of structures (steel/RCC/C.C/B.W). All the works to be executed as per specifications mentioned.

8.0 Abbreviations used in Bill of Quantities and rates have the meaning shown below:

- AMC  - Agartala Municipal Council
- BOQ  - Bill of Quantity
- BSNL - Bharat Sanchar Nigam limited
- CC   - Cement Concrete
- CI   - Cast Iron
- DI   - Ductile Iron
- cm   - Centimeter
- CM   - Cement Mortar
- CBW  - Cement brick work
- Cum / m³ - Cubic meter
- Dia  - Diameter
- SW   - Glazed Stoneware Pipes
- kg   - Kilogram
- km   - Kilometer
- LS   - Lump sum
- m    - Metre
- RM   - Running Metre
- mm   - Millimetre
- MS   - Mild Steel
- MT   - Metric Tonne
- No.  - Number
- PCC  - Plain Cement Concrete
- PSC  - Pre-Stressed Concrete
- PHE  - Public Health Engineering
- PWD  - Public Works Department
- RCC  - Reinforced Cement Concrete
- Sqm./ m² - Square meter
- SW   - Storm Water
- TSECL - Tripura State Electricity Corporation limited
- UDD  - Urban Development Department
- WBM  - Water bound macadam
- Wt   - Weight
9.0 Miscellaneous

9.1 Cost of temporary power meters, telephones, water for construction shall also be taken into Contractor’s quoted rates. Alternative power arrangement will be made by Contractor without any extra charge.

9.2 All underground and over ground utility items will have to be suitably supported during the construction phase by Contractor so that the existing utility services are not damaged. No extra payment will be made on this account.

9.3 Contractor shall keep plumbers and electricians ready for repair / removal of existing underground utilities and for crisis management.

9.4 Contractor will consider in his rates the transfer of “Great Trigonometrically Survey” (GTS) level from the nearest GTS bench mark upto required points near the area of construction.

9.5 During progress of work, convenient access to adjacent premises shall be made by contractor.

9.6 For speedy progress of work Contractor may have to do work round the clock at the instance of the Engineer. Arrangement for lighting and other safety requirements will have to be done for night working. No extra payment shall be made to the Contractor except the items provided in the BOQ.

9.7 Drawings denoted as “Standard Drawings” are explained in the list of Standard Drawings in Section – 6.

9.8 Extra work – If during the progress of work any extra Work has been directed to execute, which in the opinion of the Engineer & Employer is essentially required to be executed then the extra work shall be analyzed as follows:

   (i) Rate as per Schedule of Rates of PWD (Tripura)/ CPWD/DWS,GoT

   (ii) In the event an extra item of work cannot be derived from (i) above then the following shall be applicable.

   The lowest actual cost of materials as per purchase bills inclusive of all taxes with supporting documents from three suppliers to substantiate the lowest purchase cost + Actual cost of transportation as per bills or 1% in the event no bills are available + Labour cost analysis as per NABHI (2004) / PWD (Tripura)/ CPWD publication + Sundries as per NABHI (latest) publication for analysis of rates + Overhead & profits as per NABHI (latest) publication.

10.0 Environment management and monitoring cost should be taken in the overall cost of the individual item. No separate cost on this account is payable.
The basic labour rates of **SOR for building works, PWD, Tripura** are given below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Item</th>
<th>Unit</th>
<th>Rate</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Asst fitter</td>
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<td>125.00</td>
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<tr>
<td>2</td>
<td>Bandhani</td>
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</tr>
<tr>
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<td>Bar-bender</td>
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<tr>
<td>4</td>
<td>Beldar</td>
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<tr>
<td>5</td>
<td>Beldar (skilled)</td>
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<tr>
<td>6</td>
<td>Bhisti</td>
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</tr>
<tr>
<td>7</td>
<td>Blacksmith</td>
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<tr>
<td>9</td>
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<td>day</td>
<td>181.00</td>
</tr>
<tr>
<td>10</td>
<td>Carpenter 2\textsuperscript{nd} Class</td>
<td>day</td>
<td>145.00</td>
</tr>
<tr>
<td>11</td>
<td>Chemical applicator</td>
<td>day</td>
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</tr>
<tr>
<td>12</td>
<td>Coolie</td>
<td>day</td>
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<tr>
<td>13</td>
<td>Fitter</td>
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</tr>
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<td>14</td>
<td>Glazier</td>
<td>day</td>
<td>150.00</td>
</tr>
<tr>
<td>15</td>
<td>Helper (skilled)</td>
<td>day</td>
<td>125.00</td>
</tr>
<tr>
<td>16</td>
<td>Helper</td>
<td>day</td>
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</tr>
<tr>
<td>17</td>
<td>Khalasi</td>
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</tr>
<tr>
<td>18</td>
<td>Mali</td>
<td>day</td>
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<td>19</td>
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<td>20</td>
<td>Mason 2\textsuperscript{nd} Class</td>
<td>day</td>
<td>156.00</td>
</tr>
<tr>
<td>21</td>
<td>Mate / Supervisor</td>
<td>day</td>
<td>125.00</td>
</tr>
<tr>
<td>22</td>
<td>Mechanic</td>
<td>day</td>
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<tr>
<td>23</td>
<td>Operator (piling operator)</td>
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<tr>
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<td>Painter</td>
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<td>Plumber</td>
<td>day</td>
<td>180.00</td>
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<td>26</td>
<td>Skilled worker for rubbing of marble</td>
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<td>27</td>
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<td>day</td>
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<td>Thatcher</td>
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</tr>
<tr>
<td>31</td>
<td>White washer</td>
<td>day</td>
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**Note :-** The above rates are exclusive of
a) Overheads  
b) Contractor’s profit
## Section 5 - Eligible Countries

### SECTION V. ELIGIBLE COUNTRIES

**LIST OF ELIGIBLE MEMBER COUNTRIES OF THE ASIAN DEVELOPMENT BANK**

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<thead>
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<td>Vanuatu</td>
</tr>
<tr>
<td>67.</td>
<td>VIE</td>
<td>Viet Nam</td>
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</tbody>
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Conditions of Contract
for CONSTRUCTION

FOR BUILDING AND ENGINEERING WORKS
DESIGNED BY THE EMPLOYER

Multilateral Development Bank Harmonised Edition
June 2010

General Conditions

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1.1.1.9 Bill of Quantities 1.1.1.4 Letter of Tender
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Goods 1.1.3.9 year
1.1 Definitions

In the Conditions of Contract (“these Conditions”), which include Particular Conditions, Parts A and B, and these General Conditions, the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

1.1.1 The Contract

1.1.1.1 “Contract” means the Contract Agreement, the Letter of Acceptance, the Letter of Tender, these Conditions, the Specification, the Drawings, the Schedules, and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance.

1.1.1.2 “Contract Agreement” means the contract agreement referred to in Sub-Clause 1.6 [Contract Agreement].

1.1.1.3 “Letter of Acceptance” means the letter of formal acceptance, signed by the Employer, of the Letter of Tender, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such letter of acceptance, the expression “Letter of Acceptance” means the Contract Agreement and the date of issuing or receiving the Letter of Acceptance means the date of signing the Contract Agreement.

1.1.1.4 “Letter of Tender” means the document entitled letter of tender or letter of bid, which was completed by the Contractor and includes the signed offer to the Employer for the Works.

1.1.1.5 “Specification” means the document entitled specification, as included in the Contract, and any additions and modifications to the specification in accordance with the Contract. Such document specifies the Works.

1.1.1.6 “Drawings” means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Employer in accordance with the Contract.

1.1.1.7 “Schedules” means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Tender, as included in the Contract. Such document may include the Bill of Quantities, data, lists, and schedules of rates and/or prices.

1.1.1.8 “Tender” means the Letter of Tender and all other documents which the Contractor submitted with the Letter of Tender, as included in the Contract.

“Bill of Quantities”, “Daywork Schedule” and “Schedule of Payment Currencies” mean the documents so named (if any) which are comprised in the Schedules.

1.1.1.9 “Bill of Quantities”, “Daywork Schedule” and “Schedule of Payment Currencies” mean the documents so named (if any) which are comprised in the Schedules.

1.1.1.10 “Contract Data” means the pages completed by the Employer entitled contract data which constitute Part A of the Particular Conditions.
1.1.2 Parties and Persons

1.1.2.1 “Party” means the Employer or the Contractor, as the context requires.

1.1.2.2 “Employer” means the person named as employer in the Contract Data and the legal successors in title to this person.

1.1.2.3 “Contractor” means the person(s) named as contractor in the Letter of Tender accepted by the Employer and the legal successors in title to this person(s).

1.1.2.4 “Engineer” means the person appointed by the Employer to act as the Engineer for the purposes of the Contract and named in the Contract Data, or other person appointed from time to time by the Employer and notified to the Contractor under Sub-Clause 3.4 [Replacement of the Engineer].

1.1.2.5 “Contractor’s Representative” means the person named by the Contractor in the Contract or appointed from time to time by the Contractor under Sub-Clause 4.3 [Contractor’s Representative], who acts on behalf of the Contractor.

1.1.2.6 “Employer’s Personnel” means the Engineer, the assistants referred to in Sub-Clause 3.2 [Delegation by the Engineer] and all other staff, labour and other employees of the Engineer and of the Employer; and any other personnel notified to the Contractor, by the Employer or the Engineer, as Employer’s Personnel.

1.1.2.7 “Contractor’s Personnel” means the Contractor’s Representative and all personnel whom the Contractor utilises on Site, who may include the staff, labour and other employees of the Contractor and of each Subcontractor; and any other personnel assisting the Contractor in the execution of the Works.

1.1.2.8 “Subcontractor” means any person named in the Contract as a subcontractor, or any person appointed as a subcontractor, for a part of the Works; and the legal successors in title to each of these persons.

1.1.2.9 “DB” means the person or three persons appointed under Sub-Clause 20.2 [Appointment of the Dispute Board] or Sub-Clause 20.3 [Failure to Agree on the Composition of the Dispute Board].

1.1.2.10 “FIDIC” means the Fédération Internationale des Ingénieurs-Conseils, the international federation of consulting engineers.

1.1.2.11 “Bank” means the financing institution (if any) named in the Contract Data.

1.1.2.12 “Borrower” means the person (if any) named as the borrower in the Contract Data.

1.1.3 Dates, Tests, Periods and Completion

1.1.3.1 “Base Date” means the date 28 days prior to the latest date for submission of the Tender.

“Commencement Date” means the date notified under Sub-Clause 8.1 [Commencement of Works].

“Time for Completion” means the time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Contract Data (with any extension under Sub-Clause 8.4 [Extension of Time for Completion]), calculated from the Commencement Date.
1.1.3.4 “Tests on Completion” means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by the Employer.

1.1.3.5 “Taking-Over Certificate” means a certificate issued under Clause 10 [Employer’s Taking Over].

1.1.3.6 “Tests after Completion” means the tests (if any) which are specified in the Contract and which are carried out in accordance with the Specification after the Works or a Section (as the case may be) are taken over by the Employer.

1.1.3.7 “Defects Notification Period” means the period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedy of Defects], which extends over 365 days except if otherwise stated in the Contract Data (with any extension under Sub-Clause 11.3 [Extension of Defects Notification Period]), calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1 [Taking Over of the Works and Sections].

1.1.3.8 “Performance Certificate” means the certificate issued under Sub-Clause 11.9 [Performance Certificate].

1.1.3.9 “day” means a calendar day and “year” means 365 days.

1.1.4 Money and Payments

1.1.4.1 “Accepted Contract Amount” means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

1.1.4.2 “Contract Price” means the price defined in Sub-Clause 14.1 [The Contract Price], and includes adjustments in accordance with the Contract.

1.1.4.3 “Cost” means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.

1.1.4.4 “Final Payment Certificate” means the payment certificate issued under Sub-Clause 14.13 [Issue of Final Payment Certificate].

1.1.4.5 “Final Statement” means the statement defined in Sub-Clause 14.11 [Application for Final Payment Certificate].

1.1.4.6 “Foreign Currency” means a currency in which part (or all) of the Contract Price is payable, but not the Local Currency.

1.1.4.7 “Interim Payment Certificate” means a payment certificate issued under Clause 14 [Contract Price and Payment], other than the Final Payment Certificate.

1.1.4.8 “Local Currency” means the currency of the Country.

1.1.4.9 “Payment Certificate” means a payment certificate issued under Clause 14 [Contract Price and Payment].

1.1.4.10 “Provisional Sum” means a sum (if any) which is specified in the Contract as
a provisional sum, for the execution of any part of the Works or for the supply of Plant, Materials or services under Sub-Clause 13.5 [Provisional Sums].

1.1.4.11 “Retention Money” means the accumulated retention moneys which the Employer retains under Sub-Clause 14.3 [Application for Interim Payment Certificates] and pays under Sub-Clause 14.9 [Payment of Retention Money].

1.1.4.12 “Statement” means a statement submitted by the Contractor as part of an application, under Clause 14 [Contract Price and Payment], for a payment certificate.

1.1.5 Works and Goods

1.1.5.1 “Contractor’s Equipment” means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor’s Equipment excludes Temporary Works, Employer’s Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.

1.1.5.2 “Goods” means Contractor’s Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.

1.1.5.3 “Materials” means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.

1.1.5.4 “Permanent Works” means the permanent works to be executed by the Contractor under the Contract.

1.1.5.5 “Plant” means the apparatus, machinery and vehicles intended to form or forming part of the Permanent Works, including vehicles purchased for the Employer and relating to the construction or operation of the Works.

1.1.5.6 “Section” means a part of the Works specified in the Contract Data as a Section (if any).

1.1.5.7 “Temporary Works” means all temporary works of every kind (other than Contractor’s Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.

1.1.5.8 “Works” mean the Permanent Works and the Temporary Works, or either of them as appropriate.

1.1.6 Other Definitions

1.1.6.1 “Contractor’s Documents” means the calculations, computer programs and other software, drawings, manuals, models and other documents of a technical nature (if any) supplied by the Contractor under the Contract.

1.1.6.2 “Country” means the country in which the Site (or most of it) is located, where the Permanent Works are to be executed.

“Employer’s Equipment” means the apparatus, machinery and vehicles (if any) made available by the Employer for the use of the Contractor in the execution of the Works, as stated in the Specification; but does not include Plant which has not been taken over by the Employer.

“Force Majeure” is defined in Clause 19 [Force Majeure].
1.1.6.5 “Laws” means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority.

1.1.6.6 “Performance Security” means the security (or securities, if any) under Sub-Clause 4.2 [Performance Security].

1.1.6.7 “Site” means the places where the Permanent Works are to be executed, including storage and working areas, and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.

1.1.6.8 “Unforeseeable” means not reasonably foreseeable by an experienced contractor by the Base Date.

1.1.6.9 “Variation” means any change to the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

1.1.6.10 “Notice of Dissatisfaction” means the notice given by either Party to the other under Sub-Clause 20.4 [Obtaining Dispute Board’s Decision] indicating its dissatisfaction and intention to commence arbitration.

1.2 Interpretation

In the Contract, except where the context requires otherwise:

(a) words indicating one gender include all genders;
(b) words indicating the singular also include the plural and words indicating the plural also include the singular;
(c) provisions including the word “agree”, “agreed” or “agreement” require the agreement to be record in writing;
(d) “written” or “in writing” means hand-written, type-written, printed or electronically made, and resulting in a permanent record; and
(e) the word “tender” is synonymous with “bid”, and “tenderer” with “bidder” and the words “tender documents” with “bidding documents”.

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

In these Conditions, provisions including the expression “Cost plus profit” require this profit to be one-twentieth (5%) of this Cost unless otherwise indicated in the Contract Data.

1.3 Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

(a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Contract Data; and
(b) delivered, sent or transmitted to the address for the recipient’s communications as stated in the Contract Data. However:
(i) if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and
(ii) if the recipient has not stated otherwise when requesting an approval or
consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Engineer or the other Party, as the case may be.

1.4 Law and Language

The Contract shall be governed by the law of the country or other jurisdiction stated in the Contract Data.

The ruling language of the Contract shall be that stated in the Contract Data.

The language for communications shall be that stated in the Contract Data. If no language is stated there, the language for communications shall be the ruling language of the Contract.

1.5 Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:

(a) the Contract Agreement (if any),
(b) the Letter of Acceptance,
(c) the Letter of Tender,
(d) the Particular Conditions - Part A,
(e) the Particular Conditions - Part B,
(f) these General Conditions,
(g) the Specification,
(h) the Drawings, and
(i) the Schedules and any other documents forming part of the Contract.

If an ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.

1.6 Contract Agreement

The Parties shall enter into a Contract Agreement within 28 days after the Contractor receives the Letter of Acceptance, unless the Particular Conditions establish otherwise. The Contract Agreement shall be based upon the form annexed to the Particular Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Employer.

1.7 Assignment

Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party:

(a) may assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party, and

(b) may, as security in favour of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract.

1.8 Care and Supply of Documents

The Specification and Drawings shall be in the custody and care of the Employer. Otherwise stated in the Contract, two copies of the Contract and of each
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subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.

Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor's Documents.

The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations and other communications given under the Contract. The Employer's Personnel shall have the right of access to all these documents at all reasonable times.

If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

1.9 Delayed Drawings or Instructions

The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late.

If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Engineer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

1.10 Employer's Use of Contractor's Documents

As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

The Contractor shall be deemed (by signing the Contract) to give to the Employer a terminable transferable non-exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications thereto. This licence shall:

- apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
(b) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and

(c) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) the Employer for purposes other than those permitted under this Sub-Clause.

1.11 Contractor's Use of Employer's Documents

As between the Parties, the Employer shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) the Employer. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Employer's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12 Confidential Details

The Contractor's and the Employer's Personnel shall disclose all such confidential and other information as may be reasonably required in order to verify compliance with the Contract and allow its proper implementation.

Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.

1.13 Compliance with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions:

(a) the Employer shall have obtained (or shall obtain) the planning, zoning, building permit or similar permission for the Permanent Works, and any other permissions described in the Specification as having been (or to be) obtained by the Employer; and the Employer shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so; and

(b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so, unless the Contractor is impeded to accomplish these actions and shows evidence of its diligence.

1.14 Joint and Several Liability

If the Contractor constitutes (under applicable Laws) a joint venture, consortium or a minincorporated grouping of two or more persons:
1.15 Inspections and Audit by the Bank

(a) these persons shall be deemed to be jointly and severally liable to the Employer for the performance of the Contract;
(b) these persons shall notify the Employer of their leader who shall have authority to bind the Contractor and each of these persons; and
(c) the Contractor shall not alter its composition or legal status without the prior consent of the Employer.

The Contractor shall permit the Bank and/or persons appointed by the Bank to inspect the Site and/or the Contractor's accounts and records relating to the performance of the Contract and to have such accounts and records audited by auditors appointed by the Bank if required by the Bank.

2. The Employer

2.1 Right of Access to the Site

The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the Contract Data. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Employer shall do so in the time and manner stated in the Specification. However, the Employer may withhold any such right or possession until the Performance Security has been received.

If no such time is stated in the Contract Data, the Employer shall give the Contractor right of access to, and possession of, the Site within such times as required to enable the Contractor to proceed without disruption in accordance with the programme submitted under Sub-Clause 8.3 [Programme].

If the Contractor suffers delay and/or incurs Cost as a result of a failure by the Employer to give any such right or possession within such time, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

2.2 Permits, Licences or Approvals

The Employer shall provide, at the request of the Contractor, such reasonable assistance as to allow the Contractor to obtain properly:

(a) copies of the Laws of the Country which are relevant to the Contract but are not readily available, and
(b) any permits, licences or approvals required by the Laws of the Country.
(i) which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws],
(ii) for the delivery of Goods, including clearance through customs, and
(iii) for the export of Contractor's Equipment when it is removed from the Site.

2.3 Employer's Personnel

The Employer shall be responsible for ensuring that the Employer's Personnel and the Employer's other contractors on the Site:

(a) co-operate with the Contractor's efforts under Sub-Clause 4.6 [Co-operation], and
(b) take actions similar to those which the Contractor is required to take under subparagraphs (a), (b) and (c) of Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.18 [Protection of the Environment].

2.4 Employer's Financial Arrangements

The Employer shall submit, before the Commencement Date and thereafter within 28 days after receiving any request from the Contractor, reasonable evidence that financial arrangements have been made and are being maintained which will enable the Employer to pay the Contract Price punctually (as estimated at that time) in accordance with Clause 14 [Contract Price and Payment]. Before the Employer makes any material change to his financial arrangements, the Employer shall give notice to the Contractor with detailed particulars.

In addition, if the Bank has notified to the Borrower that the Bank has suspended disbursements under its loan, which finances in whole or in part the execution of the Works, the Employer shall give notice of such suspension to the Contractor with detailed particulars, including the date of such notification, with a copy to the Engineer, within 7 days of the Borrower having received the suspension notification from the Bank. If alternative funds will be available in appropriate currencies to the Employer to continue making payments to the Contractor beyond a date 60 days after the date of Bank notification of the suspension, the Employer shall provide reasonable evidence in his notice of the extent to which such funds will be available.

2.5 Employer's Claims

If the Employer considers himself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, the Employer or the Engineer shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.19 [Electricity, Water and Gas], under Sub-Clause 4.20 [Employer's Equipment and Free-Issue Materials], or for other services requested by the Contractor.

The notice shall be given as soon as practicable and no longer than 28 days after the Employer became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

Particulars shall specify the Clause or other basis of the claim, and shall include substantiation of the amount and/or extension to which the Employer considers he is entitled in connection with the Contract. The Engineer shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Employer is entitled to be paid by the Contractor, and/or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].
This amount may be included as a deduction in the Contract Price and Payment Certificates. The Employer shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this Sub-Clause.

The Engineer

3.1 Engineer’s Duties and Authority

The Employer shall appoint the Engineer who shall carry out the duties assigned to him in the Contract. The Engineer’s staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.

The Engineer shall have no authority to amend the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. If the Engineer is required to obtain the approval of the Employer before exercising a specified authority, the requirements shall be as stated in the Particular Conditions. The Employer shall promptly inform the Contractor of any change to the authority attributed to the Engineer.

However, whenever the Engineer exercises a specified authority for which the Employer’s approval is required, then (for the purposes of the Contract) the Employer shall be deemed to have given approval.

Except as otherwise stated in these Conditions:

(a) whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for the Employer;

(b) the Engineer has no authority to relieve either Party of any duties, obligations or responsibilities under the Contract;

(c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances; and

(d) any act by the Engineer in response to a Contractor’s request except as otherwise expressly specified shall be notified in writing to the Contractor within 28 days of receipt.

The following provisions shall apply:

The Engineer shall obtain the specific approval of the Employer before taking action under the following Sub-Clauses of these Conditions:

(A) Sub-Clause 4.12: agreeing or determining an extension of time and/or additional cost.

(B) Sub-Clause 13.1: instructing a Variation, except;

(i) in an emergency situation as determined by the Engineer, or

(ii) if such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the Contract Data.

Sub-Clause 13.3: approving a proposal for Variation submitted by the Contractor in accordance with Sub-Clause 13.1 or 13.2.
(D) Sub-Clause 13.4: specifying the amount payable in each of the applicable currencies.

Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to the Employer.

3.2 Delegation by the Engineer

The Engineer may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties. However, unless otherwise agreed by both Parties, the Engineer shall not delegate the authority to determine any matter in accordance with Sub-Clause 3.5

Determinations.

Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in Sub-Clause 1.4

Law and Language.

Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer. However:

(a) any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Engineer to reject the work, Plant or Materials;

(b) if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer, who shall promptly confirm, reverse or vary the determination or instruction.

3.3 Instructions of the Engineer

The Engineer may issue to the Contractor (at any time) instructions and additional or modified Drawings which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from an assistant to whom the appropriate authority has been delegated under this Clause. If an instruction constitutes a Variation, Clause 13

Variations and Adjustments

shall apply.

The Contractor shall comply with the instructions given by the Engineer or delegated assistant, on any matter related to the Contract. Whenever practicable, their instructions shall be given in writing. If the Engineer or a delegated assistant:

(a) gives an oral instruction,

(b) receives a written confirmation of the instruction, from (or on behalf of) the Contractor, within two working days after giving the instruction, and
(c) does not reply by issuing a written rejection and/or instruction within two working days after receiving the confirmation,

then the confirmation shall constitute the written instruction of the Engineer or delegated assistant (as the case may be).

3.4 Replacement of the Engineer

If the Employer intends to replace the Engineer, the Employer shall, not less than 21 days before the intended date of replacement, give notice to the Contractor of the name, address and relevant experience of the intended replacement Engineer. If the Contractor considers the intended replacement Engineer to be unsuitable, he has the right to raise objection against him by notice to the Employer, with supporting particulars, and the Employer shall give full and fair consideration to this objection.

3.5 Determinations

Whenever these Conditions provide that the Engineer shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter, the Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

The Engineer shall give notice to both Parties of each agreement or determination, with supporting particulars, within 28 days from the receipt of the corresponding claim or request except when otherwise specified. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [Claims, Disputes and Arbitration].

The Contractor

4.1 Contractor's General Obligations

The Contractor shall design (to the extent specified in the Contract), execute and complete the Works in accordance with the Contract and with the Engineer's instructions, and shall remedy any defects in the Works.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

All equipment, material, and services to be incorporated in or required for the Works shall have their origin in any eligible source country as defined by the Bank.

The Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the Contract, the Contractor (i) shall be responsible for all Contractor's Documents, Temporary Works, and such design of each item of Plant and Materials as is required for the item to be in accordance with the Contract, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.

The contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Engineer.
If the Contract specifies that the Contractor shall design any part of the Permanent Works, then unless otherwise stated in the Particular Conditions:

(a) the Contractor shall submit to the Engineer the Contractor's Documents for this part in accordance with the procedures specified in the Contract;
(b) these Contractor's Documents shall be in accordance with the Specification and Drawings, shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language], and shall include additional information required by the Engineer to add to the Drawings for co-ordination of each Party's designs;
(c) the Contractor shall be responsible for this part and it shall, when the Works are completed, be fit for such purposes for which the part is intended as are specified in the Contract; and
(d) prior to the commencement of the Tests on Completion, the Contractor shall submit to the Engineer the “as-built” documents and, if applicable, operation and maintenance manuals in accordance with the Specification and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair this part of the Works. Such part shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until these documents and manuals have been submitted to the Engineer.

4.2 Performance Security

The Contractor shall obtain (at his cost) a Performance Security for proper performance, in the amount stated in the Contract Data and denominated in the currency(ies) of the Contract or in a freely convertible currency acceptable to the Employer. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

The Contractor shall deliver the Performance Security to the Employer within 28 days after receiving the Letter of Acceptance, and shall send a copy to the Engineer. The Performance Security shall be issued by a reputable bank or financial institution selected by the Contractor, and shall be in the form annexed to the Particular Conditions, as stipulated by the Employer in the Contract Data, or in another form approved by the Employer.

The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and any defects have been remedied.

The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract.

The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.

The Employer shall return the Performance Security to the Contractor within 21 days of receiving a copy of the Performance Certificate.

Without limitation to the provisions of the rest of this Sub-Clause, whenever the Engineer determines an addition or a reduction to the Contract Price as a result of a change in

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cost and/or legislation, or as a result of a Variation amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor shall at the Engineer's request promptly increase, or may decrease, as the case may be, the value of the Performance Security in that currency by an equal percentage.

4.3 

Contractor's Representative

The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract.

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Engineer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked in terms of Sub-Clause 6.9 [Contractor's Personnel], or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, without the prior consent of the Engineer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Engineer's prior consent, and the Engineer shall be notified accordingly.

The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.3 [Instructions of the Engineer].

The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Engineer has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

The Contractor's Representative shall be fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language]. If the Contractor's Representative's delegates are not fluent in the said language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

4.4 

Subcontractors

The Contractor shall not subcontract the whole of the Works.

The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated in the Particular Conditions:

(a) the Contractor shall not be required to obtain consent to suppliers solely of Materials, or to a subcontract for which the Subcontractor is named in the Contract;
(b) the prior consent of the Engineer shall be obtained to other proposed Subcontractors;
(c) the Contractor shall give the Engineer not less than 28 days’ notice of the intended date of the commencement of each Subcontractor's work, and of the commencement of such work on the Site; and
(d) each subcontract shall include provisions which would entitle the Employer to require the subcontract to be assigned to the Employer under Sub-Clause 4.5 [Assignment of Benefit of Subcontract] (if or when applicable) or in the event of termination under Sub-Clause 15.2 [Termination by Employer].

The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [Confidential Details] apply equally to each Subcontractor.

Where practicable, the Contractor shall give fair and reasonable opportunity for contractors from the Country to be appointed as Subcontractors.

### 4.5 Assignment of Benefit of Subcontract

If a Subcontractor’s obligations extend beyond the expiry date of the relevant Defects Notification Period and the Engineer, prior to this date, instructs the Contractor to assign the benefit of such obligations to the Employer, then the Contractor shall do so. Unless otherwise stated in the assignment, the Contractor shall have no liability to the Employer for the work carried out by the Subcontractor after the assignment takes effect.

### 4.6 Co-operation

The Contractor shall, as specified in the Contract or as instructed by the Engineer, allow appropriate opportunities for carrying out work to:

(a) the Employer’s Personnel,
(b) any other contractors employed by the Employer, and
(c) the personnel of any legally constituted public authorities,

who may be employed in the execution on or near the Site of any work not included in the Contract.

Any such instruction shall constitute a Variation if and to the extent that it causes the Contractor to suffer delays and/or to incur Unforeseeable Cost. Services for these personnel and other contractors may include the use of Contractor’s Equipment, Temporary Works or access arrangements which are the responsibility of the Contractor.

If, under the Contract, the Employer is required to give to the Contractor possession of any foundation, structure, plant or means of access in accordance with Contractor’s Documents, the Contractor shall submit such documents to the Engineer in the time and manner stated in the Specification.

### 4.7 Setting Out

The Contractor shall set out the Works in relation to original points, lines and levels of reference specified in the Contract or notified by the Engineer. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions or alignment of the Works.

The Employer shall be responsible for any errors in these specified or notified items of reference, but the Contractor shall use reasonable efforts to verify their accuracy before they are used.

If the Contractor suffers delay and/or incurs Cost from executing work which was necessitated by an error in these items of reference, and an experienced contractor not reasonably have discovered such error and avoided this delay and/or Cost, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-20.1 [Contractor’s Claims] to:
(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

4.8 Safety Procedures

The Contractor shall:

(a) comply with all applicable safety regulations,
(b) take care for the safety of all persons entitled to be on the Site,
(c) use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons,
(d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Employer's Taking Over], and
(e) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

4.9 Quality Assurance

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Engineer shall be entitled to audit any aspect of the system.

Details of all procedures and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

4.10 Site Data

The Employer shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Employer's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. The Employer shall similarly make available to the Contractor all such data which come into the Employer's possession after the Base Date. The Contractor shall be responsible for interpreting all such data.

To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

(a) the form and nature of the Site, including sub-surface conditions,
(b) the hydrological and climatic conditions,
(c) the extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects,
(d) the Laws, procedures and labour practices of the Country, and
(e) the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.

4.11 Sufficiency of the Accepted Contract Amount

The Contractor shall be deemed to:

(a) have satisfied himself as to the correctness and sufficiency of the Accepted Contract Amount, and
(b) have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters referred to in Sub-Clause 4.10 [Site Data].

Unless otherwise stated in the Contract, the Accepted Contract Amount covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper execution and completion of the Works and the remedying of any defects.

4.12 Unforeseeable Physical Conditions

In this Sub-Clause, “physical conditions” means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Engineer as soon as practicable.

This notice shall describe the physical conditions, so that they can be inspected by the Engineer, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Engineer may give. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to notice under Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost, which shall be included in the Contract Price.

Upon receiving such notice and inspecting and/or investigating these physical conditions, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in subparagraphs (a) and (b) above related to this extent.

Further, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer may also review whether other physical conditions in similar parts of the Works (if any) were more favourable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favourable conditions were encountered, the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost.
which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates. However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.

The Engineer shall take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Tender, which shall be made available by the Contractor, but shall not be bound by the Contractor's interpretation of any such evidence.

4.13
Rights of Way and Facilities

Unless otherwise specified in the Contract the Employer shall provide effective access to and possession of the Site including special and/or temporary rights-of-way which are necessary for the Works. The Contractor shall obtain, at his risk and cost, any additional rights of way or facilities outside the Site which he may require for the purposes of the Works.

4.14
Avoidance of Interference

The Contractor shall not interfere unnecessarily or improperly with:

(a) the convenience of the public, or
(b) the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.

The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

4.15
Access Route

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

Except as otherwise stated in these Conditions:

(a) the Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;
(b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;
(c) the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route;
(d) the Employer does not guarantee the suitability or availability of particular access routes; and
(e) Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

4.16
Transport of Goods

The Contractor shall give the Engineer not less than 21 days' notice of the date on which any Plant or a major item of other Goods will be delivered to the Site; the Contractor shall be responsible for packing, loading, transporting, receiving,
unloading, storing and protecting all Goods and other things required for the Works; and

(c) the Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

4.17 Contractor’s Equipment

The Contractor shall be responsible for all Contractor’s Equipment. When brought on to the Site, Contractor’s Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor’s Equipment without the consent of the Engineer. However, consent shall not be required for vehicles transporting Goods or Contractor’s Personnel off Site.

4.18 Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations.

The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor’s activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.

4.19 Electricity, Water and Gas

The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services he may require for his construction activities and to the extent defined in the Specifications, for the tests.

The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details and prices are given in the Specification. The Contractor shall, at his risk and cost, provide any apparatus necessary for his use of these services and for measuring the quantities consumed.

The quantities consumed and the amounts due (at these prices) for such services shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Employer’s Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Employer.

4.20 Employer’s Equipment and Free-Issue Materials

The Employer shall make the Employer’s Equipment (if any) available for the use of the Contractor in the execution of the Works in accordance with the details, arrangements and prices stated in the Specification. Unless otherwise stated in the Specification:

(a) the Employer shall be responsible for the Employer’s Equipment, except that
(b) the Contractor shall be responsible for each item of Employer’s Equipment whilst any of the Contractor’s Personnel is operating it, driving it, directing it or in possession or control of it.

Appropriate quantities and the amounts due (at such stated prices) for the use of Employer’s Equipment shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Employer’s Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Employer.

The Employer shall supply, free of charge, the “free-issue materials” (if any) in accordance with the details stated in the Specification. The Employer shall, at his risk
and cost, provide these materials at the time and place specified in the Contract. The Contractor shall then visually inspect them, and shall promptly give notice to the Engineer of any shortage, defect or default in these materials. Unless otherwise agreed by both Parties, the Employer shall immediately rectify the notified shortage, defect or default.

After this visual inspection, the free-issue materials shall come under the care, custody and control of the Contractor. The Contractor’s obligations of inspection, care, custody and control shall not relieve the Employer of liability for any shortage, defect or default not apparent from a visual inspection.

4.21 Progress Reports

Unless otherwise stated in the Particular Conditions, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include:

(a) charts and detailed descriptions of progress, including each stage of design (if any), Contractor’s Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),

(b) photographs showing the status of manufacture and of progress on the Site;

(c) for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:

   (i) commencement of manufacture,
   (ii) Contractor’s inspections,
   (iii) tests, and
   (iv) shipment and arrival at the Site;

(d) the details described in Sub-Clause 6.10 [Records of Contractor’s Personnel and Equipment];

(e) copies of quality assurance documents, test results and certificates of Materials;

(f) list of notices given under Sub-Clause 2.5 [Employer’s Claims] and notices given under Sub-Clause 20.1 [Contractor’s Claims];

(g) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and

(h) comparisons of actual and planned progress, with details of any events or circumstances which may jeopardise the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

4.22 Security of the Site

Unless otherwise stated in the Particular Conditions:

The Contractor shall be responsible for keeping unauthorised persons off the Site, and...
(b) authorised persons shall be limited to the Contractor’s Personnel and the Employer’s Personnel; and to any other personnel notified to the Contractor, by the Employer or the Engineer, as authorised personnel of the Employer’s other contractors on the Site.

4.23 Contractor’s Operations on Site

The Contractor shall confine his operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Engineer as additional working areas. The Contractor shall take all necessary precautions to keep Contractor’s Equipment and Contractor’s Personnel within the Site and these additional areas, and to keep them off adjacent land.

During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor’s Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required.

Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor’s Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfil obligations under the Contract.

4.24 Fossils

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor’s Personnel or other persons from removing or damaging any of these findings.

The Contractor shall, upon discovery of any such finding, promptly give notice to the Engineer, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

5.1 Definition of “nominated Subcontractor”

In the Contract, “nominated Subcontractor” means a Subcontractor:

(a) who is stated in the Contract as being a nominated Subcontractor, or

(b) whom the Engineer, under Clause 13 [Variations and Adjustments], instructs the Contractor to employ as a Subcontractor subject to Sub-Clause 5.2 [Objection to Notification].
5.2 Objection to Nomination

The Contractor shall not be under any obligation to employ a nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars. An objection shall be deemed reasonable if it arises from (among other things) any of the following matters, unless the Employer agrees in writing to indemnify the Contractor against and from the consequences of the matter:

(a) there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength;
(b) the nominated Subcontractor does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, his agents and employees; or
(c) the nominated Subcontractor does not accept to enter into a subcontract which specifies that, for the subcontracted work (including design, if any), the nominated Subcontractor shall:

(i) undertake to the Contractor such obligations and liabilities as will enable the Contractor to discharge his obligations and liabilities under the Contract,
(ii) indemnify the Contractor against and from all obligations and liabilities arising under or in connection with the Contract and from the consequences of any failure by the Subcontractor to perform these obligations or to fulfil these liabilities, and
(iii) be paid only if and when the Contractor has received from the Employer payments for sums due under the Subcontract referred to under Sub-Clause 5.3 [Payment to nominated Subcontractors].

5.3 Payments to nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts shown on the nominated Subcontractor’s invoices approved by the Contractor which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with sub-paragraph (b) of Sub-clause 13.5 [Provisional Sums], except as stated in Sub-Clause 5.4 [Evidence of Payments].

5.4 Evidence of Payments

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

(a) submits this reasonable evidence to the Engineer, or

(b) (i) satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and
(ii) submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor’s entitlement,

the Employer may (at his sole discretion) pay, direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor refused to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Employer, the amount which the nominated Subcontractor was directly paid by the Employer.
6.1 Engagement of Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, feeding, transport and, when appropriate, housing.

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour with appropriate qualifications and experience from sources within the Country.

6.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.

The Contractor shall inform the Contractor’s Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of the Country for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

6.3 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Employer’s Personnel.

6.4 Labour Laws

The Contractor shall comply with all the relevant labour Laws applicable to the Contractor’s Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.

6.5 Working Hours

No work shall be carried out on the Site on locally recognised days of rest, or outside the normal working hours stated in the Contract Data, unless:

(a) otherwise stated in the Contract,
(b) the Engineer gives consent, or
(c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer.

6.6 Facilities for Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor’s Personnel. The Contractor shall also provide facilities for the Employer’s Personnel as stated in the Specification.

The Contractor shall not permit any of the Contractor’s Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.
6.7 Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

HIV-AIDS Prevention. The Contractor shall conduct an HIV-AIDS awareness programme via an approved service provider, and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals.

The Contractor shall throughout the contract (including the Defects Notification Period): (i) conduct Information, Education and Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labour (including all the Contractor's employees, all Subcontractors and any other Contractor's or Employer's personnel, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behaviour with respect to, of Sexually Transmitted Diseases (STD) - or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labour as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counselling and referral to a dedicated national STI and HIV/AIDS programme, (unless otherwise agreed) of all Site staff and labour.

The Contractor shall include in the programme to be submitted for the execution of the Works under Sub-Clause 8.3 an alleviation programme for Site staff and labour and their families in respect of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS. The STI, STD and HIV/AIDS alleviation programme shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause and the related specification. For each component, the programme shall detail the resources to be provided or utilised and any related sub-contracting proposed. The programme shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for preparation and implementation this programme shall not exceed the Provisional Sum dedicated for this purpose.

6.8 Contractor's Superintendence

Throughout the execution of the Works, and as long thereafter as is necessary to fulfil the contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work. Superintendence shall be given by a sufficient number of persons having adequate
knowledge of the language for communications (defined in Sub-Clause 1.4 [Law and Language]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.

6.9 Contractor's Personnel

The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:

(a) persists in any misconduct or lack of care,
(b) carries out duties incompetently or negligently,
(c) fails to conform with any provisions of the Contract, or
(d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

6.10 Records of Contractor's Personnel and Equipment

The Contractor shall submit, to the Engineer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

6.11 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

6.12 Foreign Personnel

The Contractor may bring in to the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer will, if requested by the Contractor, use his best endeavours in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

6.13 Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food as stated in the Specification at reasonable prices for the Contractor's Personnel purposes of or in connection with the Contract.

6.14 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.
6.15 Measures against Insect and Pest Nuisance
The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

6.16 Alcoholic Liquor or Drugs
The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal thereto by Contractor's Personnel.

6.17 Arms and Ammunition
The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

6.18 Festivals and Religious Customs
The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.

6.19 Funeral Arrangements
The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of his local employees who may die while engaged upon the Works.

6.20 Forced Labour
The Contractor shall not employ forced labour, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.

6.21 Child Labour
The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where the relevant labour laws of the Country have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.

6.22 Employment Records of Workers
The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarised on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment].

6.23 Workers' Organisations
In countries where the relevant labour laws recognise workers' rights to form and to join workers' organisations of their choosing without interference and to bargain collectively, the Contractor shall comply with such laws. Where the relevant labour laws substantially restrict workers' organisations, the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and their rights regarding working conditions and terms of employment. In either case described above, and where the relevant labour laws are silent, the Contractor shall not discourage the Contractor's Personnel from forming or joining workers' organisations of their choosing or from bargaining collectively, and shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to...
participate, in such organisations and bargain collectively. The Contractor shall engage with such workers’ representatives. Workers’ organisations are expected to fairly represent the workers in the workforce.

6.24 Non-Discrimination and Equal Opportunity

The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where the relevant labour laws provide for non-discrimination in employment, the Contractor shall comply with such laws. When the relevant labour laws are silent on non-discrimination in employment, the Contractor shall meet this Sub-Clause’s requirements. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination.

7 Plant, Materials and Workmanship

7.1 Manner of Execution

The Contractor shall carry out the manufacture of Plant, the production and manufacture of Materials, and all other execution of the Works:

(a) in the manner (if any) specified in the Contract,
(b) in a proper workmanlike and careful manner, in accordance with recognised good practice, and
(c) with properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.

7.2 Samples

The Contractor shall submit the following samples of Materials, and relevant information, to the Engineer for consent prior to using the Materials in or for the Works:

(a) manufacturer’s standard samples of Materials and samples specified in the Contract, all at the Contractor’s cost, and
(b) additional samples instructed by the Engineer as a Variation.

Each sample shall be labelled as to origin and intended use in the Works.

7.3 Inspection

The Employer’s Personnel shall at all reasonable times:

(a) have full access to all parts of the Site and to all places from which natural Materials are being obtained, and
(b) during production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials.

The Contractor shall give the Employer’s Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No activity shall relieve the Contractor from any obligation or responsibility.
The Contractor shall give notice to the Engineer whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Engineer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer does not require to do so. If the Contractor fails to give the notice, he shall, if and when required by the Engineer, uncover the work and thereafter reinstate and make good, all at the Contractor’s cost.

7.4 Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

Except as otherwise specified in the Contract, the Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Engineer may, under Clause 13 [Variations and Adjustments], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Engineer shall give the Contractor not less than 24 hours’ notice of the Engineer’s intention to attend the tests. If the Engineer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, and the tests shall then be deemed to have been made in the Engineer’s presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Engineer duly certified reports of the tests. When the specified tests have been passed, the Engineer shall endorse the Contractor’s test certificate, or issue a certificate to him, to that effect. If the Engineer has not attended the tests, he shall be deemed to have accepted the readings as accurate.

7.5 Rejection

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer may reject the Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.
If the Engineer requires this Plant, Materials or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer.

7.6 Remedial Work

Notwithstanding any previous test or certification, the Engineer may instruct the Contractor to:

(a) remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,
(b) remove and re-execute any other work which is not in accordance with the Contract, and
(c) execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under sub-paragraph (c).

If the Contractor fails to comply with the instruction, the Employer shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer all costs arising from this failure.

7.7 Ownership of Plant and Materials

Except as otherwise provided in the Contract, each item of Plant and Materials shall, to the extent consistent with the Laws of the Country, become the property of the Employer at whichever is the earlier of the following times, free from liens and other encumbrances:

(a) when it is incorporated in the Works;
(b) when the Contractor is paid the corresponding value of the Plant and Materials under Sub-Clause 8.10 [Payment for Plant and Materials in Event of Suspension].

7.8 Royalties

Unless otherwise stated in the Specification, the Contractor shall pay all royalties, rents and other payments for:

(a) natural Materials obtained from outside the Site, and
(b) the disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

Commencement, Delays and Suspension

8.1 Commencement

Unless as otherwise specified in the Particular Conditions of Contract, the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Engineer's notification recording the agreement of both Parties on such fulfilment and instructing to commence the Work is received by the Contractor:
(a) signature of the Contract Agreement by both Parties, and if required, approval of the Contract by relevant authorities of the Country;
(b) delivery to the Contractor of reasonable evidence of the Employer's Financial arrangements (under Sub-Clause 2.4 [Employer's Financial Arrangements]);
(c) except if otherwise specified in the Contract Data, effective access to and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [Compliance with Laws] as required for the commencement of the Works;
(d) receipt by the Contractor of the Advance Payment under Sub-Clause 14.2 [Advance Payment] provided that the corresponding bank guarantee has been delivered by the Contractor.

If the said Engineer's instruction is not received by the Contractor within 180 days from his receipt of the Letter of Acceptance, the Contractor shall be entitled to terminate the Contract under Sub-Clause 16.2 [Termination by Contractor].

The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date, and shall then proceed with the Works with due expedition and without delay.

8.2 Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

(a) achieving the passing of the Tests on Completion, and
(b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

8.3 Programme

The Contractor shall submit a detailed time programme to the Engineer within 28 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works]. The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. Each programme shall include:

(a) the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction, erection and testing,
(b) each of these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),
(c) the sequence and timing of inspections and tests specified in the Contract, and
(d) a supporting report which includes:
   (i) a general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and
details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage.

The Engineer, within 21 days after receiving a programme, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. The Employer's Personnel shall be entitled to rely upon the programme when planning their activities.
The Contractor shall promptly give notice to the Engineer of specific probable future events or circumstances which may adversely affect the work, increase the Contract Price or delay the execution of the Works. The Engineer may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal under Sub-Clause 13.3 [Variation Procedure].

If, at any time, the Engineer gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Engineer in accordance with this Sub-Clause.

8.4 Extension of Time for Completion

The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking-Over of the Works and Sections] is or will be delayed by any of the following causes:

(a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]) or other substantial change in the quantity of an item of work included in the Contract,
(b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions,
(c) exceptionally adverse climatic conditions,
(d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or
(e) any delay, impediment or prevention caused by or attributable to the Employer, the Employer’s Personnel, or the Employer’s other contractors.

If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer in accordance with Sub-Clause 20.1 [Contractor’s Claims]. When determining each extension of time under Sub-Clause 20.1, the Engineer shall review previous determinations and may increase, but shall not decrease, the total extension of time.

8.5 Delays Caused by Authorities

If the following conditions apply, namely:

(a) the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in the Country,
(b) these authorities delay or disrupt the Contractor’s work, and
(c) the delay or disruption was Unforeseeable,

then this delay or disruption will be considered as a cause of delay under subparagraph (b) of Sub-Clause 8.4 [Extension of Time for Completion].

8.6 Rate of Progress

If, at any time:

(a) actual progress is too slow to complete within the Time for Completion, and/or
(b) progress has fallen (or will fall) behind the current programme under Sub-Clause 8.3 [Programme],

then as a result of a cause listed in Sub-Clause 8.4 [Extension of Time for Completion], then the Engineer may instruct the Contractor to submit, under Sub-Clause 8.3 [Programme], a revised programme and supporting report describing the
revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless the Engineer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor’s Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause the Employer to incur additional costs, the Contractor shall subject to notice under Sub-Clause 2.5 [Employer’s Claims] pay these costs to the Employer, in addition to delay damages (if any) under Sub-Clause 8.7 below.

Additional costs of revised methods including acceleration measures, instructed by the Engineer to reduce delays resulting from causes listed under Sub-Clause 8.4 [Extension of Time for Completion] shall be paid by the Employer, without generating, however, any other additional payment benefit to the Contractor.

8.7 Delay Damages
If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to notice under Sub-Clause 2.5 [Employer’s Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Contract Data.

These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Employer] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

8.8 Suspension of Work
The Engineer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

The Engineer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub-Clauses 8.9, 8.10 and 8.11 shall not apply.

8.9 Consequences of Suspension
If the Contractor suffers delay and/or incurs Cost from complying with the Engineer’s instructions under Sub-Clause 8.8 [Suspension of Work] and/or from resuming the work, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost, which shall be included in the Contract Price.

Receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall not be entitled to an extension of time for, or to payment of the incurred, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].
8.10 Payment for Plant and Materials in Event of Suspension

The Contractor shall be entitled to payment of the value (as at the date of suspension) of Plant and/or Materials which have not been delivered to Site, if:

(a) the work on Plant or delivery of Plant and/or Materials has been suspended for more than 28 days, and

(b) the Contractor has marked the Plant and/or Materials as the Employer’s property in accordance with the Engineer’s instructions.

8.11 Prolonged Suspension

If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Engineer’s permission to proceed. If the Engineer does not give permission within 28 days after being requested to do so, the Contractor may, by giving notice to the Engineer, treat the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice of termination under Sub-Clause 16.2 [Termination by Contractor].

8.12 Resumption of Work

After the permission or instruction to proceed is given, the Contractor and the Engineer shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension after receiving from the Engineer an instruction to this effect under Clause 13 [Variations and Adjustments].

9.1 Tests on Completion

9.1.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4 [Testing], after providing the documents in accordance with subparagraph (d) of Sub-Clause 4.1 [Contractor's General Obligations].

The Contractor shall give to the Engineer not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Engineer shall instruct.

In considering the results of the Tests on Completion, the Engineer shall make allowances for the effect of any use of the Works by the Employer on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed any Tests on Completion, the Contractor shall submit a certified report of the results of these Tests to the Engineer.

9.2 Delayed Tests

If the Tests on Completion are being unduly delayed by the Employer, Sub-Clause 7.4 [Testing] (fifth paragraph) and/or Sub-Clause 10.3 [Interference with Tests on Completion] shall be applicable.

If the Tests on Completion are being unduly delayed by the Contractor, the Engineer may by notice require the Contractor to carry out the Tests within 21 days after giving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which he shall give notice to the Engineer.
If the Contractor fails to carry out the Tests on Completion within the period of 21 days, the Employer’s Personnel may proceed with the Tests at the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

9.3 Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Rejection] shall apply, and the Engineer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

9.4 Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 9.3 [Retesting], the Engineer shall be entitled to:

(a) order further repetition of Tests on Completion under Sub-Clause 9.3;
(b) if the failure deprives the Employer of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects]; or
(c) issue a Taking-Over Certificate, if the Employer so requests.

In the event of sub-paragraph (c), the Contractor shall proceed in accordance with all other obligations under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover the reduced value to the Employer as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, the Employer may require the reduction to be (i) agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking-Over Certificate is issued, or (ii) determined and paid under Sub-Clause 2.5 [Employer’s Claims] and Sub-Clause 3.5 [Determinations].

10.1 Employers Taking Over

Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by the Employer when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [Time for Completion] and except as allowed in sub-paragraph (a) below, and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor’s opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section.

The Engineer shall, within 28 days after receiving the Contractor’s application:

issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or
(b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub-Clause.

If the Engineer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.

10.2 Taking Over of Parts of the Works

The Engineer may, at the sole discretion of the Employer, issue a Taking-Over Certificate for any part of the Permanent Works.

The Employer shall not use any part of the Works (other than as a temporary measure which is either specified in the Contract or agreed by both Parties) unless and until the Engineer has issued a Taking-Over Certificate for this part. However, if the Employer does use any part of the Works before the Taking-Over Certificate is issued:

(a) the part which is used shall be deemed to have been taken over as from the date on which it is used,
(b) the Contractor shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the Employer, and
(c) if requested by the Contractor, the Engineer shall issue a Taking-Over Certificate for this part.

After the Engineer has issued a Taking-Over Certificate for a part of the Works, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding Tests on Completion. The Contractor shall carry out these Tests on Completion as soon as practicable before the expiry date of the relevant Defects Notification Period.

If the Contractor incurs Cost as a result of the Employer taking over and/or using a part of the Works, other than such use as is specified in the Contract or agreed by the Contractor, the Contractor shall (i) give notice to the Engineer and (ii) be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such Cost plus profit, which shall be included in the Contract Price. After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this Cost and profit.

If a Taking-Over Certificate has been issued for a part of the Works (other than a Section), the delay damages thereafter for completion of the remainder of the Works shall be reduced. Similarly, the delay damages for the remainder of the Section (if any) in which this part is included shall also be reduced. For any period of delay after the date stated in this Taking-Over Certificate, the proportional reduction in these delay damages shall be calculated as the proportion which the value of the part so certified bears to the value of the Works or Section (as the case may be) as a whole. The Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these proportions. The provisions of this paragraph shall only apply to the daily rate of delay damages under Sub-Clause 8.7 [Delay Damages], and shall not affect the maximum amount of these damages.

If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which the Employer is responsible, the Employer shall be
deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed.

The Engineer shall then issue a Taking-Over Certificate accordingly, and the Contractor shall carry out the Tests on Completion as soon as practicable, before the expiry date of the Defects Notification Period. The Engineer shall require the Tests on Completion to be carried out by giving 14 days’ notice and in accordance with the relevant provisions of the Contract.

If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

10.4 Surfaces Requiring Reinstatement

Except as otherwise stated in a Taking-Over Certificate, a certificate for a Section or part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.

11.1 Completion of Outstanding Work and Remediing Defects

In order that the Works and Contractor’s Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

(a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Engineer, and
(b) execute all work required to remedy defects or damage, as may be notified by (or on behalf of) the Employer on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

If a defect appears or damage occurs, the Contractor shall be notified accordingly, by (or on behalf of) the Employer.

11.2 Cost of Remediing Defects

All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remediing Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

(a) any design for which the Contractor is responsible,
(b) Plant, Materials or workmanship not being in accordance with the Contract, or failure by the Contractor to comply with any other obligation.

To the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) the Employer, and Sub-Clause 13.3 [Variation Procedure] shall apply.
11.3 Extension of Defects Notification Period

The Employer shall be entitled subject to Sub-Clause 2.5 [Employer's Claims] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or by reason of damage attributable to the Contractor. However, a Defects Notification Period shall not be extended by more than two years.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8 [Suspension of Work] or Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the Defects Notification Period for the Plant and/or Materials would otherwise have expired.

11.4 Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by (or on behalf of) the Employer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Employer may (at his option):

(a) carry out the work himself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer the costs reasonably incurred by the Employer in remedying the defect or damage;

(b) require the Engineer to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determination]; or

(c) if the defect or damage deprives the Employer of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Employer shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

11.5 Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and the Employer gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

11.6 Further Tests

If the work of remedying of any defect or damage may affect the performance of the Works, the Engineer may require the repetition of any of the tests described in the Contract. The requirement shall be made by notice within 28 days after the defect or damage is remedied.

These tests shall be carried out in accordance with the terms applicable to the tests, except that they shall be carried out at the risk and cost of the Party under Sub-Clause 11.2 [Cost of Remedying Defects], for the cost of the remedial work.
11.7 Right of Access

Until the Performance Certificate has been issued, the Contractor shall have such right of access to the Works as is reasonably required in order to comply with this Clause, except as may be inconsistent with the Employer’s reasonable security restrictions.

11.8 Contractor to Search

The Contractor shall, if required by the Engineer, search for the cause of any defect, under the direction of the Engineer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedyng Defects], the Cost of the search plus profit shall be agreed or determined by the Engineer in accordance with Sub-Clause 3.5 [Determinations] and shall be included in the Contract Price.

11.9 Performance Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Engineer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

The Engineer shall issue the Performance Certificate within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon thereafter as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. A copy of the Performance Certificate shall be issued to the Employer.

Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

11.10 Unfulfilled Obligations

After the Performance Certificate has been issued, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

11.11 Clearance of Site

Upon receiving the Performance Certificate, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site.

If all these items have not been removed within 28 days after receipt by the Contractor of the Performance Certificate, the Employer may sell or otherwise dispose of any remaining items. The Employer shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than the Employer's costs, the Contractor shall pay the outstanding balance to the Employer.

12 Measurement and Evaluation

12.1 Works to be Measured

The Works shall be measured, and valued for payment, in accordance with this Clause. The Contractor shall show in each application under Sub-Clauses 14.3 [Application for Interim Payment Certificate], 14.10 [Statement on Completion] and 14.11 [Application for Final Payment Certificate] the quantities and other particulars of the amounts which he considers to be entitled under the Contract.
Whenever the Engineer requires any part of the Works to be measured, reasonable notice shall be given to the Contractor's Representative, who shall:

(a) promptly either attend or send another qualified representative to assist the Engineer in making the measurement, and
(b) supply any particulars requested by the Engineer.

If the Contractor fails to attend or send a representative, the measurement made by (or on behalf of) the Engineer shall be accepted as accurate.

Except as otherwise stated in the Contract, wherever any Permanent Works are to be measured from records, these shall be prepared by the Engineer. The Contractor shall, as and when requested, attend to examine and agree the records with the Engineer, and shall sign the same when agreed. If the Contractor does not attend, the records shall be accepted as accurate.

If the Contractor examines and disagrees the records, and/or does not sign them as agreed, then the Contractor shall give notice to the Engineer of the respects in which the records are asserted to be inaccurate. After receiving this notice, the Engineer shall review the records and either confirm or vary them and certify the payment of the undisputed part. If the Contractor does not so give notice to the Engineer within 14 days after being requested to examine the records, they shall be accepted as accurate.

12.2 Method of Measurement

Except as otherwise stated in the Contract and notwithstanding local practice:

(a) measurement shall be made of the net actual quantity of each item of the Permanent Works, and
(b) the method of measurement shall be in accordance with the Bill of Quantities or other applicable Schedules.

12.3 Evaluation

Except as otherwise stated in the Contract, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the Contract Price by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Claus 12.1 and 12.2 and the appropriate rate or price for the item.

For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contract or, if there is no such item, specified for similar work.

Any item of work included in the Bill of Quantities for which no rate or price was specified shall be considered as included in other rates and prices in the Bill of Quantities and will not be paid for separately.

However, a new rate or price shall be appropriate for an item of work if:

(i) the measured quantity of the item is changed by more than 25% from the quantity of this item in the Bill of Quantities or other Schedule,
(ii) this change in quantity multiplied by such specified rate for this item exceeds 0.25% of the Accepted Contract Amount,
(iii) this change in quantity directly changes the Cost per unit quantity of this item by more than 1%, and
(iv) this item is not specified in the Contract as a “fixed rate item”;
or

(b) (i) the work is instructed under Clause 13 [Variations and Adjustments],
(ii) no rate or price is specified in the Contract for this item, and
(iii) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Contract, with reasonable adjustments to take account of the matters described in sub-paragraph (a) and/or (b), as applicable. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable Cost of executing the work, together with profit, taking account of any other relevant matters.

Until such time as an appropriate rate or price is agreed or determined, the Engineer shall determine a provisional rate or price for the purposes of Interim Payment Certificates as soon as the concerned work commences.

Omissions

Whenever the omission of any work forms part (or all) of a Variation, the value of which has not been agreed, if:

(a) the Contractor will incur (or has incurred) cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount;
(b) the omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and
(c) this cost is not deemed to be included in the evaluation of any substituted work;

then the Contractor shall give notice to the Engineer accordingly, with supporting particulars. Upon receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this cost, which shall be included in the Contract Price.

Variations and Adjustments

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, or (ii) such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

A Variation may include:

- changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation),
- changes to the quality and other characteristics of any item of work,
- changes to the levels, positions and/or dimensions of any part of the Works,
- omission of any work unless it is to be carried out by others.
(e) any additional work, Plant, Materials or services necessary for the Permanent Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, or
(f) changes to the sequence or timing of the execution of the Works.

The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Engineer instructs or approves a Variation.

13.2 Value Engineering

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor’s opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to the Employer of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the Employer of the completed Works, or (iv) otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [Variation Procedure].

If a proposal, which is approved by the Engineer, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties:

(a) the Contractor shall design this part,
(b) sub-paragraphs (a) to (d) of Sub-Clause 4.1 [Contractor’s General Obligations] shall apply, and
(c) if this change results in a reduction in the contract value of this part, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine a fee, which shall be included in the Contract Price. This fee shall be half (50%) of the difference between the following amounts:

(i) such reduction in contract value, resulting from the change, excluding adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost], and
(ii) the reduction (if any) in the value to the Employer of the varied works, taking account of any reductions in quality, anticipated life or operational efficiencies.

However, if amount (i) is less than amount (ii), there shall not be a fee.

13.3 Variation Procedure

If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

(a) a description of the proposed work to be performed and a programme for its execution,
(b) the Contractor’s proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion, and
(c) the Contractor’s proposal for evaluation of the Variation.

The Engineer shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Engineering] or otherwise), respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Engineer to the Contractor, who shall acknowledge receipt.
Each Variation shall be evaluated in accordance with Clause 12 [Measurement and Evaluation], unless the Engineer instructs or approves otherwise in accordance with this Clause.

13.4 Payment in Applicable Currencies

If the Contract provides for payment of the Contract Price in more than one currency, then whenever an adjustment is agreed, approved or determined as stated above, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified for payment of the Contract Price.

13.5 Provisional Sums

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed.

For each Provisional Sum, the Engineer may instruct:

(a) work to be executed (including Plant, Materials or services to be supplied) by the Contractor and valued under Sub-Clause 13.3 [Variation Procedure]; and/or

(b) Plant, Materials or services to be purchased by the Contractor, from a nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]) or otherwise; and for which there shall be included in the Contract Price:

(i) the actual amounts paid (or due to be paid) by the Contractor, and

(ii) a sum for overhead charges and profit, calculated as a percentage of these actual amounts by applying the relevant percentage rate (if any) stated in the appropriate Schedule. If there is no such rate, the percentage rate stated in the Contract Data shall be applied.

The Contractor shall, when required by the Engineer, produce quotations, invoices, vouchers and accounts or receipts in substantiation.

13.6 Daywork

For work of a minor or incidental nature, the Engineer may instruct that a Variation shall be executed on a daywork basis. The work shall then be valued in accordance with the Daywork Schedule included in the Contract, and the following procedure shall apply. If a Daywork Schedule is not included in the Contract, this Sub-Clause shall not apply.

Before ordering Goods for the work, the Contractor shall submit quotations to the Engineer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

Except for any items for which the Daywork Schedule specifies that payment is not due, the Contractor shall deliver each day to the Engineer accurate statements in duplicate which shall include the following details of the resources used in executing the previous day's work:

- the names, occupations and time of Contractor’s Personnel,
- the identification, type and time of Contractor’s Equipment and Temporary Works, and
- the quantities and types of Plant and Materials used.

A copy of each statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor. The Contractor shall then submit priced statements of
13.7 Adjustments for Changes in Legislation

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the table of adjustment data in accordance with the provisions of Sub-Clause 13.8 [Adjustments for Changes in Cost].

13.8 Adjustments for Changes in Cost

In this Sub-Clause, “table of adjustment data” means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub-Clause shall not apply.

If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formulae shall be of the following general type:

\[ P_n = a + b \frac{L_n}{L_0} + c \frac{E_n}{E_0} + d \frac{M_n}{M_0} + \ldots \]

where:

- \( P_n \) is the adjustment multiplier to be applied to the estimated contract value in the relevant currency of the work carried out in period “n”, this period being a month unless otherwise stated in the Contract Data;
- \( L_n \) is the estimated local currency value of the work carried out in period “n”;
- \( L_0 \) is the local currency value of the work for which a Payment Certificate has been issued in the previous period;
- \( E_n \) is the estimated foreign currency value of the work carried out in period “n”; and
- \( E_0 \) is the foreign currency value of the work carried out in the previous period.

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“a” is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments;

“b”, “c”, “d”, … are coefficients representing the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

“Ln”, “En”, “Mn”, … are the current cost indices or reference prices for period “n”, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and

“Lo”, “Eo”, “Mo”, … are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the “currency of index” is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable.

Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price, whichever is more favourable to the Employer.

The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.
(i) of the Works which the Contractor is required to execute, or
(ii) for the purposes of Clause 12 [Measurement and Evaluation]; and

(d) the Contractor shall submit to the Engineer, within 28 days after the Commencement Date, a proposed breakdown of each lump sum price in the Schedules. The Engineer may take account of the breakdown when preparing Payment Certificates, but shall not be bound by it.

Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts therefor, imported by the Contractor for the sole purpose of executing the Contract shall be exempt from the payment of import duties and taxes upon importation.

14.2 Advance Payment

The Employer shall make an advance payment, as an interest-free loan for mobilisation and cash flow support, when the Contractor submits a guarantee in accordance with this Sub-Clause. The total advance payment, the number and timing of instalments (if more than one), and the applicable currencies and proportions, shall be as stated in the Contract Data.

Unless and until the Employer receives this guarantee, or if the total advance payment is not stated in the Contract Data, this Sub-Clause shall not apply.

The Engineer shall deliver to the Employer and to the Contractor an Interim Payment Certificate for the advance payment or its first instalment after receiving a Statement (under Sub-Clause 14.3 [Application for Interim Payment Certificates]) and after the Employer receives (i) the Performance Security in accordance with Sub-Clause 4.2 [Performance Security] and (ii) a guarantee in amounts and currencies equal to the advance payment. This guarantee shall be issued by a reputable bank or financial institution selected by the Contractor, and shall be in the form annexed to the Particular Conditions or in another form approved by the Employer.

The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.

Unless stated otherwise in the Contract Data, the advance payment shall be repaid through percentage deductions from the interim payments determined by the Engineer in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates], as follows:

(a) deductions shall commence in the next interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds 30 percent (30%) of the Accepted Contract Amount less Provisional Sums; and
(b) deductions shall be made at the amortisation rate stated in the Contract Data of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when 90 percent (90%) of the Accepted Contract Amount less Provisional Sums has been certified for payment.
If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 [Termination by Employer], Clause 16 [Suspension and Termination by Contractor] or Clause 19.6 [Force Majeure] (as the case may be), the whole of the balance then outstanding shall immediately become due and in case of termination under Clause 15 [Termination by Employer], except for Sub-Clause 15.5 [Employer’s Entitlement to Termination for Convenience], payable by the Contractor to the Employer.

14.3 Application for Interim Payment Certificates

The Contractor shall submit a Statement in six copies to the Engineer after the end of each month, in a form approved by the Engineer, showing in detail the amounts to which the Contractor considers himself to be entitled, together with supporting documents which shall include the report on the progress during this month in accordance with Sub-Clause 4.21 [Progress Reports].

The Statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:

(a) the estimated contract value of the Works executed and the Contractor’s Documents produced up to the end of the month (including Variations but excluding items described in sub-paragraphs (b) to (g) below);

(b) any amounts to be added and deducted for changes in legislation and changes in cost, in accordance with Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost];

(c) any amount to be deducted for retention, calculated by applying the percentage of retention stated in the Contract Data to the total of the above amounts, until the amount so retained by the Employer reaches the limit of Retention Money (if any) stated in the Contract Data;

(d) any amounts to be added for the advance payment (if more than one instalment) and to be deducted for its repayments in accordance with Sub-Clause 14.2 [Advance Payment];

(e) any amounts to be added and deducted for Plant and Materials in accordance with Sub-Clause 14.5 [Plant and Materials intended for the Works];

(f) any other additions or deductions which may have become due under the Contract or otherwise, including those under Clause 20 [Claims, Disputes and Arbitration]; and

(g) the deduction of amounts certified in all previous Payment Certificates.

14.4 Schedule of Payments

If the Contract includes a schedule of payments specifying the instalments in which the Contract Price will be paid, then unless otherwise stated in this schedule:

(a) the instalments quoted in this schedule of payments shall be the estimated contract values for the purposes of sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates];

(b) Sub-Clause 14.5 [Plant and Materials intended for the Works] shall not apply; and

(c) if these instalments are not defined by reference to the actual progress achieved in executing the Works, and if actual progress is found to be less or more than that on which this schedule of payments was based, then the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine revised instalments, which shall take account of the extent to which progress is less or more than that on which the instalments were previously based.

If the Contract does not include a schedule of payments, the Contractor shall submit non-binding estimates of the payments which he expects to become due during each
quarterly period. The first estimate shall be submitted within 42 days after the Commencement Date. Revised estimates shall be submitted at quarterly intervals, until the Taking-Over Certificate has been issued for the Works.

14.5 Plant and Materials intended for the Works

If this Sub-Clause applies, Interim Payment Certificates shall include, under sub-paragraph (e) of Sub-Clause 14.3, (i) an amount for Plant and Materials which have been sent to the Site for incorporation in the Permanent Works, and (ii) a reduction when the contract value of such Plant and Materials is included as part of the Permanent Works under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates].

If the lists referred to in sub-paragraphs (b)(i) or (c)(i) below are not included in the Schedules this Sub-Clause shall not apply.

The Engineer shall determine and certify each addition if the following conditions are satisfied:

(a) the Contractor has:

(i) kept satisfactory records (including the orders, receipts, Costs and use of Plant and Materials) which are available for inspection, and
(ii) submitted a statement of the Cost of acquiring and delivering the Plant and Materials to the Site, supported by satisfactory evidence;

and either:

(b) the relevant Plant and Materials:

(i) are those listed in the Schedules for payment when shipped,
(ii) have been shipped to the Country, en route to the Site, in accordance with the Contract; and
(iii) are described in a clean shipped bill of lading or other evidence of shipment, which has been submitted to the Engineer together with evidence of payment of freight and insurance, any other documents reasonably required, and a bank guarantee in a form and issued by an entity approved by the Employer in amounts and currencies equal to the amount due under this Sub-Clause: this guarantee may be in a similar form to the form referred to in Sub-Clause 14.2 [Advance Payment] and shall be valid until the Plant and Materials are properly stored on Site and protected against loss, damage or deterioration;

or

(c) the relevant Plant and Materials:

(i) are those listed in the Schedules for payment when delivered to the Site, and
(ii) have been delivered to and are properly stored on the Site, are protected against loss, damage or deterioration, and appear to be in accordance with the Contract.

The additional amount to be certified shall be the equivalent of eighty percent (80%) of the Engineer's determination of the cost of the Plant and Materials (including delivery to Site), taking account of the documents mentioned in this Sub-Clause and contract value of the Plant and Materials.
The currencies for this additional amount shall be the same as those in which payment will become due when the contract value is included under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates]. At that time, the Payment Certificate shall include the applicable reduction which shall be equivalent to, and in the same currencies and proportions as, this additional amount for the relevant Plant and Materials.

14.6 Issue of Interim Payment Certificates

No amount will be certified or paid until the Employer has received and approved the Performance Security. Thereafter, the Engineer shall, within 28 days after receiving a Statement and supporting documents, deliver to the Employer and to the Contractor an Interim Payment Certificate which shall state the amount which the Engineer fairly determines to be due, with all supporting particulars for any reduction or withholding made by the Engineer on the Statement if any.

However, prior to issuing the Taking-Over Certificate for the Works, the Engineer shall not be bound to issue an Interim Payment Certificate in an amount which would (after retention and other deductions) be less than the minimum amount of Interim Payment Certificates (if any) stated in the Contract Data. In this event, the Engineer shall give notice to the Contractor accordingly.

An Interim Payment Certificate shall not be withheld for any other reason, although:

(a) if any thing supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or
(b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Engineer, the value of this work or obligation may be withheld until the work or obligation has been performed.

The Engineer may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Engineer's acceptance, approval, consent or satisfaction.

14.7 Payment

The Employer shall pay to the Contractor:

(a) the first instalment of the advance payment within 42 days after issuing the Letter of Acceptance or within 21 days after receiving the documents in accordance with Sub-Clause 4.2 [Performance Security] and Sub-Clause 14.2 [Advance Payment], whichever is later;
(b) the amount certified in each Interim Payment Certificate within 56 days after the Engineer receives the Statement and supporting documents; or, at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the amount shown on any statement submitted by the Contractor within 14 days after such statement is submitted, any discrepancy being rectified in the next payment to the Contractor; and
(c) the amount certified in the Final Payment Certificate within 56 days after the Employer receives this Payment Certificate; or, at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the undisputed amount shown in the Final Statement within 56 days after the date of notification of the suspension in accordance with Sub-Clause 16.2 [Termination by Contractor].

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Payment of the amount due in each currency shall be made into the bank account, nominated by the Contractor, in the payment country (for this currency) specified in the Contract.

14.8 Delayed Payment

If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b)) of the date on which any Interim Payment Certificate is issued.

Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the annual rate of three percentage points above the discount rate of the central bank in the country of the currency of payment, or if not available, the interbank offered rate, and shall be paid in such currency.

The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

14.9 Payment of Retention Money

When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate is issued for a Section or part of the Works, a proportion of the Retention Money shall be certified and paid. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section or part, by the estimated final Contract Price.

Promptly after the latest of the expiry dates of the Defects Notification Periods, the outstanding balance of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate was issued for a Section, a proportion of the second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period for the Section. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section by the estimated final Contract Price.

However, if any work remains to be executed under Clause 11 [Defects Liability], the Engineer shall be entitled to withhold certification of the estimated cost of this work until it has been executed.

When calculating these proportions, no account shall be taken of any adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost].

Unless otherwise stated in the Particular Conditions, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions or in another form approved by the Employer and issued by a reputable bank or financial institution selected by the Contractor, for the second half of the Retention Money. The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the Retention Money and is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects, as specified for the Performance Security in Sub-Clause 4.2. On receipt by the Employer of the required guarantee, the Engineer shall certify and the Employer shall pay the second half of the Retention Money. The release of the second half of the Retention Money...
against a guarantee shall then be in lieu of the release under the second paragraph of this Sub-Clause. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate.

If the Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount guaranteed under it when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security.

14.10 Statement at Completion

Within 84 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Engineer six copies of a Statement at completion with supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates], showing:

(a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,
(b) any further sums which the Contractor considers to be due, and
(c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract. Estimated amounts shall be shown separately in this Statement at completion.

The Engineer shall then certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates].

14.11 Application for Final Payment Certificate

Within 56 days after receiving the Performance Certificate, the Contractor shall submit, to the Engineer, six copies of a draft final statement with supporting documents showing in detail in a form approved by the Engineer:

(a) the value of all work done in accordance with the Contract, and
(b) any further sums which the Contractor considers to be due to him under the Contract or otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require within 28 days from receipt of said draft and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed. This agreed statement is referred to in these Conditions as the “Final Statement”.

However if, following discussions between the Engineer and the Contractor and any changes to the draft final statement which are agreed, it becomes evident that a dispute exists, the Engineer shall deliver to the Employer (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement. Thereafter, if the dispute is finally resolved under Sub-Clause 20.4 [Obtaining Dispute Board’s Decision] or Sub-Clause 20.5 [Amicable Settlement], the Contractor shall then prepare and submit to the Employer (with a copy to the Engineer) a Final Statement.

14.12 Discharge

When submitting the Final Statement, the Contractor shall submit a discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This
discharge may state that it becomes effective when the Contractor has received the Performance Security and the outstanding balance of this total, in which event the discharge shall be effective on such date.

14.13 Issue of Final Payment Certificate

Within 28 days after receiving the Final Statement and discharge in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall deliver, to the Employer and to the Contractor, the Final Payment Certificate which shall state:

(a) the amount which he fairly determines is finally due, and
(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, the balance (if any) due from the Employer to the Contractor or from the Contractor to the Employer, as the case may be.

If the Contractor has not applied for a Final Payment Certificate in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall request the Contractor to do so. If the Contractor fails to submit an application within a period of 28 days, the Engineer shall issue the Final Payment Certificate for such amount as he fairly determines to be due.

14.14 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

(a) in the Final Statement and also
(b) (except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Sub-Clause 14.10 [Statement at Completion].

However, this Sub-Clause shall not limit the Employer's liability under his indemnification obligations, or the Employer's liability in any case of fraud, deliberate default or reckless misconduct by the Employer.

14.15 Currencies of Payment

The Contract Price shall be paid in the currency or currencies named in the Schedule of Payment Currencies. If more than one currency is so named, payments shall be made as follows:

(a) if the Accepted Contract Amount was expressed in Local Currency only:

(i) the proportions or amounts of the Local and Foreign Currencies, and the fixed rates of exchange to be used for calculating the payments, shall be as stated in the Schedule of Payment Currencies, except as otherwise agreed by both Parties;
(ii) payments and deductions under Sub-Clause 13.5 [Provisional Sums] and Sub-Clause 13.7 [Adjustments for Changes in Legislation] shall be made in the applicable currencies and proportions; and
(iii) other payments and deductions under sub-paragraphs (a) to (d) of Sub-Clause 14.3 [Application for Interim Payment Certificates] shall be made in the currencies and proportions specified in sub-paragraph (a)(i) above;

(b) payment of the damages specified in the Contract Data shall be made in the currencies and proportions specified in the Schedule of Payment currencies;
15.1 Notice to Correct

If the Contractor fails to carry out any obligation under the Contract, the Engineer may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.

15.2 Termination by Employer

The Employer shall be entitled to terminate the Contract if the Contractor:

(a) fails to comply with Sub-Clause 4.2 [Performance Security] or with a notice under Sub-Clause 15.1 [Notice to Correct],
(b) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract,
(c) without reasonable excuse fails:
   (i) to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension], or
   (ii) to comply with a notice issued under Sub-Clause 7.5 [Rejection] or Sub-Clause 7.6 [Remedial Work], within 28 days after receiving it,
(d) subcontracts the whole of the Works or assigns the Contract without the required agreement,
(e) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or
(f) gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an inducement or reward:
   (i) for doing or forbearing to do any action in relation to the Contract, or
   (ii) for showing or forbearing to show favour or disfavour to any person in relation to the Contract,

or if any of the Contractor's Personnel, agents or Subcontractors gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph (f). However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination.

In any of these events or circumstances, the Employer may, upon giving 14 days' notice to the Contractor, terminate the Contract and expel the Contractor from the
Site. However, in the case of sub-paragraph (e) or (f), the Employer may by notice terminate the Contract immediately.

The Employer's election to terminate the Contract shall not prejudice any other rights of the Employer, under the Contract or otherwise.

The Contractor shall then leave the Site and deliver any required Goods, all Contractor’s Documents, and other design documents made by or for him, to the Engineer. However, the Contractor shall use his best efforts to comply immediately with any reasonable instructions included in the notice (i) for the assignment of any subcontract, and (ii) for the protection of life or property or for the safety of the Works.

After termination, the Employer may complete the Works and/or arrange for any other entities to do so. The Employer and these entities may then use any Goods, Contractor’s Documents and other design documents made by or on behalf of the Contractor.

The Employer shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to the Employer, these items may be sold by the Employer in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor.

### 15.3 Valuation at Date of Termination

As soon as practicable after a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.

### 15.4 Payment after Termination

After a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer may:

(a) proceed in accordance with Sub-Clause 2.5 [Employer's Claims],

(b) withhold further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Employer, have been established, and/or

(c) recover from the Contractor any losses and damages incurred by the Employer and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation at Date of Termination]. After recovering any such losses, damages and extra costs, the Employer shall pay any balance to the Contractor.

### 15.5 Employer’s Entitlement to Termination for Convenience

The Employer shall be entitled to terminate the Contract, at any time for the Employer's convenience, by giving notice of such termination to the Contractor. The termination shall take effect 28 days after the later of the dates on which the Contractor receives this notice or the Employer returns the Performance Security. The Employer shall not terminate the Contract under this Sub-Clause in order to execute the Works himself or to arrange for the Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor under Clause 16.2 [Termination by Contractor].

After this termination, the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor’s Equipment] and shall be paid in accordance with Sub-Clause 16.4 [Payment on Termination].
15.6 Corrupt or Fraudulent Practices

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor’s Personnel].

[For contracts financed by the African Development Bank:]

For the purposes of this Sub-Clause:

(a) “corrupt practice” means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in the contract execution; and

(b) “fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of the Contract to the detriment of the borrower, and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the borrower of the benefits of free and open competition.

16 Suspension and Termination by Contractor

16.1 Contractor’s Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days’ notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer’s Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor’s action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before a notice of termination, the Contractor shall resume normal working as soon as practicable.

If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall
give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

(a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor’s Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements],
(b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
(c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer’s Claims]),
(d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
(e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],
(f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension],
(g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,
(h) the Contractor does not receive the Engineer’s instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days’ notice to the Employer, terminate the Contract. However, in the case of subparagraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor’s entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the contract by giving notice to the Employer, with a copy to the Engineer, such notice to take effect 14 days after the giving of the notice.

The Contractor’s election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.
15.6 Corrupt or Fraudulent Practices

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor’s Personnel].

[For contracts financed by the Asian Development Bank:]

For the purposes of this Sub-Clause:

(a) “corrupt practice” means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
(b) “fraudulent practice” means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
(c) “coercive practice” means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
(d) “collusive practice” means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.

16 Suspension and Termination by Contractor

16.1 Contractor’s Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days’ notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer’s Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor’s action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before a notice of termination, the Contractor shall resume normal working as soon as reasonably practicable.

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If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

(a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor’s Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements],
(b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
(c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer’s Claims]),
(d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
(e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],
(f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension],
(g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,
(h) the Contractor does not receive the Engineer’s instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days’ notice to the Employer, terminate the Contract. However, in the case of subparagraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor’s entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such notice to take effect 14 days after the giving of the notice.

The Contractor’s election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.
15.6 Corrupt or Fraudulent Practices

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor's Personnel].

[For contracts financed by the Black Sea Trade and Development Bank or by the European Bank for Reconstruction and Development:]

For the purposes of this Sub-Clause:

(a) “corrupt practice” means the offering, giving, receiving, or soliciting of any thing of value to influence the action of a public official, or the threatening of injury to person, property or reputation, in connection with the procurement process or in contract execution in order to obtain or retain business or other improper advantage in the conduct of international business; and

(b) “fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the client, and includes collusive practices among tenderers (prior to or after tender submission) designed to establish tender prices at artificial, non-competitive levels and to deprive the client of the benefits of free and open competition.

16 Suspension and Termination by Contractor

16.1 Contractor's Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer's Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days' notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer's Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor's action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before the notice of termination, the Contractor shall resume normal working as soon as reasonably practicable.

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If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor
The Contractor shall be entitled to terminate the Contract if:

(a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer's Financial Arrangements],
(b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
(c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer's Claims]),
(d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
(e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],
(f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension],
(g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,
(h) the Contractor does not receive the Engineer's instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days' notice to the Employer, terminate the Contract. However, in the case of sub-paragraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such notice to take effect 14 days after the giving of the notice.

The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.
15.6 Corrupt or Fraudulent Practices

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor’s Personnel].

[For contracts financed by the Caribbean Development Bank:]

For the purposes of this Sub-Clause:

(a) “corrupt practice” means the offering, giving, receiving or soliciting, directly or indirectly, of any thing of value to influence the action of a public official in the procurement process or in the Contract execution;

(b) “fraudulent practice” means a misrepresentation or omission of facts in order to influence a procurement process or the execution of the Contract;

(c) “collusive practice” means a scheme or arrangement between two or more bidders, with or without the knowledge of the Borrower, designed to establish bid prices at artificial, non-competitive levels;

(d) “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the procurement process or affect the execution of a contract.

16 Suspension and Termination by Contractor

16.1 Contractor’s Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days’ notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer’s Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor’s action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before a notice of termination, the Contractor shall resume normal working as soon as reasonably practicable.
If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

(a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor’s Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements],
(b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
(c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer’s Claims]),
(d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
(e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or
Sub-Clause 1.7 [Assignment],
(f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension],
(g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,
(h) the Contractor does not receive the Engineer’s instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days’ notice to the Employer, terminate the Contract. However, in the case of subparagraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor’s entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such notice to take effect 14 days after the giving of the notice.

The Contractor’s election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.

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If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor’s Personnel].

[For contracts financed by the Inter-American Development Bank:]

For the purposes of this Sub-Clause:

The Bank requires that all Contractors adhere to the Bank’s Policies for the Procurement of Works and Goods financed by the Bank. In particular, the Bank requires that all Borrowers (including grant beneficiaries), the executing agencies and contracting agencies, as well as all firms, entities and individuals bidding for or participating in a Bank-financed project, including, inter alia, applicants, bidders, contractors, consulting firms and individual consultants (including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the Bank all suspected acts of fraud or corruption of which it has knowledge or becomes aware, during the Bidding Process and throughout the negotiation or execution of a Contract. Fraud and corruption are prohibited.

Fraud and corruption include acts of:

- (a) bribery,
- (b) extortion or coercion,
- (c) fraud, and
- (d) collusion.

The definitions of actions set forth below cover the most common types of corrupt practices, but are not exhaustive. For this reason, the Bank shall also take action in the event of any similar deed or complaint involving alleged acts of corruption, even when these are not specified in the following list. The Bank shall in all cases proceed in accordance with Sub-Clause 15.6.

In pursuance of this policy:

- (a) the Bank defines the terms set forth below as follows:
  - (i) “bribery” meaning the offering or giving of anything of value to influence the actions or decisions of third parties or the receiving or soliciting of any benefit in exchange for actions or omissions related to the performance of duties;
  - (ii) “extortion” or “coercion” meaning the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force, where potential or actual injury may befall upon a person, his/her reputation or property;
  - (iii) “fraud” meaning any action or omission intended to misrepresent the truth so as to induce others to act in reliance thereof, with the purpose of obtaining some unjust advantage or causing damage to others; and
  - (iv) “collusion” meaning a secret agreement between two or more parties to defraud or cause damage to a person or entity or to obtain an unlawful purpose;
(b) if the Bank, in accordance with its administrative procedures, demonstrates that any firm, entity or individual bidding for or participating in a Bank-financed project including, inter alia, applicants, bidders, contractors, consulting firms, individual consultants, borrowers (including grant beneficiaries), purchasers, executing agencies and contracting agency (including their respective officers, employees and agents) engaged in an act of fraud or corruption in connection with Bank-financed projects, the Bank may:

(i) decide not to finance any proposal to award a contract or a contract awarded financed by the Bank;
(ii) suspend disbursement of the operation if it is determined at any stage that evidence is sufficient to support a finding that an employee, agent or representative of the Borrower, Executing Agency or Contracting Agency has engaged in an act of fraud or corruption;
(iii) cancel and/or accelerate the payment of, the portion of a loan or grant earmarked for a contract, when there is evidence that the representative of the Borrower, or Beneficiary of a grant, has not taken the adequate remedial measures within a time period which the Bank considers reasonable, and in accordance with the due process guarantees of the Borrowing country's legislation;
(iv) issue a reprimand in the form of a formal letter of censure of the firm, entity or individual's behaviour;
(v) issue a declaration that an individual, entity or firm is ineligible, either permanently or for a stated period of time, to be awarded contracts under Bank-financed projects except under such conditions as the Bank deems to be appropriate;
(vi) refer the matter to appropriate law enforcement authorities; and/or;
(vii) may impose other sanctions that it deems to be appropriate under the circumstances, including the imposition of fines representing reimbursement of the Bank for costs associated with investigations and proceedings. Such other sanctions may be imposed in addition to or in lieu of other sanctions;

(c) the Bank has established administrative procedures for cases of allegations of fraud and corruption within the procurement process or the execution of a contract financed by the Bank which are available at the Bank's website (www.iadb.org), as updated from time to time. To that effect any complaint shall be submitted to the Bank's Office of Institutional Integrity (OII) for the appropriate investigation. Allegations may be presented confidentially or anonymously;

(d) payments are expressly conditional upon the claimant's participation in the procurement process conformed with all applicable Bank policies on Fraud and Corruption described in this Sub-Clause 15.5; and

(e) the imposition of any sanction referred to paragraph (b) of this Sub-Clause will be public;

The Bank will have the right to require that a Contractor permit the Bank to inspect their accounts and records and other documents relating to the submission of bids and contract performance and to have them audited by auditors appointed by the Bank. The Bank will have the right to require that Contractors to:

- maintain all documents and records related to the Bank-financed project for five (5) years after completion of the work; and
- require the delivery of any document necessary for the investigation of allegations of fraud or corruption and the availability of employees or agents of the contractor with knowledge of the Bank-financed project to respond to questions from the Bank.
If the Contractor refuses to comply with the Bank’s request, the Bank, in its sole discretion, may take appropriate action against the Contractor.

The Contractor represents and warrants:

(a) that they have read and understood the Bank’s prohibition against fraud and corruption and agrees to abide by the applicable rules;
(b) that they have not engaged in any violation of policies on fraud and corruption described herein;
(c) that they have not misrepresented or concealed any material facts during the procurement or contract negotiation processes or performance of the contract;
(d) that neither they nor any of their directors, officers or principal shareholders have been declared ineligible to be awarded Bank-financed contracts or have been convicted of a crime involving fraud or corruption;
(e) that none of their directors, officers or principal shareholders has been a director, officer or principal shareholder of any other company or entity that has been declared ineligible to be awarded a Bank-financed contract or has been convicted of a crime involving fraud or corruption;
(f) that all commissions, agents’ fees, facilitating payments or revenue-sharing agreements related to the Bank-financed contract or consulting agreement have been disclosed;
(g) that they acknowledge that the breach of any of these warranties constitute a basis for the imposition of any or a combination of the measures described in this Sub-Clause.

Suspension and Termination by Contractor

16.1 Contractor’s Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days’ notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer’s Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor’s action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before a notice of termination, the Contractor shall resume normal working as soon as reasonably practicable.

Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall
give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

(a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor’s Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements],

(b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,

(c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer’s Claims]),

(d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,

(e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],

(f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension],

(g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,

(h) the Contractor does not receive the Engineer’s instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days’ notice to the Employer, terminate the Contract. However, in the case of subparagraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor’s entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such notice to take effect 14 days after the giving of the notice.

The Contractor’s election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.
15.6
Corrupt or Fraudulent Practices

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor’s Personnel].

[For contracts financed by The World Bank:]

In pursuance of this policy, the Bank:

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) “corrupt practice” is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

In this context, “another party” refers to a public official acting in relation to the procurement process or contract execution. In this context, “public official” includes World Bank staff and employees of other organisations taking or reviewing procurement decisions.

(ii) “fraudulent practice” is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

In this context, “party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

(iii) “collusive practice” is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

In this context, “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non-competitive levels.

(iv) “coercive practice” is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

In this context, “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non-competitive levels.
“obstructive practice” is:

(A) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(B) acts intended to materially impede the exercise of the Bank's inspection and audit rights.

In this context, “party” refers to a participant in the procurement process or contract execution.

16. Suspension and Termination by Contractor

16.1 Contractor’s Entitlement to Suspen

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer's Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days’ notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer's Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor’s action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.

If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus profit, which shall be included in the Contract Price.
After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

(a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer's Financial Arrangements],

(b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,

(c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer's Claims]),

(d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,

(e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],

(f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension],

(g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,

(h) the Contractor does not receive the Engineer's instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days’ notice to the Employer, terminate the Contract. However, in the case of sub-paragraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such termination to take effect 14 days after the giving of the notice.

The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.
[For contracts financed by The World Bank:]

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16.3 Cessation of Work and Removal of Contractor's Equipment

After a notice of termination under Sub-Clause 15.5 [Employer's Entitlement to Termination for Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub-Clause 19.6 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:

(a) cease all further work, except for such work as may have been instructed by the Engineer for the protection of life or property or for the safety of the Works,
(b) hand over Contractor's Documents, Plant, Materials and other work, for which the Contractor has received payment, and
(c) remove all other Goods from the Site, except as necessary for safety, and leave the Site.

16.4 Payment on Termination

After a notice of termination under Sub-Clause 16.2 [Termination by Contractor] has taken effect, the Employer shall promptly:

(a) return the Performance Security to the Contractor,
(b) pay the Contractor in accordance with Sub-Clause 19.6 [Optional Termination, Payment and Release], and
(c) pay to the Contractor the amount of any loss or damage sustained by the Contractor as a result of this termination.

17. Risk and Responsibility

17.1 Indemnities

The Contractor shall indemnify and hold harmless the Employer, the Employer's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

(a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and
(b) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

The Employer shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of (1) bodily injury, sickness, disease or death, which is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and (2) the matters for which liability may be excluded from insurance cover, described in sub-paragraphs (d)(i), (ii) and (iii) of Sub-Clause 18.3 [Insurance Against Injury to Persons and Damage to Property].

17.2 Contractor's Care of the Works

The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking-Over Certificate is issued (or is deemed to be
issued under Sub-Clause 10.1 [Taking Over of the Works and Sections]) for the Works, when responsibility for the care of the Works shall pass to the Employer. If a Taking-Over Certificate is issued (or is so deemed to be issued) for any Section or part of the Works, responsibility for the care of the Section or part shall then pass to the Employer.

After responsibility has accordingly passed to the Employer, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-Clause 17.3 [Employer's Risks], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor’s Documents conform with the Contract.

The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after a Taking-Over Certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking-Over Certificate has been issued and which arose from a previous event for which the Contractor was liable.

17.3 Employer’s Risks

The risks referred to in Sub-Clause 17.4 [Consequences of Employer’s Risks] below, insofar as they directly affect the execution of the Works in the Country, are:

(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
(b) rebellion, terrorism, sabotage by persons other than the Contractor’s Personnel, revolution, insurrection, military or usurped power, or civil war, within the Country,
(c) riot, commotion or disorder within the Country by persons other than the Contractor’s Personnel,
(d) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, within the Country, except as may be attributable to the Contractor’s use of such munitions, explosives, radiation or radio-activity,
(e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,
(f) use or occupation by the Employer of any part of the Permanent Works, except as may be specified in the Contract,
(g) design of any part of the Works by the Employer’s Personnel or by others for whom the Employer is responsible, and
(h) any operation of the forces of nature which is Unforeseeable or against which an experienced contractor could not reasonably have been expected to have taken adequate preventive precautions.

17.4 Consequences of Employer’s Risks

If and to the extent that any of the risks listed in Sub-Clause 17.3 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Engineer and shall rectify this loss or damage to the extent required by the Engineer.

If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost, which shall be included in the Contract Price. In the case of sub-paragraphs (f) and (g) of Sub-Clause 17.3 [Employer’s Risks], Cost plus profit shall be payable.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determination] to agree or determine these matters.

17.5 Intellectual and Industrial Property Rights

In this Sub-Clause, “infringement” means an infringement (or alleged infringement) of any patent, registered design, copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and “claim” means a claim (or proceedings pursuing a claim) alleging an infringement.

Whenever a Party does not give notice to the other Party of any claim within 28 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

The Employer shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:

(a) an unavoidable result of the Contractor’s compliance with the Contract, or
(b) a result of any Works being used by the Employer:

(i) for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or
(ii) in conjunction with any thing not supplied by the Contractor, unless such use was disclosed to the Contractor prior to the Base Date or is stated in the Contract.

The Contractor shall indemnify and hold the Employer harmless against and from any other claim which arises out of or in relation to (i) the manufacture, use, sale or import of any Goods, or (ii) any design for which the Contractor is responsible.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it. The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.6 Limitation of Liability

Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than as specifically provided in Sub-Clause 8.7 [Delay Damages]; Sub-Clause 11.2 [Cost of Remediating Defects]; Sub-Clause 15.4 [Payment after Termination]; Sub-Clause 16.4 [Payment on Termination]; Sub-Clause 17.1 [Indemnities]; Sub-Clause 17.4(b) [Consequences of Employer’s Risks] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights].

The total liability of the Contractor to the Employer, under or in connection with the Contract other than under Sub-Clause 4.19 [Electricity, Water and Gas], Sub-Clause [Employer’s Equipment and Free-Issue Materials], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum resulting from the application of a multiplier (less or greater than
one) to the Accepted Contract Amount, as stated in the Contract Data, or (if such multiplier or other sum is not so stated), the Accepted Contract Amount.

This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

17.7 Use of Employer’s Accommodation/Facilities

The Contractor shall take full responsibility for the care of the Employer-provided accommodation and facilities, if any, as detailed in the Specification, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works).

If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which the Employer is liable, the Contractor shall, at his own cost, rectify the loss or damage to the satisfaction of the Engineer.

18 Insurance

18.1 General Requirements for Insurances

In this Clause, “insuring Party” means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause.

Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers and in terms approved by the Employer. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

Wherever the Employer is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that the Employer shall act for Employer’s Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage.

The relevant insuring Party shall, within the respective periods stated in the Contract (calculated from the Commencement Date), submit to the other Party:

(a) evidence that the insurances described in this Clause have been effected, and
(b) copies of the policies for the insurances described in Sub-Clause 18.2.
When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or the Employer, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or the Employer in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

Payments by one Party to the other Party shall be subject to Sub-Clause 2.5 [Employer's Claims] or Sub-Clause 20.1 [Contractor's Claims], as applicable.

The Contractor shall be entitled to place all insurances relating to the Contract (including, but not limited to the insurance referred to Clause 18) with insurers from any eligible source country.

18.2 Insurance for Works and Contractor's Equipment

The insuring Party shall insure the Works, Plant, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under sub-paragraph (a) of Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works.

The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable from a cause occurring prior to the issue of the Taking-Over Certificate, and for damage caused by the Contractor in the course of any other operations including those under Clause 11 [Defects Liability].

The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment,
the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.

Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

(a) shall be effected and maintained by the Contractor as insuring Party,
(b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated to the Party actually bearing the costs of rectifying the loss or damage,
(c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.3 [Employer's Risks],
(d) shall also cover, to the extent specifically required in the bidding documents of the Contract, loss or damage to a part of the Works which is attributable to the use or occupation by the Employer of another part of the Works, and loss or damage from the risks listed in sub-paragraphs (c), (g) and (h) of Sub-Clause 17.3 [Employer's Risks], excluding (in each case) risks which are not insurable at commercially reasonable terms, with deductibles per occurrence of not more than the amount stated in the Contract Data (if an amount is not so stated, this sub-paragraph (d) shall not apply), and
(e) may however exclude loss of, damage to, and reinstatement of:

(i) a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),
(ii) a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship,
(iii) a part of the Works which has been taken over by the Employer, except to the extent that the Contractor is liable for the loss or damage, and
(iv) Goods while they are not in the Country, subject to Sub-Clause 14.5 [Plant and Materials intended for the Works].

If, more than one year after the Base Date, the cover described in sub-paragraph (d) above ceases to be available at commercially reasonable terms, the Contractor shall (as insuring Party) give notice to the Employer, with supporting particulars. The Employer shall then (i) be entitled subject to Sub-Clause 2.5 [Employer's Claims] to payment of an amount equivalent to such commercially reasonable terms as the Contractor should have expected to have paid for such cover, and (ii) be deemed, unless he obtains the cover at commercially reasonable terms, to have approved the omission under Sub-Clause 18.1 [General Requirements for Insurances].

18.3 Insurance against Injury to Persons and Damage to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment]) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

Insurance shall be for a limit per occurrence of not less than the amount stated in the Contract Data, with no limit on the number of occurrences. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

Unless otherwise stated in the Particular Conditions, the insurances specified in this Sub-Clause:
(a) shall be effected and maintained by the Contractor as insuring Party,
(b) shall be in the joint names of the Parties,
(c) shall be extended to cover liability for all loss and damage to the Employer's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and
(d) may however exclude liability to the extent that it arises from:

(i) the Employer's right to have the Permanent Works executed on, over, under, in or through any land, and to occupy this land for the Permanent Works,
(ii) damage which is an unavoidable result of the Contractor's obligations to execute the Works and remedy any defects, and
(iii) a cause listed in Sub-Clause 17.3 [Employer's Risks], except to the extent that cover is available at commercially reasonable terms.

18.4 Insurance for Contractor's Personnel

The Contractor shall effect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel.

The insurance shall cover the Employer and the Engineer against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel.

The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works. For a Subcontractor's employees, the insurance may be effected by the Subcontractor, but the Contractor shall be responsible for compliance with this Clause.

19.1 Force Majeure

In this Clause, “Force Majeure” means an exceptional event or circumstance:

(a) which is beyond a Party's control,
(b) which such Party could not reasonably have provided against before entering into the Contract,
(c) which, having arisen, such Party could not reasonably have avoided or overcome, and
(d) which is not substantially attributable to the other Party.

Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

(i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
(ii) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war,
(iii) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel,
(iv) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and

(v) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

19.2 Notice of Force Majeure

If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

19.3 Duty to Minimise Delay

Each Party shall at all times use all reasonable endeavours to minimise any delay in the performance of the Contract as a result of Force Majeure.

A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

19.4 Consequences of Force Majeure

If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in the case of sub-paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment].

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

19.5 Force Majeure Affecting Subcontractor

If any Subcontractor is entitled under any contract or agreement relating to the Works from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall release the Contractor's non-performance or entitle him to relief under this Clause.

19.6 Optional Termination, Payment and Release

If execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under...
Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor’s Equipment].

Upon such termination, the Engineer shall determine the value of the work done and issue a Payment Certificate which shall include:

(a) the amounts payable for any work carried out for which a price is stated in the Contract;
(b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer’s disposal;
(c) other Costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;
(d) the Cost of removal of Temporary Works and Contractor’s Equipment from the Site and the return of these items to the Contractor’s works in his country (or to any other destination at no greater cost); and
(e) the Cost of repatriation of the Contractor’s staff and labour employed wholly in connection with the Works at the date of termination.

19.7 Release from Performance

Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

(a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and
(b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

20.1 Contractor’s Claims

If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Engineer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.
The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Engineer. Without admitting the Employer's liability, the Engineer may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all these records, and shall (if instructed) submit copies to the Engineer.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

(a) this fully detailed claim shall be considered as interim;
(b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Engineer may reasonably require; and
(c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Engineer.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Engineer shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within the above defined time period.

Within the above defined period of 42 days, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.4 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

Each Payment Certificate shall include such additional payment for any claim as has been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

If the Engineer does not respond within the timeframe defined in this Clause, either Party may consider that the claim is rejected by the Engineer and any of the Parties may refer to the Dispute Board in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision].

Requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/or additional payment shall account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause.
20.2
Appointment of the
Dispute Board

Disputes shall be referred to a DB for decision in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision]. The Parties shall appoint a DB by the date stated in the Contract Data.

The DB shall comprise, as stated in the Contract Data, either one or three suitably qualified persons (“the members”), each of whom shall be fluent in the language for communication defined in the Contract and shall be a professional experienced in the type of construction involved in the Works and with the interpretation of contractual documents. If the number is not so stated and the Parties do not agree otherwise, the DB shall comprise three persons.

If the Parties have not jointly appointed the DB 21 days before the date stated in the Contract Data and the DB is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members has been agreed by the Parties and is included in the Contract, the members shall be selected from those on the list, other than anyone who is unable or unwilling to accept appointment to the DB.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed between them.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DB consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

If at any time the Parties so agree, they may jointly refer a matter to the DB for it to give its opinion. Neither Party shall consult the DB on any matter without the agreement of the other Party.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the DB (including each member) shall expire when the discharge referred to in Sub-Clause 14.12 [Discharge] shall have become effective.

20.3
Failure to Agree on the
Composition of the
Dispute Board

If any of the following conditions apply, namely:

(a) the Parties fail to agree upon the appointment of the sole member of the DB by the date stated in the first paragraph of Sub-Clause 20.2 [Appointment of the Dispute Board],
(b) either Party fails to nominate a member (for approval by the other Party), or fails to approve a member nominated by the other Party, of a DB of three persons by such date,
(c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DB by such date, or
(d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment,

then the appointing entity or official named in the Contract Data shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

20.4 Obtaining Dispute Board’s Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Engineer, either Party may refer the dispute in writing to the DB for its decision, with copies to the other Party and the Engineer. Such reference shall state that it is given under this Sub-Clause.

For a DB of three persons, the DB shall be deemed to have received such reference on the date when it is received by the chairman of the DB.

Both Parties shall promptly make available to the DB all such additional information, further access to the Site, and appropriate facilities, as the DB may require for the purposes of making a decision on such dispute. The DB shall be deemed to be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the DB and approved by both Parties, the DB shall give its decision, which shall be reasoned and shall state that it is given under this Sub-Clause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue to proceed with the Works in accordance with the Contract.

If either Party is dissatisfied with the DB’s decision, then either Party may, within 28 days after receiving the decision, give a Notice of Dissatisfaction to the other Party indicating its dissatisfaction and intention to commence arbitration. If the DB fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give a Notice of Dissatisfaction to the other Party.

In either event, this Notice of Dissatisfaction shall state that it is given under this Sub-Clause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in Sub-Clause 20.7 [Failure to Comply with Dispute Board’s Decision] and Sub-Clause 20.8 [Expiry of Dispute Board’s Appointment], neither Party shall be entitled to commence arbitration of a dispute unless a Notice of Dissatisfaction has been given in accordance with this Sub-Clause.

If the DB has given its decision as to a matter in dispute to both Parties, and no Notice of Dissatisfaction has been given by either Party within 28 days after it received the decision, then the decision shall become final and binding upon both Parties.

20.5 Amicable Settlement

If a Notice of Dissatisfaction has been given under Sub-Clause 20.4 above, both shall attempt to settle the dispute amicably before the commencement of
For participating development bank financed contract use only. No reproduction of this document is permitted.

20.6 Arbitration

Any dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 20.5 above and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Arbitration shall be conducted as follows:

(a) if the Contract is with foreign contractors,

(i) for contracts financed by all participating Banks except under sub-paragraph (a)(ii) below:

international arbitration (1) with proceedings administered by the arbitration institution designated in the Contract Data, and conducted under the rules of arbitration of such institution; or, if so specified in the Contract Data, (2) international arbitration in accordance with the arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL); or (3) if neither an arbitration institution nor UNCITRAL arbitration rules are specified in the Contract Data, with proceedings administered by the International Chamber of Commerce (ICC) and conducted under the ICC Rules of Arbitration; by one or more arbitrators appointed in accordance with said arbitration rules.

(ii) for contracts financed by the Asian Development Bank:

international arbitration (1) with proceedings administered by the arbitration institution specified in the Contract Data and conducted under the rules of arbitration of such institution unless it is specified in the Contract Data that the arbitration shall be conducted under the rules of the United Nations Commission on International Trade Law (UNCITRAL) and if UNCITRAL Rules are so specified then the named arbitration institution shall be the appointing authority and shall administer the arbitration; or (2) if an arbitration institution is not specified in the Contract Data, with proceedings administered by the Singapore International Arbitration Centre (SIAC) and conducted under the SIAC Rules, by one or more arbitrators appointed in accordance with the said arbitration rules.

(b) if the Contract is with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's country.

The place of arbitration shall be the neutral location specified in the Contract Data; and the arbitration shall be conducted in the language for communications defined in Sub-Clause 1.4 [Law and Language].

The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for
Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

20.7 Failure to Comply with Dispute Board’s Decision

In the event that a Party fails to comply with a final and binding DB decision, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under Sub-Clause 20.6 [Arbitration]. Sub-Clause 20.4 [Obtaining Dispute Board’s Decision] and Sub-Clause 20.5 [Amicable Settlement] shall not apply to this reference.

20.8 Expiry of Dispute Board’s Appointment

If a dispute arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works and there is no DB in place, whether by reason of the expiry of the DB’s appointment or otherwise:

(a) Sub-Clause 20.4 [Obtaining Dispute Board’s Decision] and Sub-Clause 20.5 [Amicable Settlement] shall not apply, and

(b) the dispute may be referred directly to arbitration under Sub-Clause 20.6 [Arbitration].
APPENDIX

General Conditions of Dispute Board Agreement

1 Definitions

Each “Dispute Board Agreement” is a tripartite agreement by and between:

(a) the “Employer”;
(b) the “Contractor”; and
(c) the “Member” who is defined in the Dispute Board Agreement as being:

(i) the sole member of the “DB” and, where this is the case, all references to the “Other Members” do not apply, or
(ii) one of the three persons who are jointly called the “DB” (or “Dispute Board”) and, where this is the case, the other two persons are called the “Other Members”.

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the “Contract” and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2 General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

(a) the Commencement Date defined in the Contract,
(b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement, or
(c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days’ notice of resignation to the Employer and to the Contractor, and the Dispute Agreement shall terminate upon the expiry of this period.

3 Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Engineer. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member’s representations that he/she is:

(a) experienced in the work which the Contractor is to carry out under the Contract,
(b) experienced in the interpretation of contract documentation, and
(c) fluent in the language for communications defined in the Contract.

4 General Obligations of the Member

The Member shall:
(a) have no interest financial or otherwise in the Employer, the Contractor or Engineer, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;

(b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;

(c) have disclosed in writing to the Employer, the Contractor and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer or employee of the Employer, the Contractor or the Engineer, and any previous involvement in the overall project of which the Contract forms part;

(d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except as may be agreed in writing by the Employer, the Contractor and the Other Members (if any);

(e) comply with the annexed procedural rules and with Sub-Clause 20.4 of the Conditions of Contract;

(f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;

(g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor or the Engineer regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;

(h) ensure his/her availability for all site visits and hearings as are necessary;

(i) become conversant with the Contract and with the progress of the Works (and of any other parts of the project of which the Contract forms part) by studying all documents received which shall be maintained in a current working file;

(j) treat the details of the Contract and all the DB's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor and the Other Members (if any); and

(k) be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5 General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the DB's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any):

(a) be appointed as an arbitrator in any arbitration under the Contract;

(b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or

(c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.
The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the DB under Sub-Clause 20.4 of the Conditions of Contract, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

### Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

(a) a retainer fee per calendar month, which shall be considered as payment in full for:

   (i) being available on 28 days' notice for all site visits and hearings;
   (ii) becoming and remaining conversant with all project developments and maintaining relevant files;
   (iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and
   (iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which the Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one third. This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

(b) a daily fee which shall be considered as payment in full for:

   (i) each day or part of a day up to a maximum of two days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);
   (ii) each working day on Site visits, hearings or preparing decisions; and
   (iii) each day spent reading submissions in preparation for a hearing.

(c) all reasonable expenses including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent of the daily fee referred to in sub-paragraph (b) of this Clause; any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. If it specifies otherwise, these fees shall remain fixed for the first 24 calendar months.
months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the Contract Data shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and airfares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in Sub-Clause 14.8 of the Conditions of Contract.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days’ notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.
proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

If the Member fails to comply with any of his obligations under Clause 4 (e) - (k) above, he shall not be entitled to any fees or expenses hereunder from the date and to the extent of the non-compliance and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses already received by the Member, for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

9 Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.
Annex PROCEDURAL RULES

1 Unless otherwise agreed by the Employer and the Contractor, the DB shall visit the Site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor and the DB, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.

2 The timing of and agenda for each Site visit shall be as agreed jointly by the DB, the Employer and the Contractor, or in the absence of agreement, shall be decided by the DB. The purpose of Site visits is to enable the DB to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to endeavour to prevent potential problems or claims from becoming disputes.

3 Site visits shall be attended by the Employer, the Contractor and the Engineer and shall be co-ordinated by the Employer in co-operation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each Site visit and before leaving the site, the DB shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.

4 The Employer and the Contractor shall furnish to the DB one copy of all documents which the DB may request, including Contract documents, progress reports, variation instructions, certificates and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the DB comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.

5 If any dispute is referred to the DB in accordance with Sub-Clause 20.4 of the Conditions of Contract, the DB shall proceed in accordance with Sub-Clause 20.4 and these Rules. Subject to the time allowed to give notice of a decision and other relevant factors, the DB shall:
   
   (a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case, and
   
   (b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.

6 The DB may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.

7 Except as otherwise agreed in writing by the Employer and the Contractor, the DB have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor and the Engineer, and to proceed in the absence of any party who the DB notified received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.
The Employer and the Contractor empower the DB, among other things, to:

(a) establish the procedure to be applied in deciding a dispute,
(b) decide upon the DB’s own jurisdiction, and as to the scope of any dispute referred to it,
(c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Rules,
(d) take the initiative in ascertaining the facts and matters required for a decision,
(e) make use of its own specialist knowledge, if any,
(f) decide upon the payment of financing charges in accordance with the Contract,
(g) decide upon any provisional relief such as interim or conservatory measures, and
(h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute.

The DB shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the DB shall make and give its decision in accordance with Sub-Clause 20.4, or as otherwise agreed by the Employer and the Contractor in writing. If the DB comprises three persons:

(a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;
(b) it shall endeavour to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and
(c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless:

   (i) either the Employer or the Contractor does not agree that they do so, or
   (ii) the absent Member is the chairman and he/she instructs the other Members not to make a decision.
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Section 8 - Particular Conditions of Contract

The following Particular Conditions of Contract (PCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

### Part A - Contract Data

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Ref. GCC</th>
<th>Data</th>
</tr>
</thead>
</table>
| Employer's name and address        | 1.1.2.2  & 1.3 | Project Director, SIPMIU  
Urban Development Department  
Government of Tripura,  
2nd Floor, Khadya Bhavan, Pandit Nehru Complex,  
Agartala- 799 007 |
| Engineer's name and address        | 1.1.2.4 & 1.3 | Project Manager, SIPMIU  
Urban Development Department  
Government of Tripura,  
2nd Floor, Khadya Bhavan, Pandit Nehru Complex,  
Agartala- 799 007 |
| Bank's name                         | 1.1.2.11 | Asian Development Bank (ADB)                                           |
| Borrower's name                     | 1.1.2.12 | India                                                                |
| Time for Completion                 | 1.1.3.3 | 09 (Nine) calendar months from the date of issue of formal work order. |
| Defects Notification Period         | 1.1.3.7 | 365 days.                                                             |
| Sections                            | 1.1.5.6 | Not applicable                                                        |
| Electronic transmission systems     | 1.3 | Not Applicable                                                        |
| Governing Law                       | 1.4 | The laws that apply to the contract are the laws of India.            |
| Ruling language                     | 1.4 | English                                                               |
| Language for communications         | 1.4 | English                                                               |
| Time for access to the Site         | 2.1 | As per 'Notice to Proceed'/ 14 days after commencement date          |
| Engineer's Duties and Authority    | 3.1(b)(ii) | Variations resulting in any increase of the Accepted Contract Amount shall require approval of the Employer. |
| Performance Security                | 4.2 | The performance Security amount shall be 10% of the Contract Price. The Performance Security shall in the form of a Bank Guarantee issued by reputable international bank or a bank in the Employer’s country including a nationalized or scheduled bank or financial institution selected by the contractor. If the institution issuing the security is located outside the country of the Employer, it would be essential to ensure compliance with local laws and regulations. |
| **Normal working hours** | 6.5 | 8 hours during the day (sunrise to sunset) |
| **Time for Completion** | 8.2 | 9 months from the date of issue of notice to Proceed. |
| **Delay damages for the Works** | 8.7 & 14.15(b) | 0.1 (Point one) % of the final Contract Price per day, in the currencies and proportions in which the Contract Price is payable. |
| **Maximum amount of delay damages** | 8.7 | Ten (10 % ) percent of the final Contract Price. |
| **Provisional Sums** | 13.5.(b)(ii) | Percentage for adjustment : 5.0 % |
| **Adjustments for Changes in Cost; Table(s) of Adjustment Data** | 13.8 | Not applicable |
| **Total advance payment** | 14.2 | Ten percent (10 %) of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable. The said Advance is payable against the security issued by a reputable bank including scheduled bank or nationalized bank, acceptable to the Employer, in the format included in Section IX, Contract Forms, or a cashier’s check. If the Bank issuing the Security is located outside the territory of India, it shall have a correspondent Bank located in India to make it enforceable. |
| **Repayment amortization of advance payment** | 14.2(b) | Twenty (20 %) percent |
| **Percentage of Retention** | 14.3 | Five (5 %) percent of the interim payment certificate |
| **Limit of Retention Money** | 14.3 | Five (5%) percent of the Accepted Contract Amount |
| **Plant and Materials** | 14.5(b)(i) | If Sub-Clause 14.5 applies: Plant and Materials for payment when shipped en route to the Site : Not Applicable. |
| | 14.5(c)(i) | Plant and Materials for payment when delivered to the Site : Not applicable |
| **Minimum Amount of Interim Payment Certificates** | 14.6 | Two point five (2.5%) of the Accepted Contract Amount. |
| **Maximum total liability of the Contractor to the Employer** | 17.6 | The product of 1.0 (One point zero) times the Accepted Contract Amount, |
### Periods for submission of insurance:
- a. evidence of insurance.  
- b. relevant policies  

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| 18.1 | a) 28 days  
|     | b) 28 days  |

#### Minimum amount of third party insurance

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<tbody>
<tr>
<td>18.3</td>
<td>Rs 1,000,000.00 (Rupees One Million only) for 4 such incidents</td>
<td></td>
</tr>
</tbody>
</table>

#### Date by which the DAB shall be appointed

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<tr>
<td>20.2</td>
<td>28 days after the Commencement of Works</td>
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#### The DAB shall be comprised of

<p>| | | |</p>
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<tbody>
<tr>
<td>20.2</td>
<td>One (1) to Three (3)</td>
<td></td>
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#### List of potential DB sole members

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<table>
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<tr>
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<tbody>
<tr>
<td>20.2</td>
<td>None</td>
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</table>

#### Appointment (if not agreed) to be made by

<p>| | | |</p>
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<tr>
<td>20.3</td>
<td>The President, Indian Council of Arbitration</td>
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#### Place of Arbitration

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<td>20.6</td>
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### Summary of Sections of the Works

<table>
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<tr>
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<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
Section 8 - Particular Conditions of Contract

The following Particular Conditions of Contract (PCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

Part B - Specific Provisions

Sub- Clause 1.15

The Contractor should maintain their accounts for the works under contract, for annual financial audit including the investigation of all financial records and transaction.

Sub- Clause 1.4

Law and Language

The term law will include all statutes, decree, ordinances, by laws and regulations applicable in Agartala in the state of Tripura, India.

Sub- Clause 1.5

Priority of Documents

Substitute the documents listed (a) to (i) by the following sequence:

(a) the Contract Agreement (on stamp paper)
(b) the Letter of Acceptance;
(c) the Revised Priced Bill of Quantities, if any
(d) The Tender
(e) the Particular Condition of Contract Part A.
(f) the Particular Condition of Contract Part B.
(g) these General Conditions
(h) the Specifications, Quality Control & System and Environmental Management Plan
(i) the Drawings;
(j) any other documents forming part of the Contract

Sub- Clause 4.18

The Contractor make available necessary budgetary and human resource to fully implement the Environment management plan, the resettlement plan and indigenous peoples plan.
Sub Clause 4.8 Safety Procedure

Add the following paragraph:

(f) Prepare a detail Safety Plan, to be implemented under supervision of safety officer, within 28 (twenty eight) days of receiving of Letter of Acceptance to be approved by the Engineer.

(g) Take all necessary precautions against pollution or interference with the supply, or obstruction of the flow of surface or underground water. These precautions shall include but not be limited to physical measures such as earth bunds of adequate capacity around fuel, oil and solvent storage tanks and stores, oil and grease traps in drainage systems from workshops, vehicle and plant washing facilities and service and fuelling areas and kitchens, the establishment of sanitary, solid and liquid waste disposal systems, the maintenance in effective condition of these measures, the establishment of emergency response procedures for pollution events, and dust suppression, all in accordance with normal good practice and to the satisfaction of the Engineer.

(h) Provide for all safety measures, security and protection of equipment as provided in the Clause and shall be paid as per relevant items in the BOQ. Any item not covered in the BOQ shall be deemed to have been included in the bidders quoted rates.

Sub Clause 5.1 Nominated Sub-contractor

Add the following paragraph:

Subject to provision stated in clause 5.1 of GCC, aggregate value of sub-contracting shall be limited to 20% of the Contract Price for the purpose of the above clause.

Sub-Clause 6.4

The Contractor shall comply with all applicable labour laws, including those on occupational health and safety, equal pay for work of equal value between men and woman, and do not employ child labour, as define in Nation Legislation, for Construction and maintenance activities.

Add Sub-Clause 6.6.1 Contractor to Provide Site Office to the Engineer

The Contractor shall at his own cost make available during the progress of the works and until the date of final completion thereof an office in all respect suitable for the purpose of a Project Office. All such office, laboratory and other facilities shall be made available within 30 days from the date of commencement of work as per requirements and directions of the Engineer including maintenance of the same and shall be removed on the completion of the work. All dismantled items of the Project office and furniture items shall be property of the Contractor at the completion of the work.

Add Sub-Clause 6.24.1

The Contractor shall provide equal wages and benefits to men and women for work of equal value or type.

Sub Clause 8.1 Commencement of works

Delete Sub-clause 8.1 (d) in its entirety.
| Sub Clause 8.3 Programme | Programme of work shall be submitted within 28 days from the date of Letter of Acceptance.  
                             | The period between Program updates is 90 days.  
                             | The amount to be withheld for late submission of an updated Program is Rs 1,00,000.00 (0.1 million INR) |
|----------------------------|---------------------------------------------------------------|
| Sub Clause 12.3 Evaluation | Delete Sub-clause a(ii) in its entirety and replace by the following:  
                             | (a) (ii) this change in quantity multiplied by such specified rate for this item exceeds 5% (Five) of the Accepted Contract Amount. |
| Sub - Clause 13.2 Value Engineering | Delete in its entirety |
| Sub-Clause 14.1 | Add the following paragraph after Sub-clause 14.1 (b)  
                             | The Contract Price :- Sale tax, any other taxes, Duties, Royalties etc. on materials and works in respect of this contract shall be payable by the contractor and SIPMIU will not entertain any claim what so ever in this respect. Tenderer, shall note this at the time of quoting rates and price.  
                             | The Employer will assist the Contractor to obtain any lawful exemptions from payments of Duties or Taxes on Plant and Materials which are to be incorporated as a part of the Permanent Works by issue of a “Certificate under Government of India Notification No 108/95” in the requisite format certifying the estimated quantities of Plant / Materials that are to be incorporated into the Works. The responsibility for obtaining any such exemptions from the competent Authority will remain with the Contractor and the Employer shall no way be responsible for admissibility of the claims or eligibility of the Contractor |
| Sub-Clause 14.2 Advance Payment | Substitute Sub-Clause 14.2 by the following:  
                             | (a) The Employer shall make as an interest-free loan for mobilization, when the Contractor submits a guarantee in accordance with this Sub-clause. The total advance payment, the number and timing of installments ( if more than one ) and the applicable currencies and proportions, shall be as stated in the Contract Data.  
                             | Unless and until the Employer receives this guarantee, or if the total advance payment is not stated in the Contract data, this Sub-Clause shall not apply.  
                             | Payment of such advance amount will be due under separate certification by the Engineer after (i) execution of the Form of Agreement by the parties hereto; (ii) provision by the Contractor of the performance security in accordance with Sub-Clause 4.2; (iii) submission of undertaking in the acceptable form for utilization of advance payment ; (iv) Submission of a detail Safety Plan prepared by the Contractor in accordance with Clause no. 4.8 of Conditions of Particular Application and approval of the same by the Engineer and (v) provision by the |
Contractor of an unconditional bank guarantee issued either by a bank located in India or a foreign bank through a correspondent bank located in India in amounts and currencies equal to the advance payment.

Such bank guarantee shall remain effective until the advance payment has been repaid pursuant to paragraph (b) below, but the amount thereof shall be progressively reduced by the amount repaid by the Contractor as indicated in Interim Payment Certificates issued in accordance with this Clause. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been paid, and

The advance payment shall be repaid through percentage deductions from the interim payments certified by the Engineer in accordance with this Clause. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all interim payments certified to the Contractor has reached 20% percent of the Contract Price less Provisional Sums, and shall be made @ 16% of the amount of all Interim Payment Certificates in the types and proportionate amounts of currencies of the advance payment until such time as the advance payment has been repaid prior to the time when 80 percent of the Contract Price has been certified for payment.

Re-payments by the Contractor shall be made in the currencies of the advance payments.

If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 (Termination by Employer), Clause 16 (Suspension and Termination by Contractor) or Clause 19 (Force Majeure) (as the case may be), the whole of the balance then outstanding shall immediately become due and payable by the Contractor to the Employer.

Sub-Clause 14.7 Payment

Replace in (c) 56 days by 84 days

Sub Clause 20.1 Contractor’s Claim

Add the following paragraph:

No claims of any idle time charges of men and plants / equipment / machineries caused due to any reason whatsoever would be considered.
Section 9 - Contract Forms

Table of Forms

Letter of Acceptance ................................................................. 2
Contract Agreement ................................................................. 3
Performance Security ............................................................... 4
Advance Payment Security ....................................................... 5
Letter of Acceptance
[on letterhead paper of the Employer]

 . . . . . date . . . .

To: . . . . . name and address of the Contractor . . . . .

Subject: . . . . . Notification of Award Contract No. . . . . .

This is to notify you that your Bid dated . . . . date . . . . consisting of the Technical and Price Bids for execution of the . . . . . . . . name of the contract and identification number, as given in the Contract Data . . . . . . for the Accepted Contract Amount of the equivalent of . . . . . amount in numbers and words and name of currency . . . . . . , as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose the of the Performance Security Form included in Section 9 (Contract Forms) of the Bidding Document.

Authorized Signature: .................................................................

Name and Title of Signatory: .........................................................

Name of Agency: ........................................................................
Contract Agreement

THIS AGREEMENT made the . . . . . .day of . . . . . . . . . . . . . . , between . . . . name of the Employer Project Director SIPMIU Urban Development Department Govt. of Tripura (hereinafter “the Employer”), of the one part, and . . . . name of the Contractor . . . . (hereinafter “the Contractor”), of the other part:

WHEREAS the Employer desires that the Works known as . . . . name of the Contract. . . . . should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
   (a) the Contract Agreement (on stamp paper)
   (b) the Letter of Acceptance;
   (c) the Revised Priced Bill of Quantities, if any
   (d) The Tender
   (e) the Particular Condition of Contract Part A.
   (f) the Particular Condition of Contract Part B.
   (g) the General Conditions
   (h) the Specifications, Quality Control & System and Environmental Management Plan
   (i)  the Drawings;
   (j) any other documents forming part of the Contract

3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of India. . . . . on the day, month and year indicated above.

Signed by .........................................................  Signed by .............................................................
for and on behalf of the Employer  for and on behalf the Contractor
in the presence of in the presence of

Witness, Name, Signature, Address, Date  Witness, Name, Signature, Address, Date
Performance Security

Bank’s Name, and Address of Issuing Branch or Office

Beneficiary: Name and Address of Employer
Project Director (SIPMIU), Urban Development Department, Govt. of Tripura, 2nd Floor, Khadya Bhavan, Pandit Nehru Complex Agartala-799001

Date:

Performance Guarantee No.:

We have been informed that name of the Contractor has entered into Contract No. Reference number of the Contract AGT/SM/NCB/SM-02, dated . . . . . . . . . . with you, for the execution of name of contract and brief description of Works: Procurement of works for Septage Management (Civil Works). Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we name of the Bank hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of name of the currency and amount in figures such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the . . . . . Day of . . . . . . . . . . , and any demand for payment under it must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458, except that subparagraph (ii) of Sub-article 20(a) is hereby excluded.

Note:

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

1 The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract and denominated either in the currency(ies) of the Contract or a freely convertible currency acceptable to the Employer. If the bank issuing the performance security is located outside the country of the Employer, it shall have a correspondent financial institution located in the country of the Employer.

2 Insert the date twenty-eight days after the expected completion date. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: “The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Employer’s written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.”
Advance Payment Security

Bank’s Name, and Address of Issuing Branch or Office

Beneficiary: Name and Address of Employer

Project Director
(SIPMIU)  Urban Development Department  Govt. of Tripura, 2nd Floor, Khadya Bhavan, Pandit Nehru Complex Agartala-799001

Advance Payment Guarantee No.:

We have been informed that . . . . name of the Contractor. . . . . (hereinafter called "the Contractor") has entered into Contract No. . . . . reference number of the Contract AGT/SM/NCB/SM-02 dated . . . . . . . with you, for the execution of . . . . . . . name of contract and brief description of Works: Procurement of works for Septage Management (Civil Works). (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum . . . . name of the currency and amount in figures*. . . . . (amount in words. . . . . ) is to be made against an advance payment guarantee.

At the request of the Contractor, we . . . . name of the Bank. . . . . hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of . . . . name of the currency and amount in figures*. . . . . (amount in words. . . . . ) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number . . . . Contractor's account number . . . . at . . . . name and address of the Bank. . . . .

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty (80) percent of the Contract Price has been certified for payment, or on the . . day of . . . . . . , . . . . , whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458.

Seal of Bank and Signature(s)
- Note -

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

1. The Guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.

2. Insert the expected expiration date of the Time for Completion. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Employer’s written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."
SIPMIU URBAN DEVELOPMENT DEPARTMENT
GOVERNMENT OF TRIPURA

NORTH EASTERN REGION CAPITAL CITIES DEVELOPMENT
INVESTMENT PROGRAMME

ADB Loan No- 3337-IND

Tranche III

Bidding Document

Procurement of Work for Septage Management (Civil Works)

Contract No. AGT/SM/NCB/SM-02 (R)

Single-Stage: Two-Envelope Bidding Procedure under National Competitive Bidding

Volume – II.

Issued by:

Project Director, SIPMIU,
Urban Development Department,
Government of Tripura,
2nd Floor, Khadya Bhavan, Pandit Nehru Complex,
Agartala- 799 007.
Section – 6
Employer’s Requirement
This Standard Specifications and Provisions contained herein are intended as technical
guidelines to be followed during the time of civil construction activity to fulfill the overall scope as oriented
with pipe line. Work of Tube Well construction with Electrical, Mechanical, Electro-mechanical works etc.
in conjunction with the Specifications described in other chapters of this Section along with in conjunction
with the relative IS specifications. This is also applicable to materials and testing methods during the
construction activity of different parts under the Scope. These Specifications are intended to guide the
Project Facilitation Unit’s, the project institutions and the implementing agencies about the procedures to
be followed during any civil / Electrical / Mechanical / items and construction activity to be undertaken
under this Project. This Specification also provides major guidance on the environment management
measures that need to be integrated into the construction of civil works and for procurement of
Mechanical Equipments under the project. The objective of this manual is to provide guidelines for proper
planning and construction of all the works. If any short coming / defects or any contradiction found within
the described specifications between the lines or chapter and IS, the matter may be pointed out to the
Engineer for finalizing the same and his decision will be final and binding.
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Supplementary Information

Agartala is one of the strategically located cities in North East India. It's the gateway to the North East India. People visit the city on their way to further North East. Historically, Tripura first finds reference in the Ashokan pillars of the third century B.C. It was ruled by the Maharajas of Manikya dynasty since 1300 A.D and it merge with Indian Union by an Agreement signed by the Regent Maharani on 9th Sept 1947. On January 21, 1972 Tripura became a constituent state in Indian union. The Capital of Tripura was shifted to present Agartala in the year 1849 A.D. The Agartala Municipality was established in 1871 A.D with an area of 3 sq miles, having a population of 875 only.

Presently Grater Agartala Planning Area (GAPA) comprises of 92 sq k.m which includes Agartala Municipal council area and 8 villages namely Narsingarh, Singarbil, Gandhigram City, Anandanagar, Dukli, Charipara, Madhupur and Madhuban. As per 2011 census it has a total population of 4.3. Agartala is presently supply water from Haora River and Tube Wells. Surface water from 2 intake wells at College Tilla and Bordwali has been pumped to water treatment plants at College Tilla and Bordwali having capacity of 35.5 MLD & 18.0 MLD respectively. The treated water is supplied to Central and South zones of the city. Deep Tube Wells supply water to entire North zone and part of South zone.

In Agartala, the project specifically supports rehabilitation and expansion of the water treatment plant, water distribution system in the Central & South zones. Namely Storage, Transmission and secondary distribution systems, improved treatment and comprehensive non-revenue water (NRW) program, which will include installation or replacement of water meters as well as leak detection program for rehabilitation and strengthening of the existing distribution network. The project will comprise two parts: Part A will cover Urban infrastructure and services improvement including the rehabilitation, improvement and expansion of (i) water supply (ii) Solid waste management and (iii) Septage Management. Part B: will cover investment program management and implementation support and a comprehensive capacity building assistance.

The Present Agartala water supply system is covering population of about 4.5 lack. The quantity of residential supply of water is 78 lcpd in Agartala including the UFW. The level of Supply is inadequate in terms of quantity as well as poor in terms of quality.

The annual rain fall on Agartala and its surrounding areas are about 2000 mm to 2200 mm. Most of the rain fall occurs from April to October. From the Geo-Technical investigation of Greater Agaratala, as per area of confined aquifer, it reveals that daily ground water inflow in the confined aquifers at Agartala area is about 16.625 million cum. Whereas daily ground water draft in the year 2031 would be about 0.083 million cu.m. i.e water drawn will be 0.5% of the total inflow, which clearly implies that there is tremendous scope of ground water development without any adverse impact.

Apart from the increase in quantitative output, an overall improvement of the quality of output is also desired. Since the water sourced from deep tube wells in Agartala, it has significantly high proportion of iron content. Treatment of ground water through installation of Iron removal plants has not been found to be very effective and water quality remains poor and needs to be improved. As such this project has also provision for supply of water after proper treatment of ground water also.

Projected population and water demand and the present availability are presented. The Asian Development Bank is providing Loan assistance to Government of Tripura. for implementation of this project under the North Eastern Region Capital Cities Development Investment Programme. The state government has created State Investment Program Management and Implementation Unit, for implementation the Project.

The state government has appointed State Investment Program Management and Implementation Unit (SIIPMIU) under Urban Development Department, Government of Tripura for implementation the Project. In this water supply subproject a part of the loan shall be utilized for Construction of one no of Ground level Reservoir, one no. Intake well, Rehabilitation of WTPs, Rehabilitation/ laying of Water distribution main, construction of Tube wells and installation of Bulk and Domestic water meters at different locations of the city of Agartala. After implementation of the package, it will be improve the distribution of water now being supplied in Agartala city.
The water supply project in Agartala Municipal area is likely to be completed in the year 2019. The intermediate state design year is taken for 15 years and the ultimate stage design is taken for 30 years.

**AIM OF THE WORK**

With the implementation of the water supply schemes taken up under NERCCDIP, the piped water supply is expected to reach 100% households from a meager 48% at present and per capita supply will reach the national benchmark of 135 lpcd. In absence of any proper sanitation system for collection of sewage in the Agartala city at present (North Zone will soon get a proper sewerage system) households are mainly dependent on the on-site sanitation systems like septic tank, leach pits etc. AMC area is having 98% households (as per 2011 census data) with latrine facilities within the premises but only 47% are connected to septic tanks (48000 septic tanks as per census 2011). With augmentation and expansion of the water supply system under NERCCDIP, within 2019 number of pour flush latrines will increase. Due to poor progress of implementation of piped sewerage scheme (so far, implementation of sewerage scheme for Northern Zone of AMC only), the number of septic tanks needs to be increased to prevent flow of untreated sewage to the drains. Present water quality of Haora river, flowing through the Agartala city indicate severe pollution by discharge of overflow of partially treated sewage from septic tanks and disposal of septage to the drains flowing to Haora river.

- With its present resources and fleet of vehicles, AMC is not capable of providing services to the citizens for proper mechanical desludging of the septic tanks. Data available with municipality shows only around 1000 (out of 48000) are cleaned by mechanical desludging systems in 2011.

- No legislation is in place for penalizing the citizens for non-cleaning of septic tanks at required intervals or manual cleaning with improper disposal.

- No proper treatment system is there for treatment of collected septage for environmentally safe disposal and collected septage is dumped at the SWM site indiscriminately.

National Urban Sanitation Policy (NUSP, 2008) defines sanitation as “safe management of human excreta, including its safe confinement, treatment and disposal and associated hygiene-related practices." In line with the objective of NUSP, implementation of septage management plan is critical for AMC. Under NERCCDIP, septage management is encouraged for the cities covered under it. So, keeping the policy goal in view, implementation of septage management plan is taken up.
SCOPE OF WORKS

The scope of the works under this project is to improve the existing situation of septage management of the Agartala Municipal Council by strengthening the existing Septage collection and transport facilities and disposal facilities which eco-friendly and sustainable manner. This has involved identification for required number of vehicles for collection of septage and identification of a sustainable septage treatment and disposal system. The work will be mainly confined to central and Southern Zone.

(i) Supply and Installation of a Tube well.

(ii) RCC water Tank

(iii) Rest room for O&M workers.

(iv) Toilet Block

(v) Septage Collection Chambers

(vi) 3 cum capacity Vacuum tankers.

(vii) Supply of Chasis mounted diesel engine vacuum pump for sucking sludge/slurry from septic tank& disposing off the same.

(viii) Sludge tank of minimum 700Ltr. capacity for carrying and disposing off the sludge/slurry by the suction unit.
STANDARD SPECIFICATION FOR VARIOUS COMPONENTS OF CIVIL WORKS

GENERAL

1. INTRODUCTION

Description of the work under consideration are described in this chapter briefly on Civil works particularly with constructing a Water facilities out of the overall works of the Bidding document. Other type of works are described in separate chapters in this bidding document.

Description of works in this chapter:-

The work comprises Civil, Electrical and Mechanical components. The Electrical and Mechanical works and Specification has been dealt with in a separate chapter of this document.

Scope of the work in brief of the two WTPs are stated below.

(i) Supply and Installation of a Tube well.
(ii) RCC water Tank
(iii) Rest room for O&M workers.
(iv) Toilet Block
(v) Septage Collection Chambers

1.1.1 The Bidder shall be responsible for supply and procurement and providing of all materials, equipment and services, specified or otherwise which are required to meet the intent of this specification, ensuring high degree of reliability and ease of operation and maintenance in future. The equipment and system / sub-systems shall conform in all aspects to high standards of engineering and workmanship and shall be capable of performing in continuous operation, in a manner acceptable to the Employer.

1.1.2 Nature of Work

- The nature of work generally involves executing of survey & geotechnical investigations and satisfy himself about geo technical investigation result of the civil structures and Electro-Mech works to be constructed.
- Arranging men, material and machinery equipment required for successful completion of the package. Main features of the work shall be construction of civil works at the location to be fixed by the SIPMIU in Agartala city as per the design approved by the Employer.
- Site clearance, earth excavation, dressing, foundation work, construction of RCC structure, repairing of different civil /Mechanical/Electrical structures, providing of inlet & outlet pipes, valves, interconnection, Mechanical & Electrical Installations etc. for Tube wells.
- Equipment and materials required shall be survey instruments, cement, aggregate, sand, steel bars, shuttering flat and round, steel made scaffoldings and gangway, excavators, concrete mixers, bucket elevator, vibrators, sluice valves, D.I.pipes, nut & bolts, rubber joints. etc.
- Bidder shall complete other auxiliary items of work and site clearance etc. before handing over.
1.1.3 **This is a Item Rate contract.** The Contract Rates shall be inclusive of all operations including all overheads and taxes for successful completion of the approved BOQ items.

underground or partly underground liquid containing structures shall be designed for the following conditions:

Underground or partially underground structures shall also be checked against stresses developed due to any combination of full and empty compartments with appropriate ground/ uplift pressures on the base slab. Foundations

i) The minimum depth of foundations for all structures, equipment, buildings and frame foundations and load bearing walls shall be as per IS:1804. However, it shall not be less than 2m from the GL at that location. It may be reviewed by the Engineer in hard strata.

ii) Care shall be taken to avoid the interference of the foundations or any other component of the new building with the foundations of adjacent buildings or structure. Suitable adjustments in depth, location and size may have to be made depending on site conditions. The Engineer will not accept any extra claims for such adjustments.

iii) Special attention is drawn to the danger of uplift being caused by the ground water table. A base raft for underground structure shall be designed for uplift forces that are likely to be developed.

iv) Where the level of foundation is above or near the natural/ existing ground level, this difference shall be filled up in the following ways:

  - In case of non-liquid retaining structures, the natural top soil shall be removed till a firm stratum is reached (minimum depth of soil removed shall be 500 mm) and the elevation difference shall be made up by compacted backfill as per specifications. However, the thickness of each layer of the backfill shall not exceed 150 mm. The area of backfilling for floor slabs shall be confined to prevent soil from slipping out during compaction. The safe bearing capacity of this well compacted backfilled soil shall not be considered more than 100 KN/m² in the design. Pitching shall be provided to maintain slope.
  - In case of liquid retaining structures, the natural top soil shall be removed and the elevation difference shall be made up with plain cement concrete.

**General Requirements for Concrete Works**

The following are the design requirements for all reinforced or plain concrete structures:

i) All binding and leveling concrete shall be a minimum 100 mm thick in concrete M10 grade.

ii) All structural reinforced concrete other than for liquid water retaining structures shall be at least of M25 grade.

iii) The minimum grade of concrete for water retaining structures shall be M30 design mix having minimum cement content of 360 kg/m³ with maximum 20 mm size coarse aggregates. The quantity of the admixture shall be as per mix design.

iv) All design for liquid retaining structures including roof, shall be done as ‘uncracked section’.

v) The minimum cover to all reinforcement including stirrups and links shall be as per codal provision.
vi) Any structure or pipeline crossing below roads shall be designed for Class A of IRC loading.

vii) All pipes & conduits laid below the structural plinth and road works shall be embedded in concrete of grade M15 having minimum 150 mm thick concrete cover all around, if so directed by the Engineer.

viii) Approved quality waterproofing compound (chloride free) shall be added during concreting of all liquid containing structures in the proportion specified by the Manufacturer or 2% by weight of cement, whichever is higher.

ix) For walls and base slabs of liquid retaining structures, the following shall be considered:
   • Minimum reinforcement shall be as per IS:3370 (Part II). This reinforcement shall be placed closer to the concrete faces and the minimum specified clear cover as per IS:3370 and clause (v) above.

The maximum length of panel to be concreted, sequential of pouring and height of pour shall be as per specifications, IS:456 and IS:3370 (Part I) as applicable.

1.2 Testing of water tightness for water retaining structures
All water retaining structures shall be constructed and tested for water tightness as per provisions of IS: 3370 and IS: 6494.

1.3 Codal Provisions:–
All codes shall imply to the latest versions.

1.4 Preamble
1.4.1 These specifications cover the items of work in structural and non-structural parts of the works coming under purview of this document. All work shall be carried out in conformation with this specification. In general, provisions of Standard Specifications published by Bureau of Indian Standard (BIS) and other equivalent national or international standards have been followed. These specifications are not intended to cover the minute details. The work shall be executed in accordance with best modern practices. All codes and standards referred to in these Specifications shall be the latest revision thereof thirty days prior to the date of submission of bids. In case of discrepancy with the BIS codes the provision in these specifications shall prevail.

1.4.2 The provisions of Conditions of those specified in the tender as well as drawings and notes issued in writing by the Engineer as well as Quality Action Plan (QAP) shall form part of these specifications.

1.5 Order of Precedence, Clarifications and Interpretation
1.5.1 The attention of the Contractor is drawn to those Clauses of BIS codes which may require either clarification by the Engineer or the mutual agreement of the Employer and the Contractor. In such cases it is the responsibility of the Contractor to seek clarification on any uncertainty and obtain prior approval of the Engineer before taking up the supply/ construction.

1.6 DIMENSIONS:
1.6.1 Written dimensions on drawings shall supersede measurement by scale and drawings to a large scale shall take precedence over those to a smaller scale. Special dimensions or directions in the specifications shall supersede all others. All dimensions shall be checked on site prior to execution.
1.6.2 The dimensions stated do not allow for waste, laps, joints, etc. but the Contractor shall provide at his own cost sufficient labour and materials to cover such waste, laps, joints, etc. and the rate quoted is inclusive of such provision and no separate payment will be made for the same.

1.6.3 The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or the description of the ground levels or strata turning out different from what was expected or shown on the drawings.

1.7 Measurement and Payments

1.7.1 The methods of measurement and payment shall be as described under various items and in the bill of quantities. Where specific definitions are not given, the methods described in BIS Codes shall be followed. Should there be any detail of construction or materials which have not been referred to in these specifications or in the bill of quantities and drawings but the necessity for which may be implied or inferred wherefrom, or which are usual or essential to the completion of the work in the trades, the same shall be executed and if such work becomes an extra item of work, in the opinion of the Engineer, then it shall be analyzed by the Engineer and get approved by the Employer for payment to the Contractor.

2. SITE CLEARANCE

This is a item-rate contract, as such the individual work shall be measured by the Engineer and payment will be done for the individual item of works required for the execution according to the items mentioned in the BOQ.

2.1 Site Clearance (clearing and grubbing)

2.2 Scope

2.2.1 This work shall consist of cutting, removing and disposing of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness, rubbish etc., from the area of Works which in the opinion of the Engineer are unsuitable for incorporation in the Works, and such other areas as may be specified on the Drawings or by the Engineer. It shall include necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, and disposal of cleared materials. Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these Specifications.

2.3 Preservation of Property/Amenities

2.3.1 Trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all facilities within or adjacent to the site which are not to be disturbed and shall be protected from injury or damage. The Contractor shall adopt, suitable safeguards approved by the Engineer for this purpose.

2.3.2 During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional Works to that effect vide relevant Clauses of GCC. Before start of operations, the Contractor shall submit to the Engineer for approval, his work plan including the procedure to be followed for disposal of waste materials, etc., and the schedules for carrying out temporary and permanent Works as stipulated in GCC.

2.4 Methods, Tools and Equipment
2.4.1 Only such methods, tools and equipment as are approved by the Engineer and which will not affect the property to be preserved shall be adopted for the Work. All trees, stumps, etc., falling within excavation and fill lines shall be cut to such depth below ground level that in no case these fall within 500 mm of the subgrade / foundation / bed level. Also, all vegetation such as roots, under-growths, grass and other deleterious matter unsuitable for incorporation in the Work shall be removed between fill lines to the satisfaction of the Engineer. On the areas beyond these limits, trees and stumps required to be removed as directed by the Engineer shall be cut down to 1 m below ground level so that these do not present any unpleasant appearance.

2.4.2 All branches of trees extending near the site of work shall be trimmed as directed by the Engineer.

2.4.3 All excavations below the general ground level arising out of the removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface as these points conform to the surrounding area.

2.5 Disposal of Materials

2.5.1 All materials arising from clearing and grubbing operations shall be the property of Employer and shall be disposed of by the Contractor as hereinafter provided or directed by the Engineer.

2.5.2 Trunks and stumps of trees shall be cleaned of limbs and roots and stacked. Also boulders, stones and other materials usable in construction shall be neatly stacked as directed by the Engineer. Stacking stumps, boulders, stones etc., shall be done at specified spots with lift upto 1.5m and lead upto 50m.

2.5.3 All products of clearing and grubbing which, in the opinion of the Engineer, cannot be used or auctioned. They shall be cleared away from the site in a manner as directed by the Engineer. Care shall be taken to see that unsuitable waste materials are disposed off in such a manner that there is no possibility of these getting mixed up with the materials meant for construction.

2.5.4 Rate & Payment

2.5.5 The contract BOQ item rates shall be inclusive of all the operations described above for carriage, stacking and protection of the material.

3. DISMANTLING AND DEMOLITION

3.1 Scope

3.1.1 This work shall consist of dismantling and removing, as hereinafter set forth, existing structure, roofs, flooring and walls and columns, reinforced concrete and brick work, partitions, steel and iron work, pipes etc., which are in place but interfere with the new construction or are not suitable to remain in place, and of salvaging and disposing of the resulting materials and back filling the trenches and pits resulting from excavation.

3.1.2 Dismantling and removal operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and any other work to be left in place.

3.1.3 All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work.
3.2 **Applicable Codes**

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3.3 **Terminology**

3.3.1 The term ‘**Dismantling**’ implies carefully separating the parts without damage and removing. This may consist of dismantling one or more parts of the structure as specified or shown on the Drawings.

3.3.2 The term ‘**Demolition**’ implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the Drawings.

3.3.3 Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer within a lead of 50 m. All unserviceable materials rubbish etc. shall be disposed off as directed by the Engineer.

3.3.4 The Contractor shall maintain / disconnect existing services, whether temporary or permanent, where required by the Engineer.

3.3.5 **Rate & Payment**

3.3.6 The contract rate as per BOQ items shall include the cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The price shall also include the charges for separating out and stacking the serviceable material properly and disposing off unserviceable material to the dumping area with all leads and transporting the serviceable material to the store of concerned Deptt.

3.3.7 The rate shall also include for temporary shoring for the safety of portions not required to be pulled down, or of adjoining property, and providing temporary enclosures or partitions, where considered necessary.

4. **CARRIAGE OF MATERIALS**

4.1 **Scope**

This Specification covers the general requirements for carriage of materials.

4.2 **General**

The carriage and stacking of materials shall be done as directed by the Engineer. Any tools and plants required for the work shall be arranged by the Contractor. The carriage of materials including loading unloading and stacking etc. All the material required for construction shall be carried by the contractor from agency/ supplier to the site of work.

4.3 **Responsibility for Loss or Damage**

Loading, carriage, unloading and stacking shall be done carefully to avoid loss or damage to the materials. Any loss or damage of material shall be responsibility of the contractor.

4.4 **Mode of Carriage**
Depending upon the feasibility and economy, the Engineer shall determine the mode of carriage viz. whether by mechanical or manual labour.

4.5 Stacking, Covering and Protection

Material shall be stacked in such a manner as to ensure the preservation of their quality and fineness for the work. Different types of materials shall be stacked separately and in such a way that counting and measurements can be done without disturbing the stacks. Any material that is liable to be affected by rain or other adverse weather conditions shall be covered and protected against the same.

4.5.1 Earth, dismantled materials, malba and other similar materials shall be stacked as directed by the Engineer.

4.5.2 Cement bags, steel bars, structural steel sections, bricks and timber and other similar materials shall be stacked in proper manner.

4.5.3 Stone metal, sand and such similar materials shall be stacked as directed by the Engineer.

4.5.4 Rate & Payment

4.5.5 The contract BOQ item rates shall inclusive of all the operations described above for carriage, stacking and protection of the material.

5. EARTHWORK, EROSION CONTROL AND DRAINAGE

5.1 Scope

5.1.1 This Specification covers the general requirements of earthwork in excavation in different materials necessary for the construction of the Works including structures, roadway, side drains, and water supply lines in accordance with requirements of these Specifications and the lines, grades and cross-section as indicated by the Engineer. This Specification also includes site grading, filling in areas as required, filling back around foundations, plinths approach ramps, conveyance and disposal of surplus spoils or stacking them properly as per the approved drawings or as directed by the Engineer and all operations covered within the intent and purpose of this Specification. It shall also include the hauling and stacking, suitable cut materials as required, as also the disposal of unsuitable cut materials in specified manner, trimming and finishing the to specified dimensions or as directed by the Engineer.

5.1.2 Excavation for structures shall consist of the removal of material for the construction of foundation for buildings, tanks, reservoirs, retaining walls, and other similar structures, in accordance with the requirements of these Specifications and the lines and dimensions as per approved drawings or as indicated by the Engineer. The work shall include all necessary sheeting, shoring, bracing, draining and pumping; the removal of all logs, stumps, grubs and other deleterious matter and obstructions, necessary for placing the foundations; trimming bottoms of excavations; backfilling and clearing up the site and the disposal of all surplus material.

5.2 Applicable Codes

5.2.1 The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

2. IS: 3764 Safety code for excavation work.
4. IS: 2720 Method of test of soils (All parts)
5. IS: 1498 Classification and identification of soils for General Engineering purposes

5.3 Drawings

5.3.1 Engineer shall issue the Drawings to the contactor, wherever required in his opinion; such Drawings are required to show areas to be excavated / filled, sequence of priorities etc. Contractor shall follow strictly such Drawings.

5.4 Classification of Excavated Material

5.4.1 All materials involved in excavation shall be same in all kinds of soils, lifts and leads and applicable for all sites.

5.5 General

5.5.1 Contractor shall furnish all tools, plants, instruments, qualified supervisory personnel, labour, materials, any temporary work, consumable, any and everything necessary, whether or not such items are specifically stated herein for completion of the job in accordance with Specification requirements.

5.5.2 Contractor shall carry out the survey of the site before excavation and properly mark all lines and establish levels for various works such as earthwork in excavation for grading, basement, foundations, plinth filling, roads, drains, cable, trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference / grid lines at intervals as determined by Engineer based on ground profile. These shall be checked by Engineer and thereafter properly recorded.

5.5.3 The excavation shall be done to correct lines and levels. This shall also include, where required, proper shoring to maintain excavations and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for safety.

5.5.4 The contract price quoted as in BOQ shall also include the dumping of excavated materials in regular heaps with regular slopes as directed by Engineer, within the lead specified and leveling the same as to provide natural drainage. Rock / soil excavated shall be stacked properly as directed by Engineer.

5.6 Clearing

5.6.1 The area to be excavated / filled shall be cleared as described in Specification.

5.7 Timber Shoring

5.7.1 Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'Polling Boards'. These shall be of minimum 25 cm X 4 cm sections or as directed by Engineer. The boards shall generally be placed in position, vertically, side by side without any gap, on each side of the excavation and shall be secured by horizontal walling of strong wood at maximum 1.2 metres spacing, strutted with “Ballies” or as directed by Engineer. The length of the “Ballie” struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical walling, which in turn shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

5.7.2 Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by Engineer In-Charge. It shall be the responsibility of Contractor to take all necessary steps to prevent the sides of excavation, trenches, pits, etc., from collapsing.
5.7.3 Timber shoring may be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only on instructions from Engineer.

5.7.4 The withdrawal of the timber shall be done very carefully, to prevent collapse, systematically from one end to the other end. Concrete or masonry shall not be damaged during the removal of the timber. No claim shall be entertained for any timber which cannot be withdrawn and is lost or buried.

5.7.5 In case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm X 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of Engineer. In all other respects, Specification for close timbering shall apply to open timbering.

5.7.6 In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations / pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. Load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut. If, however, Engineer directs any timbering to be left-in, keeping in mind the type of construction or any other factor, Contractor shall be paid for, at the scheduled item rate, for such left-in timbering.

5.7.7 All works of timber shoring shall be inclusive in the contract price. All planks, boards, walling, vertical, struts, props and all other materials required for shoring and subsequent safe dismantling and removal shall be included in the quoted contract price. No extra payment is allowed.

5.8 Slips and Slides

5.8.1 If slips, slides, over-breaks or subsidence occur in cuttings during the process of construction, they shall be removed at the cost of the Contractor as ordered by the Engineer. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Adequate precautions shall be taken to ensure that during construction, the slopes are not rendered unstable or give rise to recurrent slides after construction. If finished slopes slide into the excavated area subsequently, such slides shall be removed.

5.9 Methods, Tools and Equipment

5.9.1 Only such methods, tools and equipment as approved by the Engineer shall be adopted / used in the work. If so desired by the Engineer, the Contractor shall demonstrate the efficacy of the type of equipment to be used before the commencement of work.

5.10 Construction Operations

5.10.1 Setting out

After the site has been cleared, the limits of excavation shall be set out true to lines, curves, slopes, grades and sections as shown on the Drawings or as directed by the Engineer. The Contractor shall provide all labour, survey instruments and materials such as strings, pegs, nails, bamboos, stones, lime, mortar, concrete, etc., required in connection with the setting out of works and the establishment of bench marks. The Contractor shall be responsible for the maintenance of bench marks and other marks and stakes as long as in the opinion of the Engineer, they are required for the work.

5.10.2 Excavation
5.10.2.1 All excavations shall be carried out by mechanical equipment unless, in the opinion of Engineer, the work involved and time schedule permit manual work. The work shall be so done that the suitable material available from excavation are satisfactorily utilized.

5.10.2.2 While planning or executing excavations, the Contractor shall take all adequate precautions against soil erosion, water pollution etc.

5.10.2.3 The excavations shall be taken out to such widths, lengths, depths, profiles and levels shown on the Drawings or as directed by the Engineer. The Contractor shall not excavate outside the limits of excavation. Subject to the permitted tolerances, any excess depth / width excavated beyond the specified level / dimensions on the Drawings shall be made good at the cost of the Contractor with suitable material of characteristics.

5.10.2.4 All debris and loose material on the slopes of cuttings shall be removed. No backfilling shall be allowed to obtain required slopes except that when boulders or soft materials are encountered in cut slopes, these shall be excavated to approved depth on instructions of the Engineer and the resulting cavities filled with suitable material and thoroughly compacted in an approved manner.

5.10.2.5 After excavation, the sides of excavated area shall be trimmed and the area contoured to minimise erosion and ponding, allowing for natural drainage to take place. If trees were removed, new trees shall be planted, as directed by the Engineer.

5.10.2.6 In works, if any existing structure gets disturbed or loosened, it shall be dismounted and cut to regular shape and relaid as directed by the Engineer, at the cost of the Contractor.

5.10.3 Disposal of excavated materials.

5.10.3.1 Unsuitable and surplus material not intended for use within the lead specified above shall also, if necessary, be transported and disposed off or used with all lead and lifts as directed by the Engineer.

5.10.4 Filling, Backfilling and site Grading

5.10.4.1 General:

1. All fill material will be subject to Engineer's approval. If any material is rejected by Engineer, Contractor shall remove the same forthwith from the site at no extra cost to the Owner. Surplus fill material shall be deposited / disposed off as directed by Engineer after the fill work is completed.

2. No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by Engineer.

5.10.4.2 Material:

1. To the extent available, selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic or other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of moorum or earth to fill up the voids and the mixture used for filling.

5.10.4.3 Sand filling in plinth and other places:

1. At places backfilling shall be carried out with local sand if directed by Engineer. The sand used shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water for 2 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to Contractor's account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not
be started until Engineer has inspected and approved the fill.

5.10.4.4 Filling in trenches:

1. Filling in trenches shall be commenced as soon as the const work in the trench is completed and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the constructed

2. Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the centerline of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the centerline of the pipe shall be done with selected earth by hand compaction or other approved means in layers not exceeding 15 cm.

3. Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

5.10.5 General site grading:

1. Site grading shall be carried out as directed by Engineer. Excavation shall be carried out as specified in the Specification. Filling and compaction shall be carried out as specified.

2. Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, Contractor shall remove the affected material and make good the slip at his cost.

3. The fill shall be carried out to such dimensions and levels as indicated on the Drawings after the stipulated compaction. The fill will be considered as incomplete if the desired compaction has not been obtained.

5.10.6 Measurement and payment:

5.10.6.1 All works of excavation for all kind soils/material for all leads shall be inclusive in the contract rate in BOQ item.

5.10.6.2 Backfilling as per Specification on the sides of pipe lines trenches shall be inclusive in the contract price. As a rule material to be backfilled shall be stacked temporarily within the excavted site unless otherwise directed by the Engineer.

5.10.6.3 Cost of all other operations shall be deemed to have been covered in the rate quoted in BOQ.

5.10.6.4 Backfilling, plinth filling, etc. with borrowed earth shall be inclusive in the contract rate. The rate quoted in BOQ shall include all operations such as clearing, excavation, lead and transport, fill, compaction, etc. as specified

5.10.7 Preservation of Property

5.10.7.1 The Contractor shall undertake all reasonable precautions for the protection and preservation of any or all existing roadside trees, drains, sewers or other sub-surface drains, pipes, conduits and any other structures under or above ground, which may be affected by construction operations and which, in the opinion of the Engineer, shall be continued in use without any changes. Safety measures taken by the Contractor in this respect, shall be got approved from the Engineer. However, if any of these objects is damaged by reason of the Contractor's negligence, it shall be replaced or restored to the original condition at his expense. If the Contractor fails to do so, within the required time as directed by the Engineer or if, in the opinion of the Engineer, the actions initiated by the Contractor to replace / restore the damaged objects are not satisfactory, the Engineer shall
arrange the replacement / restoration directly through any other agency at the risk and cost of the Contractor after issuing a prior notice to the effect.

5.10.8 Finishing Operations

5.10.8.1 Finishing operations shall include the work of properly shaping and dressing all excavated surfaces.

5.10.8.2 Where directed, the topsoil removed earlier and conserved shall be spread over cut slopes, where feasible, berms and other disturbed areas. Slopes may be roughened and moistened slightly, prior to the application of topsoil, in order to provide satisfactory bond. The depth of topsoil shall be sufficient to sustain plant growth, the usual thickness being from 75 mm to 100 mm.

5.10.8.3 The Contract price shall be inclusive for the afore said works, in full, for carrying out the operations required for the individual items including full compensation for:

1. Setting out;
2. Transporting the excavated materials and depositing the same on sites or stacking as directed within all lifts and lead. Trimming bottoms and slopes of excavation;
3. Keeping the work free of water;
4. All labour, materials, tools, equipment, safety measures, testing and incidentals necessary to complete the work to Specifications.

5.10.8.4 The disposal of surplus earth from excavation shall be full compensation for all labour, equipment, tools and incidentals necessary on account of the additional haul or transportation involved all leads and the cost involved of such works are includes in the overall cost of the completed work as per BOQ.

5.11 Construction Operation for Surface/Sub-Surface Drains

5.11.1 This work shall consist of constructing/restoring surface and/or sub-surface drains in accordance with the requirements of site/specifications to the lines, grades, dimensions or as directed by the Engineer.

5.11.2 Surface Drains

5.11.2.1 Surface drains shall be excavated to the specified lines, grades, levels and dimensions to the requirements. The excavated material shall be removed from the area adjoining the drains and if found suitable, utilized in embankment / subgrade construction. All unsuitable material shall be disposed of as directed.

5.11.2.2 All works on drain construction shall be planned and executed in proper sequence with other works as approved by the Engineer, with a view to ensuring adequate drainage for the area and minimising erosion / sedimentation.

5.12 Works to be Kept Free of Water

5.12.1 The Contractor shall arrange for the rapid dispersal of water collected / accumulated during construction or on the existing roadway and where practicable, the water shall be discharged into the permanent outfall of the drainage system. The arrangement shall be made in respect of all earthworks including excavation for pipe trenches, foundations or cuttings.

5.12.2 The Contractor shall provide, where necessary, temporary water courses, ditches, drains, pumping or other means for maintaining the earthwork free from water.
5.12.3 The works involved in keeping the earthwork or any other item of works free of water shall be deemed as incidental to the respective item of work and no separate payment shall be made for the same.

5.12.4 Rate & Payment

The contract BOQ item rates shall inclusive of all the operations described above.

6. MATERIALS FOR STRUCTURES

6.1 Scope

6.1.1 Materials to be used in the work shall conform to the Specifications mentioned in the document, the requirements laid down in this section and Specifications for relevant items of work covered under the Specifications.

6.1.2 If any material, not covered in these Specifications, is required to be used in the work, it shall conform to relevant Indian Standards, unless otherwise specified by the Engineer.

6.2 Sources of Material

6.2.1 The Contractor shall notify the Engineer of his proposed sources of materials prior to delivery. If it is found after trial that sources of supply previously approved do not produce uniform and satisfactory products, or if the product from any other source proves unacceptable at any time, the Contractor shall furnish acceptable material from other sources at his own expense.

6.3 Bricks

6.3.1 Burnt clay 1st. class bricks shall conform to the requirement of IS: 1077. They shall be free from cracks and flaws and nodules of free lime. The brick shall have smooth rectangular faces with sharp corners and emit a clear ringing sound when struck. The size may be according to local practice with a tolerance of ± 5 per cent

6.4 Cement

6.4.1 Cement to be used in the works shall be any of the following types with the prior approval of the Engineer:

1. Portland-Pozzolana Cement, conforming to IS: 1489

6.5 Coarse Aggregates

6.5.1 For plain and reinforced cement concrete (PCC and RCC) works, coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone, crushed gravel, natural gravel or a suitable combination thereof or other approved inert material. They shall not consist pieces of disintegrated stones, soft, flaky, elongated particles, salt, alkali, vegetable matter or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the steel reinforcement. Coarse aggregate having positive alkali silica reaction shall not be used. All coarse aggregates shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386 Parts I to VIII.

6.5.2 The Contractor shall submit for the approval of the Engineer, the entire information indicated in Appendix A of IS: 383.
6.5.3 Maximum nominal size of coarse aggregate for various structural components in PCC, RCC shall conform to Specification.

6.5.4 The maximum value for flakiness index for coarse aggregate shall not exceed 35 percent. The coarse aggregate shall satisfy the following requirements of grading:

<table>
<thead>
<tr>
<th>IS Sieve Size</th>
<th>Percent by Weight Passing the Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40 mm</td>
</tr>
<tr>
<td>63 mm</td>
<td>100</td>
</tr>
<tr>
<td>40 mm</td>
<td>95-100</td>
</tr>
<tr>
<td>20 mm</td>
<td>30-70</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>-</td>
</tr>
<tr>
<td>10 mm</td>
<td>10-35</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>0-5</td>
</tr>
</tbody>
</table>

6.6 Sand/Fine Aggregates

6.6.1 For masonry work, sand shall conform to the requirements of IS: 2116.

6.6.2 For plain and reinforced cement concrete (PCC and RCC) works, fine aggregate shall consist of clean, hard, strong and durable pieces of crushed stone, crushed gravel, or a suitable combination of natural sand, crushed stone or gravel. They shall not contain dust, lumps, soft or flaky, materials, mica or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the embedded steel. Motorised sand washing machines should be used to remove impurities from sand. Fine aggregate having positive alkali-silica reaction shall not be used. All fine aggregate shall conform to IS: 383 and test for conformity shall be carried out as per IS: 2386 (Part I to VIII). The Contractor shall submit to the Engineer the entire information indicated in Appendix A of IS: 383. The fineness modules of fine aggregate shall neither be less than 2.0 nor greater than 3.5.

6.6.3 Sand/fine aggregate for structural concrete shall conform to the following grading requirements:

<table>
<thead>
<tr>
<th>IS Sieve Size</th>
<th>Percent by Weight Passing the Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone I</td>
</tr>
<tr>
<td>10 mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>90-100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>60-95</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>30-70</td>
</tr>
<tr>
<td>600 micron</td>
<td>15-34</td>
</tr>
<tr>
<td>300 micron</td>
<td>5-20</td>
</tr>
<tr>
<td>150 micron</td>
<td>0-10</td>
</tr>
</tbody>
</table>

6.7 Steel

6.7.1 Reinforcement / Untensioned Steel

6.7.1.1 For plain and reinforced cement concrete (PCC and RCC) works, the reinforcement / untensioned steel as the case may be shall consist of the following grades of reinforcing bars:

<table>
<thead>
<tr>
<th>Grade Designation</th>
<th>Bar Type conforming to governing IS Specification</th>
<th>Characteristic Strength fy MPa</th>
<th>Elastic Modulus GPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 240</td>
<td>IS: 432 Part I Mild Steel Bar</td>
<td>240</td>
<td>200</td>
</tr>
<tr>
<td>S 415</td>
<td>IS: 1786 High Yield Strength</td>
<td>415</td>
<td>200</td>
</tr>
</tbody>
</table>
Deformed, CRS & Non CRS Thermo-Mechanically Treated Bars

6.7.1.2 Thermo mechanically treated (TMT) reinforced bars Fe 415 as per IS 1786 and Corrosion Resistant Steel grade Fe 500 can also be used.

6.7.1.3 All steel shall be procured from original producers; no re-rolled steel shall be incorporated in the work.

6.7.1.4 Only new steel shall be delivered to the site. Every bar shall be inspected before assembling on the work and defective, brittle or burnt bar shall be discarded. Cracked ends of bars shall be discarded.

6.7.2 Structural Steel

6.7.2.1 Unless otherwise permitted herein, all structural steel shall before fabrication comply with the requirement of the following Indian Standards:

| IS: 808  | Specifications for Rolled Steel Beam, Channel and Angle Sections |
| IS: 2062 | Specification for Steel of General purposes. |
| IS: 1239 | Mild Steel Tubes |
| IS: 1730 | Dimension for Steel Plate, sheet and strip for structural and general engineering purposes |
| IS: 1731 | Dimension for Steel flats for structural and general engineering purposes |
| IS: 1732 | Dimension for round and square steel bars for structural and general engineering purposes |
| IS: 1852 | Rolling and cutting tolerances for hot rolled steel products |

6.7.2.2 The use of structural steel not covered by the above standards may be permitted with the specific approval of the authority.

6.8 Water

Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete. Mixing and curing with sea water shall not be permitted and conform as prescribed in IS 456.

6.9 Concrete Admixtures

6.9.1 General

6.9.1.1 As per Engineer’s guideline/requirement, admixtures to be added to the concrete before or during mixing with a view to modify one or more of the properties of concrete in the plastic or hardened state.

6.9.1.2 Concrete admixtures are proprietary items of manufacture and shall be obtained only from established manufacturers with proven track record, quality assurance and full fledged laboratory facilities for the manufacture and testing of concrete.

6.9.1.3 The Contractor shall provide the following information concerning each admixture after obtaining the same from the manufacturer:

1. Normal dosage and detrimental effects, if any, of under dosage and over dosage.
2. The chemical names of the main ingredients in the admixtures.
3. The chloride content, if any, expressed as a percentage by weight of the admixture.
4. Values of dry material content, ash content and relative density of the admixture which can be used for Uniformity Tests.
5. Whether or not the admixture leads to the entertainment of air when used as per the manufacturer’s recommended dosage and it so to what extent.
6. Where two or more admixtures are proposed to be used in any one mix, confirmation as to their compatibility.
7. There would be no increase in risk of corrosion of the reinforcement or other embeddings as a result of using the admixture.

6.9.2 Physical and Chemical Requirements

6.9.2.1 Admixtures shall conform to the requirements of IS: 9103. In addition, the following conditions shall be satisfied:

1. Synthetic fibre (Polyester 12mm Recron 3S) triangular; admixtures shall be added in concrete works.
2. “Plasticisers”, “Super - Plasticisers” shall meet the requirements indicated for “Water reducing Admixture”.
3. The chloride content of the admixture shall not exceed 0.2 per cent when tested in accordance with IS: 6925. In addition, the maximum permissible limit of chloride content of all the constituents (not to exceed 1.5% of the weight of cement in each batch of concrete) shall also be observed.
4. Uniformity tests on the admixtures are essential to compare qualitatively the composition of different samples taken from batch to batch or from the same batch at different times.

The tests that shall be performed along with permissible variations in the same are indicated below:

- Dry Material Content: to be within 3 per cent and 5 per cent of liquid and solid admixtures respectively of the value stated by the manufacturer.
- Ash content: to be within 1 per cent of the value stated by the manufacturer.

Relative density (for liquid admixtures): to be within 2 percent of the value stated by the manufacturer.

5. All tests relating to the concretes admixtures shall be conducted periodically at an independent laboratory and compared with the date given by the manufacturer.

6.10 Storage of Materials

6.10.1 General

6.10.1.1 All materials may be stored at proper places so as to prevent their deterioration or intrusion by foreign matter and to ensure their satisfactory quality and fitness for the work. The storage space must also permit easy inspection, removal and restorage of the materials. All such materials even though stored in approved godowns/places, must be subjected to acceptance test prior to their immediate use.

6.10.2 Aggregates

6.10.2.1 Aggregate stockpiles may be made on ground that is denuded of vegetation, is hard and well drained if necessary, the ground shall be covered with 50 mm plank.

6.10.2.2 Coarse aggregates, unless otherwise agreed by the Engineer in writing, shall be delivered to the site in separate sizes. Aggregates placed directly on the ground shall not be removed from the stockpile within 30 cm of the ground until the final cleaning up of the work, and then only the clean aggregate will be permitted to be used.

6.10.2.3 In the case of fine aggregates, these shall be deposited at the mixing site not less than 8 hours before use and shall have been tested and approved by the Engineer.
6.10.3 Cement

6.10.3.1 Cement shall be transported, handled and stored on the site in such a manner as to avoid deterioration or contamination. Cement shall be stored above ground level in perfectly dry and water-tight sheds and shall be stacked not more than eight bags high. Wherever bulk storage containers are used their capacity should be sufficient to cater to the requirement at site and should be cleaned at least once every 3 to 4 months.

6.10.3.2 Each consignment shall be stored separately so that, it may be readily identified and inspected and cement shall be used in the sequence in which it is delivered at site. Any consignment or part of a consignment of cement which had deteriorated in any way, during storage, shall not be used in the works and shall be removed from the site by the Contractor without charge to the Employer.

6.10.3.3 The Contractor shall prepare and maintain proper records on site in respect of delivery, handling, storage and use of cement and these records shall be available for inspection by the Engineer at all times.

6.10.3.4 The Contractor shall make a monthly return to the Engineer on the date corresponding to the interim certificate date, showing the quantities of cement received and issued during the month and in stock at the end of the month.

6.10.4 Reinforcement / Structural Steel

6.10.5 Water

6.10.5.1 Water shall be stored in containers / tanks covered at top and cleaned at regular intervals in order to prevent intrusion by foreign matter or growth of organic matter. Water from shallow, muddy or marshy surface shall not be permitted.

6.11 Tests and Standard of Acceptance

6.11.1 All materials, even though stored in an approved manner shall be subjected to an acceptance test prior to their immediate use. Independent testing of cement for every consignment shall be done by the Contractor at site in the laboratory approved by the Engineer before use. Any cement with lower quality than those shown in manufacturer’s certificate shall be debarred from use. In case of imported cement, the same series of tests shall be carried out before acceptance.

6.11.2 Testing and Approval of Material

6.11.2.1 The Contractor shall furnish test certificates from the manufacturer/supplier of materials along with each batch of material(s) delivered to site.

6.11.2.2 The Contractor shall set up a field laboratory with necessary equipment for testing of all materials, finished products used in the construction as per requirements of conditions of contract and the relevant Specifications. The testing of all the materials shall be carried out by the Engineer or his representative for which the Contractor shall make all the necessary arrangements and bear the entire cost.

6.11.2.3 Tests which cannot be carried out in the field laboratory have to be got done at the Contractor’s cost at any recognised laboratory/testing establishments approved by the Engineer.

6.11.3 Sampling of Materials
6.11.3.1 Samples provided to the Engineer or his representatives for their retention are to be in labeled boxes suitable for storage.

6.11.3.2 Samples required for approval and testing must be supplied well in advance by at least 48 hours or minimum period required for carrying out relevant tests to allow for testing and approval. Delay to works arising from the late submission of samples will not be acceptable as a reason for delay in the completion of the works.

6.11.3.3 If materials are brought from abroad, the cost of sampling/testing whether in India or abroad shall be borne by the Contractor.

6.11.4 Rejection of Materials not conforming to the Specifications

6.11.4.1 Any stack or batch of material(s) of which sample(s) does not conform to the prescribed tests and quality shall be rejected by the Engineer or his representative and such materials shall be removed from site by the Contractor at his own cost. Such rejected materials shall not be made acceptable by any modifications.

6.11.5 Testing and Approval of Plant and Equipment

6.11.5.1 All Plants and equipment used for preparing, testing and production of materials for incorporation into the permanent works shall be in accordance with manufacturer’s Specifications and shall be got approved by the Engineer before use.

6.11.5.2 The procurement of above material and its consumption / fitting shall be inclusive in the contract price.

7. STRUCTURAL STEEL WORK

7.1 Scope

7.1.1 These Specification cover the general requirements of furnishing, fabricating, transporting, erecting and painting structural steel, and other incidental metal construction of the kind, size and quantity in conformity with the Drawings and as desired by the Engineer.

7.1.2 The specification include fabrication and erection of spiral staircase railing, stair case landing, steel ladder, gallery railing, manhole frame & cover, boundary wall gate and other steel fixtures as per the requirement of the site

7.2 Applicable Codes

7.2.1 The provisions of the latest Indian Standards listed below, but not restricted to, form part of these Specifications:

<table>
<thead>
<tr>
<th>IS 226</th>
<th>Structural Steel (Standard Quality)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS: 800</td>
<td>Code of Practice for Use of Structural Steel in General Building Construction</td>
</tr>
<tr>
<td>IS: 816</td>
<td>Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.</td>
</tr>
<tr>
<td>IS: 1599</td>
<td>Method for Bend Test for Steel Products Other Then Sheets, Strip, Wire and Tube.</td>
</tr>
<tr>
<td>IS: 1608</td>
<td>Method for Tensile Testing of Steel Products.</td>
</tr>
<tr>
<td>IS: 1731</td>
<td>Dimensions for Steel Flats for Structural and General Engineering Purposes.</td>
</tr>
<tr>
<td>IS: 1852</td>
<td>Rolling and Cutting Tolerances for Hot-Rolled Steel Products.</td>
</tr>
</tbody>
</table>
7.2.2 Other I.S. Codes and I.R.C. codes pertaining to the items of structural steel not specifically listed shall also be deemed to come under the purview of this clause.

7.3 General

7.3.1 Finished rolled material shall be free from cracks, flaws, injurious seams, laps, blisters, ragged and imperfect edges and other defects. It shall have a smooth and uniform finish, and shall be straightened in the mill before shipment. They shall also be free from loose mill scale, rust, pits or other defects affecting its strength and durability.

7.3.2 The acceptance of any material on inspection at the mill i.e., rolling mills, fabricating plant where material for the work is manufactured, shall not be a bar to its subsequent rejection, if found defective.

7.4 Materials

7.4.1 All materials conform to Specification. Special requirements are given below:

7.4.2 Materials for fasteners and welding consumable shall be as under:

7.4.2.1 Fasteners: Bolts, nuts and washers shall comply with following or relevant IS standards as appropriate:

<table>
<thead>
<tr>
<th>IS:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5624</td>
<td>Foundation Bolts</td>
</tr>
<tr>
<td>5369</td>
<td>Plain Washers and Lock Washers – General Requirements</td>
</tr>
</tbody>
</table>

7.4.2.2 Welding consumable

Welding consumable shall comply with the following Indian Standards as appropriate:

<table>
<thead>
<tr>
<th>IS:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>814 (Part I)</td>
<td>Covered Electrodes for Metal Arc Welding of Structural (Part 1) Steel for Welding Other Than Sheets.</td>
</tr>
<tr>
<td>814 (Part II)</td>
<td>for Welding Sheets</td>
</tr>
<tr>
<td>1278</td>
<td>Filler Rods and Wires for Gas Welding</td>
</tr>
<tr>
<td>6419</td>
<td>Welding Rods and Bare Electrodes for Gas Shielded Arc Welding of Structural Steel</td>
</tr>
</tbody>
</table>

7.4.3 Paints

7.4.3.1 All materials for paints and enamels shall conform to the requirements specified on the Drawings or other special provisions laid down by the Engineer.

7.4.3.2 The type of paints which can be used shall be as follows:

1. Ordinary i.e., paints based on drying oils, phenolic varnish epoxy.
2. Chemical Resistant - one pack type (ready for use).
3. Epoxy

7.4.3.3 Unless otherwise specified, paints shall conform to the relevant IS Specifications. The paints which have been tested for the following qualities as per Specifications given in the relevant IS codes only shall be used:
1. Weight test (weight for 10 litre of paint, thoroughly mixed)
2. Drying time
3. Consistency
4. Dry thickness and rate of consumption

7.5 **Fabrication and Erection**

7.5.1 **General**

7.5.1.1 All work shall be in accordance with the Drawings and as per these specifications with care being taken that all parts of an assembly fit accurately together. All members shall carry mark number and item number and, if required, serial number.

7.5.1.2 Templates, jigs and other appliances used for ensuring the accuracy of the work shall be of mild steel; where specially required, these shall be bushed with hard steel.

7.5.1.3 All structural steel members and parts shall have straight edges and blunt surfaces. If necessary, they shall be straightened or flattened by pressure unless they are required to be of curvilinear forms. They shall also be free from twist. Pressure applied for straightening or flattening shall be such as would not injure the materials. Hammering shall not be permitted. Adjacent surfaces or edges shall be in close contact or at uniform distance throughout.

7.5.1.4 The Contractor shall submit his programme of work with complete details of fabrication and welding procedures.

7.5.2 **Preparation of Edges and Ends**

7.5.2.1 All structural steel-parts, where required, shall be sheared, cropped, sawn or flame cut and ground accurately to the required dimension and shape.

7.5.2.2 End/edge planing and cutting shall be done by any one of the following prescribed methods:

   1. Shearing, cropping, sawing, flame cutting.
   2. Hand flame cutting with subsequent grinding to a smooth edge.
   3. Sheared edges of plate not more than 16 mm thick with subsequent grinding to smooth profile, which are for secondary use such as stiffeners and gussets.

7.5.2.3 If ends of stiffeners are required to be fitted, they shall be ground, so that the maximum gap over 60 per cent of the contact area does not exceed 0.25 mm.

7.5.3 Where flame cutting or shearing is used, the edge is incorporated in weld or grounded.

7.5.3.1 Outside edges of plate and section, which are prone to corrosion, shall be smoothed by grinding or filing.

7.5.3.2 All edges of splice and gusset plates 12 mm thick and over shall be grounded smooth.

7.5.3.3 Where ends of stiffeners are required to be fitted, they shall be machine flame cut, sawn and ground, or hand flame cut and ground.

7.5.3.4 The ends of lacing bar shall be rounded unless otherwise required.

7.5.3.5 Others edges and ends of mild steel parts may be devoid of any burrs.

7.5.4 **Welding**

7.5.4.1 All welding shall be done with prior approval of the Engineer and the workmanship shall conform to the Specifications of IS: 823 or other relevant Indian Standards as appropriate.
7.5.4.2 When material thickness is 20 mm or more, special precautions like preheating shall be taken as laid down in IA: 823. Surfaces and edges to be welded shall be smooth, uniform and free from fins, tears, cracks and other discontinuities. Surface shall also be free from loose or thick scale, slag rust, moisture, oil and other foreign materials. Surfaces within 50 mm of any weld location shall be free from any paint or other material that may prevent proper welding or cause objectionable fumes during welding.

7.5.4.3 The general welding procedures including particulars of the preparation of fusion faces for metal arc welding shall be carried out in accordance with IS: 9595.

7.5.4.4 The welding procedures for shop and site welds including edge preparation of fusion faces shall be submitted in writing in accordance with Clause 22 of IS: 9595 for the approval of the Engineer before commencing fabrication and shall also be as per details shown on the Drawings. Any deviation from above has to be approved by Engineer. Preparation of edges shall, wherever practicable, be done by machine methods.

7.5.4.5 Flame cut edges shall be substantially as smooth and regular as those produced by edge planning and shall be left free of slag. Manual flame cutting shall be permitted by the Engineer only where machine cutting is not practicable.

7.5.4.6 Electrodes to be used for metal arc welding shall comply with relevant IS Specifications mentioned in IRC: 24. Procedure test shall be carried out as per IS: 8613 to find out suitable wire-flux combination for welded joint.

7.5.4.7 Assembly of parts for welding shall be in accordance with provisions of IS: 9595.

7.5.4.8 The welded temporary attachment should be avoided as far as possible; otherwise the method of making any temporary attachment shall be approved by the Engineer. Any scars from temporary attachment shall be removed by cutting, chipping and surface shall be finished smooth by grinding to the satisfaction of the Engineer.

7.5.4.9 Welding shall not be done when the air temperature is less than 10 degrees Celsius. Welding shall not be done when the surfaces are moist, during periods of strong winds or in snowy weather unless the work and the welding operators are adequately protected.

7.5.4.10 For welding of any particular type of joint, welders shall qualify to the satisfaction of the Engineer in accordance with appropriate welders qualification test as prescribed in any of the Indian Standards IS: 817, IS: 1966, IS: 1393, IS: 7307 (part I), IS: 7310 (Part I) and IS: 7318 (part I) as relevant.

7.5.4.11 In assembling and joining parts of a structure or of built-up members, the procedure and sequence of welding shall be such as to avoid distortion and minimise shrinkage stress.

7.5.4.12 All requirements regarding pre-heating of parent material and interpass temperature shall be in accordance with provision of IS: 9595.

7.5.4.13 Butt welds are to be ground flush, the loss of parent metal shall not be greater than that allowed for minor surface defects. The ends of butt joints shall be welded so as to provide full throat thickness. This may be done by use of extension pieces, cross runs or other means approved by the Engineer. Extension piece shall be removed after the joint has cooled and the ends of the weld shall be finished smooth and flush with the faces of the abutting parts.

7.5.4.14 The joints and welds listed below are prohibited type, which do not perform well under cyclic loading.

1. Butt joints are fully welded throughout their cross-section.
2. Groove welds made from one side only without any backing grip
3. Intermittent groove welds
4. Intermittent fillet welds
5. Bevel-grooves and J-grooves in butt joints for other than horizontal position.
6. Plug and slot welds

7.5.4.15 The run-on and run-off plate extension shall be used providing full throat thickness at the end of butt welded joints. These plates shall comply with the following requirements.

1. One pair of “run-on” and one pair of “run-off” plates prepared from same thickness and profile as the parent metal shall be attached to start and finish of all butt welds preferably by clamps.
2. When “run-on” and “run-off” plates shall be removed by flame cutting, it should be cut at more than 3 mm from parent metal and remaining metal shall be removed by grinding or by any other method approved by the Engineer.

7.5.5 Handling and Storing of Materials

7.5.5.1 Suitable area for storage of structures and components shall be located near the site of work. The access road should be free from water logging during working period and the storage area should be on leveled and firm ground.

7.5.5.2 Small fitting hand tools are to be kept in containers in covered stores.

7.5.5.3 All materials, consumable, including raw steel or fabricated material shall be stored Specification-wise and size-wise above the ground upon platforms, skids or other supports. It shall be kept free from dirt and other foreign matter and shall be protected as far as possible from corrosion and distortion. The electrodes shall be stored Specification-wise and shall be kept in dry warm condition in properly designed racks. The bolts, nuts, washers and other fasteners shall be stored on racks above the ground with protective oil coating in gunny bags. The paint shall be stored under cover in air-tight containers.

7.5.5.4 IS: 7293 and IS: 7969 dealing with handling of materials and equipment for safe working should be followed. Safety nuts and bolts as directed are to be used while working. The Contractor shall be held responsible for loss or damage to any material paid for by the Department while in his care or for any damage to such material resulting from his work.

7.5.6 Formwork

7.5.6.1 The formwork shall be properly designed, substantially built and maintained for all anticipated loads. The Contractor, if required, shall submit plans for approval to the Engineer. Approval of the plans, however, shall not relieve the Contractor of his responsibility.

7.5.7 Straightening Bent Material

7.5.7.1 The straightening of plates, angles and other shapes shall be done by methods not likely to produce fracture or any injury. The metal shall not be heated unless permitted by the Engineer for special cases, when the heating shall not be to a temperature higher than that producing a dark “cherry red” colour, followed by as slow cooling as possible. Following the straightening of a bend or buckle the surface shall be carefully investigated for evidence of fracture. Sharp kinks and bends may be the cause for rejection of material.

7.5.8 Field Inspection

7.5.8.1 General

All materials, equipment and work of erection shall be subject to the inspection of the Engineer who shall be provided with all facilities including labour and tools required at all reasonable times. Any work found defective is liable to be rejected.
7.5.8.2 No protective treatment shall be applied to the work until the appropriate inspection and testing has been carried out. The stage inspection shall be carried out for all operations so as to ensure the correctness of fabrication and good quality. Girder dimensions and camber shall not be finally checked until all welding and heating operations are completed and the member has cooled to a uniform temperature.

7.5.8.3 Welding and welding consumable

1. Welding procedure, welded connection and testing shall be in compliance with Codal requirements.
2. All facilities necessary for stage inspection during welding and on completion shall be provided to the Engineer or their inspecting Authority by manufacturer.
3. Adequate means of identification either by identification mark or other record shall be provided to enable each weld to be traced to the welder(s) by whom it was carried out.
4. All metal arc welding shall be in compliance with IS: 9595 provisions.
5. The method of inspection shall be in accordance with IS: 822 and extent of inspection and testing shall be in accordance with the relevant standards or in the absence of such a standards, as agreed with the Engineer.
6. Procedure tests: The Destructive and Non-Destructive test of weld shall be carried out according to IS: 7307 (Part I).
7. Any lamination, lamellar tearing or other defect found shall be recorded and reported to Engineer for his decision.

7.6 Painting

7.6.1 General

7.6.1.1 All metal work shall be given approved shop coats as well as field coats of painting. The item of work shall include preparation of metal surfaces, application of protective covering and drying of the paint coatings and supply of all tools, scaffolding, labour and materials necessary.

7.6.1.2 Coatings shall be applied only to dry surfaces and the coated surfaces shall not be exposed to rain or frost before they are dry. The coatings shall be applied to all surfaces excluding shear connectors and inner surfaces of fully sealed hollow sections. Care shall be taken during coating of adjacent surfaces to build up primer on the shear connectors.

7.6.1.3 Types of paints

- Primer Paints
  
  This shall be applied immediately after the surface preparation and should have the properties of adhesion, corrosion inhibition and imperviousness to water and air.

- Finishing Paints
  
  These are applied over the primary coat and should have the properties of durability, abrasion resistance, aesthetic appearance and smooth finish.

  The suitable painting application shall be with brush.

7.6.1.4 Quality of paint

Paints, oils varnishes etc. of approved brand and manufacture shall be used. Only ready mixed paint (exterior grade) as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer shall be used.
Approved paints, oil or varnishes shall be brought to the site of work by the Contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least of fortnight’s work. The empties shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer.

7.6.1.5 Unless otherwise specified, all painting and protective coating work shall be done in accordance with IS: 1477 (Part I).

7.6.2 Surface Preparation

7.6.2.1 Steel surface to be painted either at the fabricating shop or at the site of work shall be prepared in a thorough manner with a view to ensuring complete removal of mill scale by one of the following processes as agreed to between the fabricator and the Engineer:

1. Mechanical wire brushing

7.6.2.2 Primary coat shall be applied as soon as practicable after cleaning and in case of flame cleaning, primary coat shall be applied while the metal is still warm.

7.6.2.3 All slag from welds shall be removed before painting. Surfaces shall be maintained dry and free from dirt and oil. Work out of doors in frosty or humid weather shall be avoided.

7.6.3 Coatings

7.6.3.1 Prime coat to be used shall conform to the Specification of primers approved by the Engineer. Metal coatings shall be regarded as priming coatings. Primer shall be applied to the blast cleaned surface before any deterioration of the surface is visible. In any case, the surface shall receive one coat of primer within 4 hours of abrasive blast cleaning.

7.6.3.2 All coats shall be compatible with each other. When metal coatings are used, the undercoat shall be compatible with the metal concerned. The undercoat and finishing coat shall preferably be from the same manufacturer. Successive coats of paints shall be of different shades or colours and each shall be allowed to dry thoroughly before the next is applied. Particular care shall be taken with the priming and painting of edges, corners, welds and rivets. Typical guidelines for epoxy based paints and the conventional painting system for bridge girders as given below may be compiled with:

1. Epoxy Based Painting

   • Surface preparation: Remove oil/grease by use of petroleum hydrocarbon solution (IS: 1745) and Grit blasting to near white metal surface.
   • Paint system: 2 coats of epoxy zinc phosphate primer - 60 micron; Total 5 coats = 200 micron

2. Painting System

   • Priming Coat: One heavy coat or ready mixed paint, red lead primer conforming to IS: 102 or One coat of ready mixed zinc chrome primer conforming to IS: 104 followed by one coat of ready mixed red oxide zinc chrome primer conforming to IS: 2074 or Two coats of Zinc chromates red oxide primer conforming to IS: 2074.

   • Finishing Coats: Two cover coats of red oxide paint conforming to IS: 123 or any other approved paint shall be applied over the primer coat. One coat shall be applied before the fabricated steel work leaves the shop. After the steel work is erected at site, the second coat shall be given after touching up the primer and the cover coats if damaged in transit.

7.6.4 Methods of application
7.6.4.1 The methods of application of all paint coatings shall be in accordance with the manufacturer’s written recommendation and shall be as approved by the Engineer.

7.6.4.2 Oil based red lead primers must be applied by brush only, taking care to work into all corners and crevices.

7.6.4.3 The primer, intermediate and finishing coats shall all be applied so as to provide smooth coatings of uniform thickness. Wrinkled or blistered coatings or coatings with pinholes, sags, lumps or other blemishes shall not be accepted. Where the Engineer so directs, the coating shall be removed by abrasive blast cleaning and replaced at the Contractor’s expense.

7.7 Tests and Standards of Acceptance

7.7.1 The materials shall be tested in accordance with relevant IS specifications and necessary test certificate shall be furnished.

7.7.2 The fabrication, furnishing, erecting, painting of structural steel work shall be in accordance with the Specifications and shall be checked and accepted by the Engineer.

7.7.3 Rate & Payment

7.7.4 The contract BOQ item rates shall inclusive of all the operations described above.

8. METAL DOORS, WINDOWS, VENTILATORS, GATES, ROLLING SHUTTER, GRILLS AND MISCELLANEOUS METAL & STEEL WORKS

8.1 Scope

8.1.1 The work shall generally refer to supply, erection and installation of metal doors, windows, ventilators, steel rolling shutters, MS grill gates, collapsible gates etc. at all level and location inside or outside of installations. This also refers to supply, erection and installation of accessories and hardware integral to the main items. Unless otherwise specified in Bill of Quantities glazing work shall come under separate scope of work.

8.1.2 The work to be provided for by the Contractor shall include, but not be limited to furnishing all labour service, supervision, materials, tools, plants & equipment and execution of all transportation, handling to execution, preparation, fabrication, treatment of materials as necessary, erection in portion, installation, finishing, protection, maintenance, temporary works, approach and all other incidental works for the successful execution of the items of work under the scope of the contract.

8.2 Applicable Codes

8.2.1 The provisions of the latest Indian Standards mentioned below shall form a part of these specifications. Other IS Codes not specifically mentioned here but pertaining to metal doors, windows, ventilators, gates, rolling shutter, grills and miscellaneous metal & steel Works form part of these specifications.

<table>
<thead>
<tr>
<th>IS:813</th>
<th>Scheme of symbols for welding</th>
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<tr>
<td>IS:814</td>
<td>Covered electrodes for manual metal arc welding of carbon and carbon manganese steel – Specification</td>
</tr>
<tr>
<td>IS:1038</td>
<td>Specification for steel doors, windows and ventilators</td>
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</table>
### 8.3 Materials

8.3.1 Steel doors, windows, ventilators and composite units shall be of approved make and manufactured as per the specification stated below using rolled steel sections of the weights specified in IS:1038. It shall be fixed, centre hung, top hung, bottom hung, side hung or composite as specified. The steel shall be of ST 32-0 grade conforming to IS:2062.

### 8.4 Sizes

8.4.1 The type, overall sizes, side opening, position of steel doors, windows and ventilators shall be as shown in drawing, Bill of Quantities or as directed by the Engineer.

8.4.2 The steel doors and windows shall be fabricated to size so as to allow for easy fitting of doors, windows and ventilators into the opening. The actual measurements of openings for sizes of doors, windows and ventilators shall be taken at site before fabrication.

### 8.5 Fabrication

8.5.1 Welding

8.5.1.1 Both the fixed and opening frames shall be constructed of sections which have been cut to length and metered. The corners of fixed and opening frames shall be welded to form a solid fused welded joint conforming to the requirements given below. All frames shall be square and flat. The process of welding adopted may be flash butt welding or any other suitable method which provide for the desired requirements.

### 8.6 Requirements of Welded Joints

8.6.1 Visual Inspection Test

When two opposite corners of the frames are cut, paint removed and inspected, the joint shall conform to the following:

1) Welds shall have been made all along the place of meeting the members
2) Welds shall have been properly ground
3) Complete cross section of the corner shall be checked up to see that the joint is completely solid and there are no cavities visible.

8.6.2 Micro and Macro Examinations
From the two opposite corners obtained for visual test, the flanges of the sections shall be cut with the help of a saw. The cut surfaces of the remaining portions shall be polished, etched and examined.

The polished and etched faces of the weld and the base metal shall be free from under cutting, overlaps, gross porosity and entrapped slag.

8.6.3 Fillet Weld Test

The fillet weld in the remaining portion of the joint obtained shall be fractured by hammering. The fractured surfaces shall be free from slag inclusions, porosity, crack, penetration defects and fusion defects.

8.7 Doors

8.7.1 The hinges shall be of 100 mm MS heavy hinges. Projecting type hinges may also be used if approved by the Engineer. The hinge pin shall be of electro-galvanized steel of suitable thickness and size. Door handles shall be approved by the Engineer. An approved latch and lock for door openable from outside shall be provided.

8.8 Windows and Fittings

8.8.1 For fixed windows, the frames shall be fabricated as stated aforesaid for doors.

8.8.2 Side hung window – For fixing steel hinges, slots shall be cut in the fixed frames and hinges inserted inside and welded to the frame. The hinges shall be of projecting type and not less than 65 mm and not more than 25 mm wide. The hinges pin shall be of galvanized steel.

8.8.3 For fixing hinges to inside frame, the method described above may be adopted but the weld shall be cleaned or holes made in the inside frame and hinges riveted.

8.8.4 The casement window fastener for side hung shutter shall be of black oxidized steel or as specified and mounted on a steel plate. The handle plate shall be welded, screwed or riveted to the opening frame in such a manner that it can be fixed before the shutter is glazed and should not be easily removable after glazing.

8.8.5 The handles shall have a two point nose which shall engage with a brass striking plate on the fixed frame to a slightly opened position as well as in the tightly closed position.

8.8.6 The boss of the handle shall incorporate a friction device to prevent the handle from dropping under its own weight and the assembly shall be so designed that the rotation of the handle may not cause it to unscrew from the pin. The strike plate shall be so designed and fixed in such a position in relation to the handle that with the later bearing against its stop, there shall be adequate tight fit between the casement and outer frame.

8.8.7 Windows shall be fitted with peg stays which shall be either of black oxidized steel or as specified, 300 mm long with steel peg and locking brackets. The pegs stay shall have three holes to open the side hung casement in three different angles, the maximum openable angle being 90 degree.

8.9 Ventilators

8.9.1 The top hung ventilator shall be provided with steel butt hinges. Top hung ventilators shall be riveted to the fixed frame or welded to it after cutting a slot in it. Hinges to the opening frame shall be riveted or welded. Top hung casements shall be provided with a peg stay with three holes, which when closed shall be held tightly by the locking bracket. The locking bracket shall either be fitted to the fixed frames or to the window.
8.10 Glazing

8.10.1 The glass panes provided of specified thickness shall be free from flaws, specks or bubbles and shall have square corners and straight edges. The glass pane shall be so cut that it fits slightly loose in the frames.

8.10.2 Glazing shall be provided on the outside of the frame unless otherwise specified. Special metal sash putty of approved make shall be used for fixing glass panes. Putty shall be applied between glass panes and glazing bars. Putty shall then be applied over the glass pane, which shall stop 2 to 3 mm from the sight line of the back rebate to enable the painting to be done upto the sight line, to seal the edge of the putty to the glass. The oozed out back putty shall be cleaned and from putty cut to straight line. Quantity of putty shall not be less than 185 gm/metre of glass perimeter. Putty shall be painted within 2 to 3 weeks after glazing is fixed to avoid its cracking.

8.10.3 Four glazing clips may be provided per glass pane for a size larger than 30 cm x 60 cm for all types. Where the glass pane size exceeds 80 cm x 200 cm, 6 glazing clips shall be used. In case of doors, windows and ventilators without horizontal glazing, clips may be spaced according to the slots in the vertical members, provided the spacing does not exceed 30 cm, otherwise the spacing shall be 30 cm.

8.10.4 Where specially stipulated, fixing of glass panes may be done with metal or wooden beading instead of mere putty. Where beadings are proposed to be used, the manufacturers shall be intimated in advance to drill holes for head screws. Usually beads shall be fixed with screws spaced not more than 10 cm from each corner and the intermediate not more than 20 cm apart. When glass panes are fixed with wooden or metal beading having mitered joints, a thin layer of putty shall be applied between glass panes and sash bars and also between glass panes and the beading.

8.10.5 Where metal beading specified, extra payment shall be made on this account if not included in the item.

8.11 Finishing

8.11.1 All steel surfaces shall be thoroughly cleaned of rust, scale and dirt. Where so specified, the steel surfaces shall be treated for rust proofing hot dip, zinc spray or electro-galvanizing process. A priming coat of approved steel primer shall be given.

8.11.2 Final finishing coat shall be given after the doors, windows and ventilators are erected and fixed in final position. The rate shall be exclusive of final finishing coats but shall include the priming coat.

8.12 Fixing

8.12.1 Steel doors and windows shall be so stacked as to keep them in true shape without damage. Doors, windows and ventilators shall be fixed as described below.

8.12.2 Openings may be flush or rebated as shown in the drawings. Those openings may have rendered finish or a ‘fair faced’ finish (i.e. without rendering as in case of marble or stone facing). Where openings are flush and with a rendered finish, clearance of 1.25 cm shall be provided between the steel frame and opening. In case of external masonry finish ‘fair faced’ and with rebated jambs, a minimum 1.25 cm clearance between frame and opening shall be provided. Opening in steel work shall be so designed that the outer flange of the door, window or ventilator frame section overlaps the steel surface by 10 mm.

8.13 Fixing in Masonry Openings

8.13.1 Fixing with Lugs
8.13.1.1 Doors, windows and ventilators shall not be ‘built-in’ as the work proceeds but opening shall be left out and frames fitted afterwards so that the minimum specified clearance between opening and unit frame is left around. The size of the opening shall first be checked and cleared of obstruction, if any. The position of the unit and fixing holes shall be marked on the jamb. Necessary holes shall be made in the masonry and lugs not less than 10 cm long 15 x 3 mm size fixed in cement concrete blocks 15 x 10 x 10 cm size of 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size). The frames of units shall be set in the opening by using wooden wedges at the jamb, head and sill (wedges shall preferably be placed near the points where a glazing bar meets the frames and be plumbed in position).

8.13.1.2 After it, the frame shall be fixed with the lugs 20 mm long and 6.3 mm dia., GI counter sunk machine screws and nuts. In case of flush opening which are rendered smooth, wedges shall be removed and gap between unit and jambs shall be filled with cement mortar.

8.13.1.3 In case of flush jamb with external ‘fair faced’ finish, the gap between the opening and frame shall be filled with mastic from inside till it oozes out on external face. The oozing mastic shall be cleaned and flush pointed. The internal gap shall be filled with mastic to about 1/3rd depth and the rest with cement mortar.

8.13.1.4 In case of rebated and jambs finished ‘fair faced’ externally, the mastic shall be freely applied to the inside channel of frame, jamb and sill, so as to ensure a watertight joint. After the unit is firmly fixed in position surplus mastic shall be cleaned and flush pointed, as shown in drawing.

8.14 Fixing with Screws and Plugs

8.14.1 In RCC work where lugs cannot be embedded due to reinforcement bars etc. rawl plugs or other metallic fasteners such as Das fasteners of the required size and type as approved shall be used.

8.15 Angle Section Doors, Windows and Ventilators

8.15.1 Angle section doors, windows and ventilator frames shall be manufactured from uniform mild steel Tee section. The steel shall be of ST 32-0 grade conforming to IS:2062.

8.16 Sizes

8.16.1 The sizes of doors, windows and ventilator frames shall be as per drawing or as decided by the Engineer. The size of doors, windows and ventilators shall be calculated so as to allow 13 mm clearance on all sides to allow an easy fitting in opening. The actual size of doors, windows and ventilators shall not vary by more than ± 2 mm than those shown in the drawings.

8.16.2 The height of angle section used for manufacture of doors, windows and ventilators shall not be less than those specified in IS:1038.

8.17 Fabrications

8.17.1 The frame shall be constructed in section which has been cut to length and mitred. The corners of the frames shall be butt welded to form a true and right angle. All frames shall be square and flat.

8.18 Fittings

8.18.1 Requisite number of holes shall be made in the frames for fixing of fittings. Detailed arrangements of fixing fittings shall be as shown in drawing.
8.19 Fixing Procedure

8.19.1 Fixing procedure for angle section doors, windows and ventilator frames in masonry openings shall be as described above. Fixing arrangements of shutters to such frames is shown in drawing or as described in schedule or as directed.

8.20 Rolling Shutters

8.20.1 General

8.20.1.1 Rolling shutters shall be of best quality and obtained from approved make. These shall include necessary locking arrangement and handles etc. These shall be suitable for fixing in position as specified i.e. outside or below lintel or between jambs of the opening. The door shall be push and pull type and also operated with chain crank as required.

8.21 Shutters

8.21.1 The shutters shall consist of MS plates 1.25 mm thick and 75 mm wide or as specified. The laths shall be machine rolled and straightened with an effective bridge depth of 16 mm and shall be interlocked together throughout their entire length and jointed together at the end with end locks. These shall be mounted on specifically designed pipe shaft. Each lath section shall be a continuous single strip piece without any joint.

8.22 Springs

8.22.1 The springs shall be preferably of coiled type. The spring shall be manufactured from high tensile spring steel wire or strip of adequate strength to balance the shutters in all positions. The spring pipe shaft etc. shall be supported on strong mild steel brackets.

8.23 Guide Channels

8.23.1 The guide channels shall be of mild steel deep channel section and of rolled, pressed or built-up construction. The thickness of the sheet used shall not be less than 3.15 mm. The minimum depth of guide channels shall be 63.5 mm for clear width of shutters upto 3.5m.

8.23.2 The gap between the two legs of the guide channel shall be sufficient to allow free movement of the curtain and at the same time closes enough to prevent the rattling of the curtain due to wind.

8.23.3 Each guide channel shall be provided with a minimum of three fixing cleats to the walls or columns by means of bolts or screws.

8.24 Fixing

8.24.1 Brackets shall be fixed on the lintel or under the lintel as shown with rawl plugs, screws, bolts, etc. The shaft along with the spring shall then be fixed to the brackets.

8.24.2 The shutters shall be laid on the ground and the side guide channels shall be bound with it with ropes etc. The shutter shall then be placed in position and top fixed with pipe shaft with bolts and nuts. The side guide channels and the cover frame shall then be fixed to the walls through the plate welded to the guides.

8.24.3 Fixing shall be done accurately in workmanlike manner so that the operation of the shutter is easy and smooth.

8.25 Grilled Curtain

8.25.1 Wherever specified, rolling shutter shall be provided with grilled curtain.
8.26  Finishing

8.26.1  The rolling shutter together with guide channel, cover and accessories shall be supplied with two coats of approved primer and shall be painted finally with two coats of approved paint at site after installation, as specified.

8.27  Miscellaneous MS Works

8.27.1  All mild steel used in this work shall be tough with even surface and shall be cleanly rolled, sound and free from flaws, cracks, crop ends and other defects.

8.28  Workmanship

8.28.1  All work shall be carried out as per drawing in a neat and good crafts-man-like manner by especially skilled men known for good quality work.

8.29  Measurements to be Checked

8.29.1  The Contractor shall check all measurements at and with surrounding works and make necessary adjustments in the drawings, if required, to suit actual site conditions to the approval of the Engineer before starting fabrication.

8.30  Assembly

8.30.1  Work carried out in sections shall be carefully assembled. All members shall be secured together or to the anchors by welding or as shown in the details. All welds shall be ground smooth and made to match surrounding surfaces and finished to the satisfaction of the Engineer.

8.31  Fan Clamp

8.31.1  Fan clamp is to be fixed during laying of the RCC slab, as shown in drawing or as directed by the Engineer. The fan clamp shall be of 16 mm dia MS bar, bent to shape with its end hooked. Overall height of the clamp shall be made to suit the depth of the slab.

8.31.2  Holes for inserting the fan clamp in position shown in the drawing or as instructed by the Engineer shall be made in the shuttering after the later has been fixed in positions. After steel reinforcement is tied, fan clamps shall be fixed as shown in the drawing. The clamp shall neither be disturbed out of position during concreting nor shall they be bent out of shape when shuttering of slab beam is removed. Exposed portion of loops of the clamp shall be given two or more coats of paint, including priming coat as approved by the Engineer.

8.32  Measurements for Payment of MS Doors, Windows, Rolling Shutters and General Fabrication Work

8.32.1  Supply, fabrication, erection, hoisting and installation of general fabrication work shall be measured according to actual weight in kg of the item in assembled condition as installed.

8.32.2  In case of MS ornamental grills for doors/ windows/ ventilators etc. the actual opening area shall be measured and calculated in sqm. For MS fabricated railings, the actual weight shall be ascertained for fabricated material in kg.

8.33  Rate & Payment

8.33.1  The contract BOQ item rates shall inclusive of all the operations described above.
9. STRUCTURAL CONCRETE AND MORTAR WORK

9.1 Scope

This Specification covers the general requirements for concrete and mortar work to be used on jobs using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing and testing of concrete and also requirements in regard to the quality, storage, bending and fixing of reinforcement. This also covers the transportation of concrete from the mixer to the place of final deposit and the placing, curing, protecting, repairing and finishing of concrete.

9.2 Applicable Codes and Specifications

9.2.1 The following Specifications, standards and codes are made a part of this Specification. All Standards, Specifications, Codes of Practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of discrepancy between this Specification and those referred to herein, this Specification shall govern.

9.2.2 Materials

| IS: 1489 | Specification for Portland-Pozzolana Cement. |
| IS: 383 | Specification for Coarse and Fine Aggregates From Natural Sources for Concrete. |
| IS: 2386 | Methods of Test for Aggregates for Concrete. (Part I To VIII) |
| IS: 516 | Method of Test for Strength of Concrete. |
| IS: 1199 | Method of Sampling and Analysis of Concrete. |
| IS: 3025 | Method of Sampling and Test (Physical and Chemical) Water Used In Industry. |
| IS: 432 | Specification for Mild Steel and Medium Tensile Steel Bars and Hard Drawn Steel Wire for Concrete Reinforcement. (Part I & II) |
| IS: 1139 | Specification for Hot Rolled Mild Steel and Medium Tensile Steel Deformed Bar for Concrete Reinforcement. |
| IS: 1566 | Specification for Plain Hard Drawn Steel Wire Fabric for Concrete (Part I) Reinforcement. |
| IS: 1786 | Specification for Cold Twisted Steel Bars for Concrete Reinforcement. |
| IS: 4990 | Specification for Plywood for Concrete Shuttering Work. |
| IS: 2645 | Specification for Integral Cement Water-Proofing Compounds. |
| BS4461 | Cold Worked Steel Bars for The Reinforcement of Concrete. |

9.2.3 Equipment

| IS: 1791 | Specification for Batch Type Concrete Mixers. |
| IS: 2505 | Specification for Concrete Vibrators, Immersion Type. |
| IS: 2506 | Specification for Screen Board Concrete Vibrators. |
| IS: 2514 | Specification for Concrete Vibrating Tables. |
| IS: 3366 | Specification for Pan Vibrators. |
| IS: 4656 | Specification for Form Vibrators for Concrete. |
| IS: 2722 | Specification for Portable Swing Weigh Batchers for Concrete (Single and Double Bucket Type). |
| IS: 2750 | Specification for Steel Scaffolding. |
| IS: 2438 | Roller Fan Mixer (Reaffirmed 1990) |
9.2.4 Codes of Practice

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>IS: 456</td>
<td>Code of Practice for Plain and Reinforced Concrete.</td>
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<tr>
<td>IS: 457</td>
<td>Code of Practice for General Construction of Plain and Reinforced Concrete for Dams and Other Massive Structures.</td>
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<td>IS: 3370</td>
<td>Code of Practice for Concrete Structures for Storage of Liquids (Part I to IV)</td>
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<td>Code of Practice for Composite Construction.</td>
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<td>IS: 3201</td>
<td>Criteria for Design and Construction of Precast Concrete Trusses.</td>
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<td>IS: 2204</td>
<td>Code of Practice for Construction of Reinforced Concrete Shell Roof.</td>
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<td>Criteria for The Design of R.C. Shell Structures and Folded Plates.</td>
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<td>Code of Practice for Preparation and Use of Masonry Mortar (1st Revision)</td>
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9.2.5 Construction Safety

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9.2.6 In the event that state, city or other governmental bodies have requirements more stringent than those set forth in this Specification, such requirement shall be considered part of this Specification and shall supersede this Specification where applicable.

9.3 General

9.3.1 The quality of materials and method and control of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise, shall conform to the applicable portions of this Specification.

9.3.2 Engineer shall have the right to inspect the source(s) of material(s), the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer's approval obtained, prior to starting of concrete work.

9.4 Materials

9.4.1 All materials shall conform to the requirements laid in Specification.

9.4.2 Steel Reinforcement

9.4.2.1 Laps

Laps and splices for reinforcement shall be as shown on the Drawings. Splices in adjacent bars shall be staggered and the locations of all splices, except those specified on the Drawings, shall be approved by Engineer. The bars shall not be lapped unless the length required exceeds the maximum available length of bars at site.

9.4.2.2 Bending

1. Reinforcing bars supplied bent or in coils, shall be straightened before they are cut to
size. Straightening of bars shall be done in cold and without damaging the bars. This is considered as a part of reinforcement bending fabrication work.

2. All bars shall be accurately bent according to the sizes and shapes shown on the detailed working Drawings / bar bending schedules. They shall be bent gradually by approved means. Reinforcing bars shall not be straightened and rebent in a manner that will injure the material and bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 25 mm in diameter which may be bent hot if specifically approved by Engineer. Bars which depend for their strength on cold working shall not be bent hot. Bars bent hot shall not be heated beyond cherry red colour (nor exceeding 845oC) and after bending, shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only if the means used for straightening and rebending be such as shall not, in the opinion of Engineer, injure the material. No reinforcement shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by design shall not be used.

9.4.2.3 Fixing

Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the Drawings by the use of blocks, spacers and chairs as per IS: 2502 to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be securely bound together at all such points with number 16 gauge annealed soft iron wire. The vertical distances required between successive layers of bar in beams or similar members shall be maintained by the provision of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between spacer bars.

9.4.2.4 Cover

Unless indicated in approved Drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows:

1. At each end of reinforcing bar, not less than 25 mm or less than twice the diameter of the bar.
2. For a longitudinal reinforcing bar in a column, not less than 40 mm, nor less than the diameter of the bar. In case of columns of minimum dimension of 20 cm. or under, with reinforcing bars of 12 mm and less in diameter, a cover of 25 mm may be used.
3. For longitudinal reinforcing bars in a beam, not less than 25 mm nor less than the diameter of the bar.
4. For tensile, compressive, shear, or other reinforcement in a slab or wall, not less than 13 mm, nor less than the diameter of such reinforcement.
5. For any other reinforcement, not less than 13 mm, nor less than the diameter of such reinforcement.
6. For footings and other principal structural members in which the concrete is deposited directly against the ground, cover to the bottom reinforcement shall be 75 mm. If concrete is poured on a layer of lean concrete the bottom cover may be reduced to 50 mm.
7. For concrete surfaces exposed to the weather or the ground after removal of forms, such as retaining walls, grade beams, footing sides and top, etc., not less than 50 mm for bars larger than 16 mm diameter and not less than 40 mm for bars 16 mm diameter or smaller.
8. Increased cover thickness shall be provided for surfaces exposed to the action of harmful chemicals (or exposed to earth contaminated by such chemical), acid, alkali, saline atmosphere, sulphurous smoke, etc.
9. Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing a dense impermeable concrete with approved protective coatings, as specified on the Drawings. In such a case the extra cover
mentioned in (8) and (9) above, may be reduced by Engineer to those shown on the Drawings.

10. The correct cover shall be maintained by cement mortar cubes or other approved means. Reinforcement for footings, grade beams and slabs on subgrade shall be supported on precast concrete blocks as approved by Engineer. The use of pebbles or stones shall not be permitted.

11. The 28 day crushing strength of cement mortar cubes / precast concrete cover blocks shall be atleast equal to the specified strength of concrete in which these cubes / blocks are embedded.

12. The minimum clear distance between reinforcing / bars shall be in accordance with IS: 456 or as shown in Drawings.

9.4.2.5 Inspection

Erected and secured reinforcement shall be inspected and approved by Engineer prior to placement of concrete.

9.5 Controlled Concrete

9.5.1 All concrete in the works shall be "Controlled Concrete" as defined in IS: 456, unless it is a nominal mix concrete such as 1:3:6, 1:4:8 or 1:5:10. Whether reinforced or otherwise, all controlled concrete works to be carried out under this Specification shall be divided into the following classification:

9.5.2 Minimum compressive strength of 15 cm. Cubes at 7 and 28 days after mixing, conducted in accordance with IS: 516

<table>
<thead>
<tr>
<th>Class</th>
<th>Preliminary test Kg/cm²</th>
<th>Work test Kg/cm²</th>
<th>Max. size of Aggregate</th>
<th>Location for Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At 7 days</td>
<td>At 28 days</td>
<td>At 7 days</td>
<td>At 28 days</td>
</tr>
<tr>
<td>M300</td>
<td>250</td>
<td>380</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>M250</td>
<td>220</td>
<td>320</td>
<td>170</td>
<td>250</td>
</tr>
<tr>
<td>M200</td>
<td>175</td>
<td>260</td>
<td>135</td>
<td>200</td>
</tr>
<tr>
<td>M150</td>
<td>135</td>
<td>200</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>

Note: It shall be very clearly understood that whenever the class of concrete such as M200 is specified it shall be Contractor's responsibility to ensure that minimum crushing strength stipulated for the respective class of concrete is obtained at works. The maximum total quantity of aggregate by weight per 50 Kg. of cement shall not exceed 450 Kg., except when otherwise specifically permitted by Engineer.

9.5.3 Minimum cement content, minimum water- cement ratio and minimum grade of concrete for different exposures with normal weight aggregates of 20 mm nominal maximum size shall be as per IS 456 as follows:-

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Exposure</th>
<th>Plain Concrete</th>
<th>Reinforced Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Cement Content Kg/m³</td>
<td>Maximum Free Water-Cement Ratio</td>
<td>Minimum Grade of Concrete</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>i)</td>
<td>Mild</td>
<td>220</td>
<td>0.60</td>
</tr>
</tbody>
</table>
9.6 Mix Design

9.6.1 This is to investigate the grading of aggregates, water cement ratio, workability and the quantity of cement required to give preliminary and works cubes of the minimum strength specified. The proportions of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be based on the principles given in IS: 456-2000 and SP: 23-1982 "Handbook for Design Mix Concrete."

9.6.2 Whenever there is a change either in required strength of concrete, or water-cement ratio or workability or the source of aggregates and / or cement, preliminary tests shall be repeated to determine the revised proportions of the mix to suit the altered conditions. While designing mix proportions, over-wet mixes shall always be avoided.

9.6.3 While fixing the value for water / cement ratio for preliminary mixes, assistance may be derived from the graph (Appendix A IS: 456) showing the relationship between the 28-day compressive strengths of concrete mixes with different water / cement ratios and the 7 day compressive strength of cement tested in accordance with IS: 269.

9.6.4 Preliminary tests

9.6.4.1 Tests specimens shall be prepared with at least two different water/cement ratios for each class of concrete, consistent with workability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those, to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce concrete of required consistency and to give the specified strength. It will be Contractor's sole responsibility to carry out statement of proportions proposed to be used for the various concrete mixes. For preliminary tests, the following procedure shall be followed:

9.6.4.2 Materials shall be brought to the room temperature and all materials shall be in a dry condition. The quantities of water, cement and aggregates for each batch shall be determined by weight to an accuracy of 1 part in 1000 parts.

9.6.5 Mixing Concrete

9.6.5.1 For all works, concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained through out the construction. Mixing shall be continued till materials are uniformly distributed and a uniform colour of entire mass is obtained and each individual particle of the coarse aggregate shows a complete coating of mortar containing its proportionate amount of cement. In no case, the mixing is done for a period of not less than two minutes after all ingredients have been put into the mixer. In case of hand mixing, quantity of cement shall be increased by 10% above that specified in Specification, the cost of increased cement quantity being borne by the Contractor. Hand mixing shall be permitted only under exceptional conditions and the Contractor must take the permission of the Engineer in advance. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting a new batch. Unless otherwise agreed by the Engineer, the first batch of concrete from the mixer shall contain only two thirds of the normal quantity of coarse aggregate. The mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

9.6.6 Consistency

9.6.6.1 The consistency of each batch of concrete shall be measured immediately after mixing, by the slump test, care should be taken to ensure that no water or other material is lost; the material used for the slump test may be remixed with the remainder of the concrete for making the specimen test cubes. The period of re-mixing shall be as short as possible yet sufficient to produce a homogeneous mass.
9.6.7 Size of Test Cubes

9.6.7.1 Compression tests of concrete cubes shall be made as per IS: 516 on 15 cm cubes. Each mould shall be provided with a metal base plate having no leakage. The base plate shall be preferably attached to the mould when assembled and shall be positively and rigidly held together. Before placing concrete, the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits:

1. Height and distance between the opposite faces of the mould shall be of specified size + 0.2 mm. The angle between the adjacent internal faces and between internal faces and top and bottom planes of mould shall be 90° ± 0.5°. The interior faces of the mould shall be plane surfaces with a permissible variation of 0.03 mm.

9.6.8 Compacting

9.6.8.1 Concrete tests cubes shall be moulded by placing fresh concrete in the mould and compacted as specified in IS: 516.

9.6.9 Curing

9.6.9.1 Curing shall be as specified in IS: 516. The cubes shall be kept in moist air of at least 90% relative humidity at a temperature of 27°C ± 2°C for 2 hours ± 1/2 hr. from the time of adding water to the dry ingredients. Thereafter in clean, fresh water and kept at 27°C ± 2°C temperature until seven days. A record of maximum and minimum temperatures at the places of storage of the cubes shall be maintained during the period they remain in storage.

9.6.10 Testing of Specimens

9.6.10.1 The strength shall be determined based on not less than five cube test specimens for each age and each water-cement ratio. All these laboratory test results shall be tabulated and furnished to Engineer. The test results shall be accepted by Engineer if the average compressive strengths of the specimens tested is not less than the compressive strength specified for the age at which specimens are tested, subject to the condition that only one out of the five consecutive tests may give a value less than the specified strength for that age. Engineer may direct Contractor to repeat the tests if the results are not satisfactory and also to make such changes as he considers necessary to meet the requirements specified. All these preliminary tests shall be conducted by Contractor at his own cost in an approved laboratory.

9.7 Proportioning, Consistency, Batching and Mixing of Concrete

9.7.1 Proportioning

9.7.1.1 Aggregate

The proportions which shall be decided by conducting preliminary tests shall be by weight. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete batching by means of weigh batchers conforming to IS: 2722 capable of controlling the weights within one percent of the desired value. Except where it can be shown to the satisfaction of Engineer that supply of properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stocked in separate stock piles. The grading of coarse and fine aggregate shall be checked as frequently as possible, as determined by Engineer, to ensure maintaining of grading in accordance with the sample used in preliminary mix design. The material shall be stock piled well in advance of use.
9.7.1.2 Cement

The cement shall be measured by weight.

9.7.1.3 Water

Only such quantity of water shall be added to the cement and aggregates in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with the strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of material or the collection of excessive free water on the surface of the concrete.

9.7.1.4 Definition of Water - Cement Ratio.

The water cement (W/C) ratio is defined as the weight of water in the mix (including the surface moisture of the aggregates) divided by the weight of cement in the mix.

9.7.1.5 Water - Cement Ratio

The actual water - cement ratio to be adopted shall be determined in each instance by Contractor and approved by Engineer.

9.7.1.6 Proportioning by Water - Cement Ratio

The W/C ratio specified for use by Engineer shall be maintained. Contractor shall determine the water content of the aggregates as frequently as directed by Engineer In-Charge as the work progresses and as specified in IS: 2386 (part III) and the amount of mixing water added at the mixer shall be adjusted as directed by Engineer so as to maintain the specified by W/C ratio. To allow for the variation in weight of aggregates due to variation in their moisture content, suitable adjustments in the weights of aggregates shall also be made.

9.7.2 Consistency and slump

9.7.2.1 Concrete shall be of a consistency and workability suitable for the condition of the job. After the amount of water required is determined, the consistency of the mix shall be maintained throughout the progress of the corresponding parts. Compacting factor tests, in accordance with IS: 1199 shall be conducted from time to time to ensure the maintenance of such consistency.

9.7.2.2 The following table gives range of slumps which shall be used for various types of construction on the approval of the Engineer.

<table>
<thead>
<tr>
<th>Types of Construction</th>
<th>Slump in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>Reinforced foundation walls and footings</td>
<td>75</td>
</tr>
<tr>
<td>Plain footings, caissons and substructure walls</td>
<td>75</td>
</tr>
<tr>
<td>Slabs, Beams and reinforced walls</td>
<td>100</td>
</tr>
<tr>
<td>Building columns</td>
<td>100</td>
</tr>
<tr>
<td>Pavements</td>
<td>50</td>
</tr>
<tr>
<td>Heavy mass construction</td>
<td>50</td>
</tr>
</tbody>
</table>

9.7.3 Batching and mixing of concrete

9.7.3.1 The materials and proportions of concrete materials as established by the preliminary tests for the mix design shall be rigidly followed for all concrete on the project and shall not be changed except when specifically permitted by Engineer.
9.7.3.2 Concrete shall be produced only by weigh batching the ingredients. The mixer and weigh
batchers shall be maintained in clean, serviceable condition. The accuracy of weigh
batchers shall be periodically checked. They shall be set up level on a firm base and the
hopper shall be loaded evenly. The needle shall be adjusted to zero when the hopper is
empty. Fine and coarse aggregates shall be weighed separately. Volume batching will not
be permitted. However, Engineer In-Charge may permit volume batching by subsequent
conversion of the weights of important pours involving concrete of not more than 0.25
cubic metres, on days when other pours involving weigh batching are not likely to be taken
up. Concrete shall be of strength stipulated in the respective items. All concrete shall be
mixed in mechanically operated batch mixers complying with IS: 1791 and of approved
make with suitable provision for correctly controlling the water delivered to the drum.

9.7.3.3 The quantity of water actually entering the drum shall be checked with the reading of the
gauge or valve setting, when starting a job. The test should be made while the mixer is
running. The volume of the mixed material shall not exceed the manufacturer's rated mixer
capacity. The batch shall be charged into the mixer so that some water will enter the drum
in advance of cement and aggregates. All water shall be in the drum by the end of the first
15 seconds of the specified mixing time. Each batch shall be mixed until the concrete is
uniform in colour, for a minimum period of two minutes after all the materials and water are
in the drum. The entire contents of the drum shall be discharged in one operation before
the raw materials for the succeeding batches are fed into the drum.

9.7.3.4 Each time the work stops, the mixer shall be cleaned out and when next commencing the
mixing, the first batch shall have 10% additional cement to allow for sticking in the drum.

9.7.4 Sampling and testing concrete in the field

9.7.4.1 Facilities required for sampling materials & concrete in the field, if Engineer so desires,
shall be provided by Contractor at no extra cost. The following equipment with operator
shall be made available at Engineer's request (all must be in serviceable condition)

<table>
<thead>
<tr>
<th>Sr.</th>
<th>EQUIPMENT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete cube testing machine suitable for 15 cm cubes of 100 Tones capacity with proving calibration ring</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Cast Iron cube moulds 15 cm size.</td>
<td>6 Nos.(min.)</td>
</tr>
<tr>
<td>3</td>
<td>Slump cone complete with tamping road</td>
<td>1 set</td>
</tr>
<tr>
<td>4</td>
<td>Laboratory balance to weigh upto 5 Kg, with sensitivity of 10 gm.</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>IS Sieves for coarse and fine aggregates.</td>
<td>1 set</td>
</tr>
<tr>
<td>6</td>
<td>Electric oven with thermostat upto 120°C.</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Flakiness gauge.</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Elongation index gauge.</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Sedimentation pipette.</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Pycnometer.</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Calibrated glass jar 1 litre capacity.</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>12</td>
<td>Glass flasks &amp; metal containers.</td>
<td>As required</td>
</tr>
<tr>
<td>13</td>
<td>Chemical reagents like sodium hydroxide, tannic acid, litmus papers etc.</td>
<td>As required</td>
</tr>
<tr>
<td>14</td>
<td>Laboratory balance of 2 Kg capacity and of sensitivity of 1 gm.</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

9.7.4.2 Sampling for strength of concrete:

At least 6 test cubes of each class of concrete shall be taken for every 15 cum. concrete or
part thereof. Such samples shall be drawn on each day for each type of concrete. of each
set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The laboratory
test results shall be tabulated and furnished to Engineer. Engineer will pass the concrete if
average strength of the specimens tested is not less than the strength specified, subject to
the condition that only one out of three consecutive tests may give a value less than the
specified strength but this shall not be less than 90% of the specified strength.
9.7.4.3 Consistency:

Slump tests shall be carried out as often as demanded by Engineer and invariably from the same of concrete from which the test cubes are made. Slump tests shall be done immediately after sampling.

9.7.5 Admixtures:

9.7.5.1 Water proofing agent:

Where specified and approved by Engineer, water proofing agent confirming to IS: 2645, shall be added in quantities specified by Engineer.

9.7.5.2 Other admixtures:

Synthetic Fibre (Polyster 12mm Recron 3-S) triangular with dosage @ 0.25% by weight of cement; admixtures shall be added in all concrete works.

9.7.6 Optional Tests

9.7.6.1 Engineer, if he so desires, may order tests to be carried out on cement, sand, coarse aggregate, water in accordance with the relevant Indian Standards.

9.7.6.2 Tests on cement shall include:

1. Test for normal consistency
2. Test for setting time
3. Test for tensile strength
4. Test for compressive strength
5. Test for heat of hydration (by experiment and by calculations) in accordance with IS: 269.

9.7.6.3 Tests on sand shall include:

1. Sieve test
2. Test for organic impurities
3. Decantation test for determining clay and silt content
4. Specific gravity test
5. Test for unit weight and bulkage factor
6. Test for sieve analysis and fineness modulus.

9.7.6.4 Tests on coarse aggregate shall include

1. Sieve analysis
2. Specific gravity and unit weight of dry, loose and rodded aggregate
3. Soundness and alkali aggregate reactivity
4. Deleterious materials and organic impurities
5. Test for aggregate crushing value.

9.7.6.5 Any or all these tests would normally be ordered to be carried out only if Engineer In-Charge feels the materials are not in accordance with the Specifications or if the specified concrete strengths are not obtained and shall be performed by Contractor at an approved test laboratory. If the tests are successful, owner shall pay for all such optional tests otherwise Contractor shall have to pay for them.

9.7.6.6 If the works cubes do not give the stipulated strengths, Engineer reserves the right to ask Contractor to dismantle such portions of the work, which in his opinion are unacceptable and re-do the work to the standard stipulated, at Contractor's cost. The unit rate for concrete shall be all inclusive, including making preliminary mix design and test cubes, works, cubes, testing them as per Specification, slump tests, optional tests, etc. complete.
9.7.6.7 Load test on members or any other tests:

In the event of any work being suspected of faulty material or workmanship or both, Engineer requiring its removal and reconstruction may order, or Contractor may request that it should be load tested in accordance with the following provisions:

1. The test load shall be 125 percent of the maximum super-imposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of concrete. During the test, struts strong enough to take the whole load shall be placed in position leaving a gap under the members. The test load shall be maintained for 2 hours before removal.

2. If within 24 hours of the removal of the load, the structure does not show a recovery of at least 75 percent of the maximum deflection shown during the 24 hours under load, the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the test if the recovery after the second test is not at least 75 percent of the maximum deflection shown during the second test. If the structure is certified as failed by the Engineer, the cost of the load test shall be borne by the Contractor.

3. Any other tests, e.g. taking out in an approved manner concrete cores, examination and tests on such cores removed from such parts of the structure as directed by Engineer In-Charge, sonic testing etc. shall be carried out by Contractor if so directed.

Unsatisfactory tests:

1. Should the results of any test prove unsatisfactory, or the structure shows signs of weakness, undue deflection or faulty construction Contractor shall remove and rebuild the member or members involved or carry out such other remedial measures as may be required by Engineer / Owner. Contractor shall bear the cost of so doing, unless the failure of the member or members to fulfill the test conditions is proved to be solely due to faulty design. The cost of load and other tests shall be borne by Contractor if the tests show unsatisfactory results; otherwise such costs will be borne by Owner.

9.7.7 Concrete in alkali soils and alkaline water:

9.7.7.1 Where concrete is liable to attack from alkali salts or alkaline water, special cements containing low amount of tricalcium aluminate shall be used, if so required as per site condition. Such concrete shall have a minimum 28 days compressive strength of 250 kg/cm² and shall contain not less than 370 Kg of cement per cubic metre of concrete. If required, additional protection shall be obtained by the use of a chemically resistant stone facing or a layer or Plaster of Paris covered with suitable fabric, such as jute, thoroughly impregnated with tar.

9.7.8 Preparation prior to concrete placement, final inspection and approval

9.7.8.1 Before the concrete is actually placed in position, the insides of the formwork shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottom of columns and wall forms, to permit removal of saw dust, wood shavings, binding wire, rubbish, dirt etc. Openings shall be placed or holes drilled so that these materials and water can be removed easily. Such openings / holes shall be later suitably plugged.

9.7.8.2 All embedded parts, inserts etc. supplied by Owner or Contractor shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

9.7.8.3 All anchor bolts shall be positioned and kept in place with the help of properly manufactured templates with the approval of the Engineer. The use of all such templates,
fixtures etc. shall be deemed to be included in the rates. Slots, openings, holes, pockets etc. shall be provided in the concrete work in the positions indicated in the Drawings or as directed by Engineer.

9.7.8.4 Reinforcement and other items to be cast in concrete shall have clean surfaces that will not impair bond.

9.7.8.5 Prior to concrete placement all work shall be inspected and approved by Engineer and if found unsatisfactory, concrete shall not be poured until after all defects have been corrected at Contractor's cost.

9.7.8.6 Approval by Engineer of any and all materials and work as required herein shall not relieve Contractor from his obligation to produce finished concrete in accordance with the Drawings and Specifications.

9.7.9 Rain or wash water:

9.7.9.1 No concrete shall be placed in wet weather or on a water covered surface. Any concrete that has been washed by heavy rains shall be entirely removed, if there is any sign of cement and sand having been washed away from the concrete mixture. To guard against damage which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted before leaving the work unattended. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over / around freshly placed concrete, suitable drains & sumps shall be provided.

9.7.10 Bonding mortar:

9.7.10.1 Immediately before concrete placement begins, prepared surfaces except formwork, which will come in contact with the concrete to be placed, shall be covered with a bonding mortar.

9.7.11 Transportation:

9.7.11.1 All buckets or containers used for transporting concrete shall be mortar-tight. Irrespective of the method of transportation adopted, concrete shall be delivered with the required consistency and plasticity without segregation or loss of slump. Chutes shall not be used for transport of concrete and concrete shall not be rehandled before placing.

9.8 Procedure for Placing of Concrete:

9.8.1 Engineer's approval of equipment & methods:

9.8.1.1 Before any concrete is placed, the entire placing programme, consisting of equipment, layout, proposed procedures and methods shall be submitted to Engineer for approval. Concrete shall be placed until Engineer's approval has been received. Equipment for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing, without segregation of materials, considering the size of the job and placement location.

9.8.2 Time interval between mixing and placing

9.8.2.1 Concrete shall be placed in its final position before the cement reaches its initial set and concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer, and once compacted it shall not be disturbed.

9.8.3 Avoiding segregation
9.8.3.1 Concrete shall, in all cases, be deposited as nearly as practicable directly in its final position, and shall not be rehandled or caused to flow in a manner which will cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible, and in narrow forms, Contractor shall provide suitable drop and "Elephant Trunks" to confine the movement of concrete.

9.8.3.2 Special care shall be taken when concrete is dropped from a height, especially if reinforcement is in the way, particularly in columns and thin walls.

9.8.4 Placing by manual labour

9.8.4.1 Except when otherwise approved by Engineer, concrete shall be placed in the shuttering by shovels or other approved implements and shall not be dropped from a height more than 1.0 M or handled in a manner which will cause segregation.

9.8.5 Placement in restricted forms

9.8.5.1 Concrete placed in restricted forms by barrows, buggies, short chutes hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

9.8.6 Chuting

9.8.6.1 Where it is necessary to use transfer chutes, specific, approval of Engineer must be obtained to type, length, slopes, baffles, vertical terminals and timing of operations. These shall be so arranged that an almost continuous flow of concrete is obtained at the discharge and without segregation. To allow for the loss of mortar against the sides of the chutes, the first mixes shall have less coarse aggregate. During cleaning of chutes, the waste water shall be kept clear of the forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1.0 M. Chutes, when approved for use, shall have slopes not flatter than 1 vertical: 3 horizontal and not steeper than 1 vertical: 2 horizontal. Chutes shall be of metal or metal lined and of rounded cross section. The slopes of all chute sections shall be approximately the same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms.

9.8.7 Concrete in layers

9.8.7.1 Concrete, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 to 90 cm or as directed by Engineer. These shall be placed as rapidly as practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit, shall be spotted progressively along the face of the layer with such overlap as will facilitate spreading the layer to uniform depth and texture with a minimum of shoveling. Any tendency to segregation shall be corrected by shoveling stones. Such a condition shall be corrected by redesign of mix or other means, as directed by Engineer.

9.8.8 Bedding of layers

9.8.8.1 The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

9.8.9 Compaction

9.8.9.1 Concrete shall be compacted during placing, with approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the form
faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over vibrate the concrete to the point that segregation results.

9.8.10 Type of Vibrators

9.8.10.1 Vibrators shall conform to IS Specifications and Type of vibrator as mentioned in the specification shall be used.

9.8.10.2 Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

9.8.11 Use of Vibrators

9.8.11.1 The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of lift e.g. in a column or wall.

9.8.12 Melding Successive Batches

9.8.12.1 When placing concrete in layers, which are advancing horizontally as the work progresses, great care shall be exercised to ensure adequate vibration, blending and melding of the concrete between the succeeding layers.

9.8.13 Penetration of Vibrator

9.8.13.1 The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below while the underlayer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

9.8.14 Vibrating Against Reinforcement

9.8.14.1 Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come in contact with forms or finished surfaces.

9.8.15 Stone pockets and Mortar Pondages

9.8.15.1 The formation of stone pockets or mortar pondages in corners and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to sufficient depth and shape for through bonding, as directed by Engineer.

9.8.16 Placement interval

9.8.16.1 Except when placing with slip forms, each placement of concrete in multiple lift work shall be allowed to set for at least 24 hours after the final set of concrete and before the start of a subsequent placement.

9.8.17 Special provision in placing

9.8.17.1 When placing concrete in walls with openings, in floors of integral slabs and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls or bottom horizontal surface of the slab, as the case may be. Placing shall be resumed before the concrete in place takes initial set, but not until it has had time to settle as determined by Engineer In-Charge.
9.8.18 Placing concrete through reinforcing steel

9.8.18.1 When placing concrete through reinforcing steel, care shall be taken to prevent segregation of the coarse aggregate. Where the congestion of steel makes placing difficult, it may be necessary to temporarily move the top aside to get proper placement and restore reinforcing steel to design position.

9.8.19 Bleeding

9.8.19.1 Bleeding or free water on top of concrete being deposited into the forms shall be a cause to stop the concrete pour and the conditions causing this defect corrected before any further concreting is resumed.

9.9 Construction Joints and Keys

9.9.1 Concrete shall be placed without interruption until completion of the part of the work between predetermined construction joints, as specified hereinafter. Time lapse between the pouring of adjoining units shall be as specified on the Drawings or as directed by Engineer.

9.9.2 If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made where the work is stopped. Joints shall be either vertical or horizontal, unless shown otherwise on Drawings. In case of an inclined or curved member, the joint shall be at right angles to the axis of the member. Vertical joints shall be formed against a stop board; horizontal joints shall be level and wherever possible, arranged so that the joint lines coincide with the architectural features of the finished work. Battens shall be nailed to the formwork to ensure a horizontal line and if directed, shall also be used to form a grooved joint. For tank walls and similar works joints shall be formed as per IS: 3370. Concrete that is in the process of setting shall not be disturbed or shaken by traffic either on the concrete itself or upon the shuttering. Horizontal and vertical construction joints and shear keys shall be located and shall conform to the requirements of the plans unless otherwise directed by Engineer. Where not described, the joint shall be in accordance with the following:

1. Column Joint

   In a column, the joint shall be formed 75 mm below the lowest soffit of the beams including haunches if any. In flat slab construction, the joint shall be 75 mm below the soffit of column capital. At least 2 hours shall elapse after depositing concrete in columns, piers or walls, before depositing in beams, girders or slabs supported thereon.

2. Beam and Slab Joints

   Concrete in a beam shall be placed throughout without a joint but if the provision of a joint is unavoidable the joint shall be vertical and at the centre or within the middle third of the span unless otherwise shown on Drawings. Where a beam intersects a girder, the joints in the girder shall be offset by a distance equal to twice the width of the beam and additional reinforcement provided for shear. The joints shall be vertical throughout the full thickness of the concrete member. A joint in a slab shall be vertical and parallel to the principal reinforcement. Where it is unavoidably at the right angles to the principal reinforcement, the joint shall be vertical and at the middle of the span.

9.9.3 Mass Foundations

9.9.3.1 Mass Foundations shall be poured in lifts not exceeding 1.5m. in height or as per the Drawings or approved by Engineer.

9.9.4 Treatment of construction joints on resuming concreting
9.9.4.1 A drier mix shall be used for the top lift of horizontal pours to avoid laintance. All laintance and loose stones shall be thoroughly and carefully removed by wire brushing / hacking and surface washed.

9.9.4.2 Just before concreting is resumed, the roughened joint surface shall be thoroughly cleaned and loose matter removed and then treated with a thin layer of cement group of proportion specified by Engineer and worked well into the surface. The new concrete shall be well worked against the prepared face before the grout mortar sets. Special care shall be taken to obtain thorough compaction and to avoid segregation of the concrete along the joint plane.

9.10 Curing, Protecting, Repairing and Finishing

9.10.1 Curing

9.10.1.1 All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays, or ponded water, continuously saturated covering of sacking, canvas, hessian or other absorbent materials, or approved effective curing compounds applied with spraying equipment capable of producing a smooth, even-textured coat. Extra precautions shall be exercised in curing concrete during cold and hot weather. The quality of curing water shall be the same as the one used for mixing concrete.

9.10.1.2 Certain types of finish or preparation for overlaying concrete must be done at certain stages of the curing process and special treatment may be required for specific concrete surface finish.

9.10.1.3 Curing with water

Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete, following a lapse of 12 to 14 hours after laying concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately after the concrete has hardened. Water shall be applied to unformed concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

9.10.1.4 Continuous Spraying:

Curing shall be assured by use of an ample water supply under pressure in pipes, with all necessary appliance of hose, sprinklers and spraying devices. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by Engineer.

9.10.1.5 Alternate Curing Methods:

Whenever, in the judgment of Engineer, it may be necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during the curing period.

9.10.1.6 For curing of concrete in floors, flat roofs or other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by Engineer. Special attention shall be given to edges and corners of the slabs to ensure proper protection to these areas. The ponded areas shall be kept continuously filled with water during the curing period.

9.10.1.7 Curing Equipment:

All equipment and materials required for curing shall be on hand and ready for use before
protecting fresh concrete:

9.10.2 Protecting fresh concrete:

9.10.2.1 Fresh concrete shall be protected from the elements, from defacements and damage due to construction operations by leaving forms in place for an ample period. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer shall also be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion or contact with other materials etc. that may impair the strength and / or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that workmen enter the area of freshly placed concrete, Engineer may require that bridges be placed over the area.

9.10.3 Repair and replacement of unsatisfactory concrete

9.10.3.1 Immediately after the shuttering is removed, the surface of concrete shall be very carefully gone over and all defective areas called to the attention of Engineer who may permit patching of the defective areas or also reject the concrete unit either partially or in its entirely. Rejected concrete shall be removed and replaced by Contractor at no additional expense to Owner.

9.10.3.2 Holes left by form bolts etc. shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing 2.36 mm IS sieve after removing any loose stones adhering to the concrete. Mortar filling shall be struck off flush at the face of the concrete. Concrete surfaces shall be finished as described under the particular items of work.

9.10.3.3 Superficially honeycombed surfaces and rough patches shall be similarly made good immediately after removal of shuttering, in the presence of Engineer and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by Engineer, the surface of the exposed concrete placed against shuttering to remove fine or other irregularities, care being taken to avoid damaging the surface. Surface irregularities shall be removed by grinding.

9.10.3.4 If reinforcement is exposed or the honey combing occurs at vulnerable positions e.g. ends of beams or columns it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer shall be final in this regard.

9.10.3.5 If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25 mm) the edges being cut perpendicular to the affected surface or with a small under cut if possible. Anchors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place.

9.10.3.6 An area extending several centimeters beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

9.10.3.7 Use of Polymers:

The use of polymers for bonding fresh concrete used for repairs will be permitted upon written approval of Engineer In-Charge. Polymers shall be applied in strict accordance with the instruction of the manufacturer.

9.10.3.8 Method of Repair:

Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form bolts, grout insert holes and slots cut for repair of cracks shall be
repaired as follows:

1. The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops. A 5 mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched followed immediately by the patching concrete which shall be well consolidated with a wooden float and left slightly proud of the surrounding surface. The concrete patch shall be built up in 10 mm thick layers. After an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and a smooth finished obtained by wiping with hessian, a steel trowel shall be used for this purpose. The mix for patching shall be of the same materials and in the same proportions as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

9.10.3.9 Curing of Patched Work

The patched area shall be covered immediately with an approved non-staining, water-saturated material such as gunny bags which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by a fine spray, or sprinkling for not less than 10 days.

9.10.3.10 Approval by Engineer:

All materials, procedures and operations used in the repair of concrete and also the finished repair work shall be subject to the approval of Engineer. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and dried.

9.10.4 Finishing:

9.10.4.1 This Specification is intended to cover the treatment of concrete surfaces of all structures. Areas requiring special finish not covered by this Specification shall be clearly indicated on the Drawings and special Specifications shall be furnished.

9.10.4.2 Finish for Formed Surfaces and Exposed Concrete

- Surfaces which will be exposed to the weather and which would normally be level shall be sloped for drainage. Unless the Drawing specifies a horizontal surface or shows the slope required, the tops of narrow surfaces such as stair treads, walls, curbs and parapets shall be sloped across the width approximately 1 in 30.

- A smooth finish shall be obtained with the use of lined or plywood forms having smooth and even surfaces and edges. Panels and form linings shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, projections, etc. removed leaving the surfaces reasonably smooth and unmarred.

9.10.5 Protection

9.10.5.1 All concrete shall be protected against damage until final acceptance by Engineer / Owner.

9.11 Formwork

9.11.1 The formwork shall consist of shores, bracings, sides of beams and columns, bottom of slabs including ties, anchors, hangers, inserts and shall be properly designed and planned for the work. False work shall be so constructed that vertical adjustments can be made to compensate for take up and settlements. Wedges may be used at the top or bottom of timber shores, but not at both ends, to facilitate vertical adjustment or dismantling of the formwork.
9.11.2 Design of formwork

9.11.2.1 The design and engineering of the formwork as well as its construction shall be the responsibility of Contractor. If so instructed, the Drawings and/or calculations for the design of the formwork shall be submitted to Engineer In-Charge for approval before proceeding with work, at no extra cost to Owner. Engineer's approval shall not however relieve Contractor of the full responsibility for the design and construction of the formwork. The design shall take into account all the loads vertical as well as lateral, that the forms will be carrying including live and vibration loadings.

9.11.3 Camber

Suitable camber shall be provided in horizontal members of structure, especially in cantilever spans to counteract the effect of deflection. The formwork shall be so assembled as to provide for camber. The camber for beams and slabs shall be 4 mm per metre (1 to 25) or as directed by the Engineer, so as to offset the subsequent deflection. For cantilevers the camber at free end shall be 1/50th of the projected length or as directed by the Engineer.

9.11.4 Tolerances

9.11.4.1 Tolerance is specified as permissible variation from lines, grade or dimensions given in Drawings. No tolerances specified for horizontal or vertical building lines or footings shall be construed to permit encroachment beyond the legal boundaries. Unless otherwise specified, the following tolerances will be permitted.

9.11.4.2 Tolerances in Concrete Structures

1. All Structures
   • Variation of the constructed linear outline from established position in plan.
     In 5 m - 10 mm
     In 10 m or more - 15 mm
   • Variations of dimensions to individual structure features from established positions.
     In 20 m or more - 25 mm
     In buried construction - 50 mm
   • Variation from plumb, from specified batter or from curved surfaces of all structures.
     In 2.5 m - 10 mm
     In 5 m - 15 mm
     In 10 m or more - 25 mm
     In buried-construction - Twice the above amounts
   • Variation from level or grade indicated on Drawings in slab, beams, soffits, horizontal groves and visible arises.
     In 2.5 - 5 mm
     In 7.5 m or more - 10 mm
     In buried-construction - Twice the above amounts
   • Variation in cross-sectional dimensions of columns beams, buttresses, piers and similar members.
     Minus - 5 mm
     Plus - 10 mm
   • Variation in the thickness of slabs, walls, arch sections and similar members
     Minus - 5 mm
     Plus- - 10 mm

2. Footing for columns, piers, walls, buttresses and similar members
   • Variation of dimensions in plan
     Minus - 10 mm
     Plus - 50 mm
   • Misplacement or eccentricity
     2% of footing width in the direction of misplacement but not more than 50 mm.
• Reduction in thickness
  5% of specified thickness subject to a max. of 50 mm.

9.11.5 Type of formwork

9.11.5.1 Formwork may be of plywood and metal. For special finishes the formwork may be lined with plywood, steel sheets, oil tempered hard board, etc. Sliding forms and slip forms may be used with the approval of Engineer.

9.11.6 Formwork requirements

9.11.6.1 Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the Drawings. Ample studs, walers, braces, ties, straps, shores, etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete has set sufficiently to permit removal of the form. In special cases where form vibrators are to be used, the shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete. Faces coming in contact with the concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water and fine material from concrete.

9.11.6.2 Plywood shall be used for Exposed Concrete surfaces; where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surfaces which are to be rubbed finished shall be planned to remove irregularities or unevenness in the face. Formwork with linings will be permitted.

9.11.6.3 All new and used form lumber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form lumber unsatisfactory in any respect shall not be used and; if rejected by Engineer, shall be removed from the site.

9.11.6.4 Shores supporting successive stories shall be placed directly over those below or be so designed and placed that the load will be transmitted directly on to them Truss supports shall be provided for shores that cannot be secured on adequate foundations.

9.11.6.5 Formwork, during any stage of construction showing signs of distortion or distorted to such a degree that the intended concrete work will not conform to the exact contours indicated on the Drawings, shall be repositioned and strengthened. Poured concrete affected by the faulty formwork, shall be removed in its entirety and the formwork corrected prior to placing new concrete.

9.11.6.6 Excessive construction camber to compensate for shrinkage settlement, etc. that may impair the structural strength of members will not be permitted.

9.11.6.7 Forms for substructure concrete may be omitted when, in the opinion of Engineer the open excavation is firm enough to act as the form. Such excavations shall be slightly larger than required by the Drawings to compensate for irregularities in excavation and to ensure the design requirements.

9.11.6.8 Forms shall be so designed and constructed that their removal will not damage the concrete. Face formwork shall provide true vertical and horizontal joints, conform to the architectural features of the structure as to location of joints and be as directed by Engineer.

9.11.6.9 Where Exposed smooth or rubbed concrete finishes are required, the forms shall be constructed with special care so that the resulting concrete surfaces require a minimum finish.

9.11.7 Bracing, struts and props
9.11.7.1 Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials. Bamboo shall not be used as props or cross bearers.

9.11.7.2 The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Reproping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated to be in excess of the design load. Vertical props shall be supported on wedges or other measures shall be take whereby the props can be gently lowered vertically while striking the shuttering.

9.11.7.3 If the shuttering for a column is erected for the full height of the column, one side shall be left open and built up in sections as placing of concrete proceeds, or windows may be left for pouring concrete from the sides to limit the drop of concrete to 1.0 M or as directed by Engineer.

9.11.8 Mould oil

9.11.8.1 Care shall be taken to see that the faces of form-work coming in contact with concrete are perfectly cleaned and two coats of mould oil or any other approved materials applied before fixing reinforcement and placing concrete. Such coating shall be insoluble in water, non-staining and not injurious to the concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and / or other items to be cast in the concrete shall not be placed until coating of the forms is complete. Adjoining concrete surfaces shall also be protected against contamination from the coating materials.

9.11.9 Chamfers and fillets

9.11.9.1 All corners and angles exposed in the finished structure shall be formed with mouldings to form chamfers or fillets on the finished concrete. The standard dimensions of chamfers and fillets, unless otherwise specified, shall be 20 mm X 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the moulding shall be planed or surfaced to the same texture as the forms to which it is attached.

9.11.10 Vertical construction joint chamfers

9.11.10.1 Vertical construction joints on faces which will be exposed at the completion of the work shall be chamfered as above except where not permitted by Engineer for structural or hydraulic reasons.

9.11.11 Reuse of forms

9.11.11.1 Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary, repaired and the inside retreated to prevent adhesion, to the satisfaction of Engineer. Warped lumber shall be resized. Contractor shall equip himself / herself with enough shuttering to complete the job in the stipulated time.

9.11.12 Removal of forms

9.11.12.1 Contractor shall record on the Drawing or on a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed therefrom.

9.11.12.2 In no circumstances shall forms be struck until the concrete reaches strength of at least twice the stress due to self weight and any construction / erection loading to which the concrete may be subjected at time of striking formwork.

9.11.12.3 Informal circumstances (generally where temperatures are above 20°C) forms may be struck after expiry of the following periods:
<table>
<thead>
<tr>
<th>Item</th>
<th>Ordinary Portland cement concrete</th>
<th>Rapid hardening Portland cement concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Walls, columns and vertical sides of beams</td>
<td>24 to 48 hours or as directed by the Engineer</td>
<td>24 hours</td>
</tr>
<tr>
<td>2. Slabs (props left under)</td>
<td>3 days</td>
<td>2 days</td>
</tr>
<tr>
<td>3. Beam soffits (Props left under)</td>
<td>7 days</td>
<td>4 days</td>
</tr>
<tr>
<td>4. Removal of props to slabs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Spanning upto 4.5 m</td>
<td>7 days</td>
<td>4 days</td>
</tr>
<tr>
<td>• Spanning over 4.5 m</td>
<td>14 days</td>
<td>8 days</td>
</tr>
<tr>
<td>5. Removal of props to beams &amp; arches:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Spanning upto 6 m.</td>
<td>14 days</td>
<td>8 days</td>
</tr>
<tr>
<td>• Spanning over 6 m.</td>
<td>21 days</td>
<td>12 days</td>
</tr>
</tbody>
</table>

9.11.12.4 Striking shall be done slowly with utmost care to avoid damage to arises and projections and without shock or vibration, by gently easing the wedges. If after removing the formwork, it is found that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

9.11.12.5 Reinforced temporary openings shall be provided, as directed by Engineer, to facilitate removal of formwork which otherwise may be inaccessible.

9.11.12.6 Tie rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structures shall be loosened neither sooner than 24 hours nor later than 40 hours after the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time. Ties, withdrawn from walls and grade beams shall be pulled toward the inside face. Cutting ties back from the faces of walls and grade beams will not be permitted.

9.11.12.7 For liquid retaining structures no sleeves for through bolts shall be used nor shall through bolts be removed as indicated in **Specification.** The bolts, in this case, shall be cut at 25 mm depth from the surface and then the hole shall be made good by sand cement mortar of the same proportions as the concrete just after striking the formwork.

9.12 **Foundation Bedding, Bonding and Jointing**

9.12.1 All surfaces upon or against which concrete will be placed shall be suitably prepared by thoroughly cleaning, washing and dewatering, as may be indicated in the plans or as Engineer, may direct, to meet the various situations encountered in the work.

9.12.2 Soft or spongy areas shall be cleaned out and back filled with either a soil-cement mixture, lean concrete or clean sand fill compacted to a minimum density of 90% Modified Proctor, unless otherwise mentioned in Schedule of Quantities.

9.12.3 Prior to construction of formwork for any item where soil will act as bottom form, approval shall be obtained from Engineer as to the suitability of the soil.

9.12.4 Preparation of earth strata of foundations

9.12.4.1 All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft, yielding soil shall be removed and replaced with suitable earth well compacted as directed by Engineer. Where specified, lean concrete shall be provided on the earth stratum for receiving concrete. The surface of absorptive soils against which concrete is to be placed shall be moistened thoroughly so that no moisture will be drawn from the freshly placed concrete and later shall help to cure the concrete.
9.12.5 Preparation of concrete surfaces

9.12.5.1 The preparation of concrete surfaces upon which additional concrete is to be placed later, shall preferably be done by scarifying and cleaning while the concrete is between its initial and final set. This shall consist of cutting the surface with picks and stiff brooms and by use of an approved combination of air and water jet as directed by Engineer. Great care shall be taken in performing this work to avoid removal of too much mortar and the weakening of the surface by loosening of aggregate.

9.12.5.2 It shall be a pitted surface from which all dirt, unsound concrete, laitance and glazed mortar have been removed.

9.12.6 Bonding Treatment (Mortar)

9.12.6.1 The required concrete surfaces have been scarified, cleaned and wetted as specified herein; they shall receive a bonding treatment, immediately before placement of the concrete.

9.12.6.2 The bonding medium shall be a coat of cement-sand mortar. The mortar shall have the same cement-sand proportions as the concrete which shall be placed on it. The water-cement ratio shall be determined by placing conditions and as approved by Engineer.

9.12.6.3 Bonding mortar shall be placed in sufficient quantity to completely cover the surface about 10 mm thick for rock surface and about 5 mm thick for concrete surfaces. It shall be brushed or broomed over the surface and worked thoroughly into all cracks, crevices and depressions. Accumulations or puddles of mortar shall not be allowed to settle in depressions and shall be brushed out to a satisfactory degree, as determined by Engineer.

9.12.6.4 Mortar shall be placed at such a rate that it can be brushed over the surface just in advance of placement of concrete. Only as much area shall be covered with mortar as can be covered with concrete before initial set in the mortar takes place. The amount of mortar that will be permitted to be placed at any one time, on the area which it is to cover, shall be in accordance with Engineer's directions.

9.12.7 Cleaning and bonding formed construction joints

9.12.7.1 Vertical construction joints shall be cleaned as specified above or by other methods approved by Engineer. In placing concrete against formed construction joints, the surface of the joints, where accessible, shall be coated thoroughly with the specified bed-joint bonding mortar immediately before they are covered with concrete or by scrubbing with wire brooms dipped into the fresh concrete. Where it is impracticable to apply such a mortar coating, special precautions shall be taken to ensure that the new concrete is brought into intimate contact with the surface of the joint by careful puddling and spading with aid of vibrators and suitable tools.

9.12.8 Expansion and contraction joints

9.12.8.1 Provision shall be made for expansion and contraction in concrete by use of special type joints at locations as directed by Engineer.

9.12.9 Hot weather requirement.

9.12.9.1 All concrete work performed in hot weather shall be in accordance with IS: 456 except as herein modified.

9.12.9.2 Admixtures may be used only when approved by Engineer.
9.12.9.3 Adequate provisions shall be made to lower concrete temperatures by cool ingredients, eliminating excessive mixing, preventing exposure of mixers and conveyors to direct sunlight and the use of reflective paints on mixers, etc. The temperature of the freshly placed concrete shall not be permitted to exceed 38°C.

9.12.9.4 In order to reduce loss of mixing water, the aggregates, wooded forms, subgrade, adjacent concrete and other moisture absorbing surfaces shall be well wetted prior to concreting. Placement and finishing shall be done as quickly as possible.

9.12.9.5 Extra precautions shall be taken for the protection and curing of concrete. Consideration shall be given to continuous water curing and protection against high temperatures and drying hot winds for a period of at least 7 days immediately after concrete has set and after which normal curing procedures may be resumed.

9.13 Slots, Openings, etc.

9.13.1 Slots, openings or holes, pockets etc. shall be provided in the concrete work in the positions indicated in the Drawings or as directed by Engineer. Any deviation from the approved Drawings shall be made good by Contractor at his own expense, without damaging any other work. Sleeves, bolts, inserts, etc. shall also be provided in concrete work where so specified.

9.14 Inspection

9.14.1 All materials, workmanship and finished construction shall be subject to the continuous inspection and approval of Engineer.

9.14.2 All materials supplied by Contractor and all work or construction performed by Contractor rejected as not in conformance with the Specifications and Drawings, shall be immediately replaced at no additional expense to the Owner.

9.14.3 Approvals of any preliminary materials or phase or work shall in no way relieve the Contractor from the responsibility of supplying concrete and or producing finished concrete in accordance with the Specifications and Drawings.

9.14.4 All concrete shall be protected against damage until final acceptance by Engineer or his representative.

9.15 Clean-up

9.15.1 Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris resulting from the work shall be removed from the premises.

9.15.2 All debris i.e. empty containers, scrap wood, etc. shall be removed to "dump" daily or as directed by Engineer.

9.15.3 The finished concrete surfaces shall be left in a clean condition satisfactory to Engineer.

9.16 Preparation of Mortars and its Grade

9.16.1 Grade of Masonry Mortar

9.16.1.1 The grade of masonry mortar will be defined by its compressive strength in N/mm² at the age of 28 days as determined by the standard procedure detailed in IS: 2250-1981.

9.16.1.2 Proportioning

The ingredient in specified proportions shall be measured using boxes of suitable sizes. Sand and pozzolanic material shall be measured on basis of their dry volume.
9.16.2 Cement Mortar

9.16.2.1 This shall be prepared by mixing cement and sand with or without the addition of Pozzolana as specified.

9.16.2.2 Proportioning

Cement bag weighting 50 kg shall be taken as 0.035 cubic metres. Other ingredients in specified proportion shall be measured using boxes of size 40 X 35 X 25 cm. Sand shall be measured on the basis of its dry volume.

9.16.2.3 Mixing

The mixing of mortar shall be done manually. The Contractor shall take permission of the Engineer in writing before the commencement of the work.

Hand Mixing: The measured quantity of sand shall be leveled on a clean masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture is of a uniform colour. The quantity of dry mix which can be used within 30 minutes shall then be mixed in a masonry trough with just sufficient quantity of water to bring the mortar to a stiff plaster of necessary working consistency.

9.16.2.4 Precautions

Mortar shall be used as soon as possible after mixing and before it begins to set, and in any case within half hour, after the water is added to the dry mixture.

9.17 Rate & Payment

9.17.1 The contract BOQ item rates shall inclusive of all the operations described above.

10. PRECAST CONCRETE

10.1 The specification for precast concrete will be exactly similar as for the cast-in-situ concrete.

10.1.1 Precast concrete shall comply with IS:456 and with the following requirements:

10.1.1.1 All precast units shall be cast on a suitable bed or platform with firm foundation and free from wind.

10.1.1.2 The Contractor shall be responsible for accuracy of the level or shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.

10.1.2 Striking Forms

10.1.2.1 Side shutters shall not be struck in less than 24 hours after depositing concrete and no precast unit shall be lifted until the concrete reaches strength of at least twice the stress to which the concrete may be subjected to at the time of lifting.

10.1.3 Precast Units

10.1.3.1 The lifting and removal of precast units shall be undertaken without causing shock, vibration or undue bending. The Contractor shall satisfy the Engineer or his representative that the methods proposed to be adopted for these operations will not over-stress or otherwise affect seriously the strength of the precast units. The reinforced side of the units shall be distinctly marked.
10.1.4 Curing

10.1.4.1 All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during that period each unit shall be kept constantly watered or preferably be completely immersed in water if the size of the unit so permits. Otherwise curing practice as given in Specification shall be followed.

10.2 Rate & Payment

10.2.1 The rate for precast units shall include the necessary covered area, construction and maintenance of casting beds /yard, all materials, transport, labour and equipment including proper handling devices for erection of the units, formwork, cutting bending placing and fixing in position of reinforcement, mixing placing and compacting of concrete of specified grade, removal of forms, handling and erection of the units after they attain the proper strength, placing and fixing them in position, joining the units with mortar / concrete and sealing as per details shown for the type of unit. Where there are embedments / fixtures shown in the drawing, the rate would include them also.

Reinforcement and structural steel for framing shall be paid extra, measurements being done as per BOQ items.

11. BRICK MASONRY

11.1 Description

11.1.1 This work shall consist of construction of structures with bricks jointed together by cement mortar in accordance with the details shown on the Drawings or as approved by the Engineer.

11.2 Applicable Codes

11.2.1 The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to:

<table>
<thead>
<tr>
<th>IS number</th>
<th>Specification</th>
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<tbody>
<tr>
<td>IS - 1077</td>
<td>Specifications for common burnt clay building bricks</td>
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<td>Measurements for Building works</td>
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<td>IS - 1725</td>
<td>Specifications for solid cement blocks used in general building construction</td>
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<td>IS - 2222</td>
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<td>IS - 4441</td>
<td>Code of practice for use of silicate type chemical resistant mortars.</td>
</tr>
<tr>
<td>IS - 4442</td>
<td>Code of practice for use of sulphur type chemical resistant mortars</td>
</tr>
</tbody>
</table>

11.2.2 Others I.S. Codes not specifically mentioned here but pertaining to the use of bricks for structural purposes form part of these Specifications.

11.3 Materials

11.3.1 All materials to be used in the work shall conform to the requirements laid down in Specification.
11.4 Personnel

11.4.1 Only experienced personnel shall be employed for construction and supervision.

11.5 Cement Mortar

11.5.1 Cement and sand shall be mixed in specified proportions given in the Drawings. Cement shall be proportioned by weight, taking the unit weight of cement as 1.44 tonne per cubic metre. Sand shall be proportioned by volume taking into account due allowance for bulking. All mortar shall be mixed with a minimum quantity of water to produce desired workability consistent with maximum density of mortar. The mix shall be clean and free from injurious type of soil/acid/alkali/organic matter or deleterious substances.

11.5.2 The mixing shall preferably be done in a mechanical mixer operated manually or by power. Hand mixing can be resorted to as long as uniform density of the mix and its strength are assured subject to prior approval of the Engineer. Where permitted by the Engineer, Hand mixing operation shall be carried out on a clean water-tight platform, where cement and sand shall be first mixed dry in the required proportion by being turned over and over, backwards and forwards several times till the mixture is of uniform colour. Thereafter, minimum quantity of water shall be added to bring the mortar to the consistency of a stiff paste. The mortar shall be mixed for at least two minutes after addition of water.

11.5.3 Mortar shall be mixed only in such quantity as required for immediate use. The mix which has developed initial set shall not be used. Initial set of mortar with ordinary Portland Cement shall normally be considered to have taken place in 30 minutes after mixing. In case the mortar has stiffened during initial setting time because of evaporation of water, the same can be re-tempered by adding water as frequently as needed to restore the requisite consistency, but this re-tempering shall not be permitted after 30 minutes. Mortar unused for more than 30 minutes shall be rejected and removed from site of work.

11.6 Soaking of Bricks

11.6.1 All bricks shall be thoroughly soaked in a tank filled with water for a minimum period of one hour prior to being laid. Soaked bricks shall be removed from the tank sufficiently in advance so that they are skin dry at the time of actual laying. Such soaked bricks shall be stacked on a clean place where they are not contaminated with dirt, earth, etc.

11.7 Joints

11.7.1 The thickness of joints shall not exceed 10 mm. All joints on exposed faces shall be tooled to give concave finish.

11.8 Laying

11.8.1 All brickwork shall be laid in an English bond, even and true to line, in accordance with the Drawing or as directed by the Engineer, plumb and level and all joints accurately kept. Half and cut bricks shall not be used except when necessary to complete the bond. Closer in such cases shall be cut to the required size and used near the ends of the walls. The bricks used at the face and also at the angles forming the junction of any two walls shall be selected whole bricks of uniform size, with true and rectangular faces.

11.8.2 All bricks shall be laid with frogs up on a full bed of mortar except in the case of tile bricks. Each brick shall be properly bedded as set in position by slightly pressing while laying, so that the mortar gets into all their surface pores to ensure proper adhesion. All head and side joints shall be completely filled by applying sufficient mortar to brick already placed and on brick to be placed. All joints shall be properly flushed and packed with mortar so that no hollow spaces are left. No bats or cut bricks shall be used except to obtain dimensions of the different courses for specified bonds or wherever a desired shape so requires.
11.8.3 The brick work shall be built in uniform layers, and for this purpose wooden straight edge with graduations indicating thickness of each course including joint shall be used. Corners and other advanced work shall be raked back. Brickwork shall be done true to plumb or in specified batter. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. Vertical joints in alternate courses shall come directly one over the other. During construction, no part of work shall rise more than one metre above the general construction level, to avoid unequal settlement and improper jointing. Where this is not possible in the opinion of the Engineer, the works shall be raked back according to the bond (and not toothed) at an angle not steeper than 45 degrees with prior approval of the Engineer. Toothing may also be permitted where future extension is contemplated.

11.8.4 Before laying bricks in foundation, the foundation slab shall be thoroughly hacked, swept clean and wetted. A layer of mortar not less than 12 mm thick shall be spread on the surface of the foundation slab and the first course of bricks shall be laid.

11.9 Jointing Old and New Work

11.9.1 Where fresh masonry is to join the masonry that is partially/entirely set, the exposed jointing surface of the set masonry shall be cleaned, roughened and wetted, so as to effect the best possible bond with the new work. All loose bricks and mortar or other material shall be removed.

11.9.2 In the case of vertical or inclined joints, it shall be further ensured that proper bond between the old and new masonry is obtained by interlocking the bricks. Any portion of the brickwork that has been completed shall remain undisturbed until thoroughly set.

11.9.3 In case of sharp corners especially in skew bridges, a flat cutback of 100 mm shall be provided so as to have proper and bonded laying of bricks.

11.10 Curing

11.10.1 Green work shall be protected from rain by suitable covering and shall be kept constantly moist on all faces for a minimum period of seven days. Brick work carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period. Top of the masonry work shall be left flooded with water at the close of the day. Watering may be done carefully so as not to disturb or wash out the green mortar.

11.10.2 During hot weather, all finished or partly completed work shall be covered or wetted in such a manner as will prevent rapid drying of the brickwork.

11.10.3 During the period of curing of brick work, it will be suitably protected from all damages. At the close of day’s work or for other period of cessation, watering and curing shall have to be maintained. Should the mortar perish i.e., become dry, white or powdery, through neglect of curing, work shall be pulled down and rebuilt as directed by the Engineer. It any stains appear during watering, the same shall be removed from the face.

11.11 Scaffolding

11.11.1 The Scaffolding shall be sound, strong and safe to withstand all loads likely to come upon it. The holes which provide resting space for horizontal members shall not be left in masonry under one metre in width or immediately near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled with dense concrete and made good. Scaffolding shall be got approved by the Engineer. However, the Contractor shall be responsible for its safety.
11.12.1 All tools and equipment used for mixing, transporting and laying of mortar and bricks shall be clean and free from set mortar, dirt or other injurious foreign substances.

11.13 Finishing of Surfaces

11.13.1 General

11.13.1.1 All brickwork shall be finished in a workmanlike manner with the thickness of joints, manner of striking or tooing as described in these above Specifications.

11.13.1.2 The surfaces can be finished by "joining" or "pointing" or by "plastering" as given in the Drawings.

11.13.1.3 For a surface which is to be subsequently plastered or pointed, the joints shall be squarely raked out to a depth of 15 mm, while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

11.13.1.4 The mortar for finishing shall be prepared as per Specification.

11.13.2 Jointing

11.13.2.1 In jointing, the face of the mortar shall be worked out while still green to give a finished surface flush with the face of the brick work. The faces of brick work shall be cleaned to remove any splashes of mortar during the course of raising the brick work.

11.13.3 Pointing

11.13.3.1 Pointing shall be carried out using mortar not leaner than 1:3 by volume of cement and sand or as shown on the Drawing. The mortar shall be filled and pressed into the raked joints before giving the required finish. The pointing shall be ruled type for which it shall, while still green, be ruled along the centre with half round tools of such width as may be specified by the Engineer. The super flush mortar shall then be taken off from the edges of the lines and the surface of the masonry shall be cleaned of all mortar. The work shall conform to IS: 2212.

11.13.4 Plastering

11.13.4.1 Plastering shall be done where shown on the Drawing. Superficial plastering may be done, if necessary, only in structures situated in fast following rivers or in severely aggressive environment.

11.13.4.2 Plastering shall be started from top and worked down. All putlog holes shall be properly filled in advance of the plastering while the scaffolding is being taken down. Wooden screeds 75 mm wide and of the thickness of the plaster shall be fixed vertically 2.5 to 4 meters apart, to act as gauges and guides in applying the plaster. The mortar shall be laid on the wall between the screeds using the plaster's float and pressing the mortar so that the raked joints are properly filled. The plaster shall be finished off with a wooden straight edge reaching across the screeds. The straight edge shall be worked on the screeds with a small upward and sideways motion 50 mm to 75 mm at a time. Finally, the surface shall be finished off with a plasterer's wooden float. Metal floats shall not be used.

11.13.5 When recommencing the plastering beyond the work suspended earlier, the edges of the old plaster shall be scrapped, cleaned and wetted before plaster is applied to the adjacent areas.

11.13.5.1 No portion of the surface shall be left unfinished for patching up at a later period.

11.13.5.2 The plaster shall be finished true to plumb surface and to the proper degree of smoothness as directed by the Engineer.
11.13.5.3 The average thickness of plaster shall not be less than the specified thickness. The minimum thickness over any portion of the surface shall not be less than the specified by more than 3 mm.

11.13.5.4 Any cracks which appear in the surface and all portions which should hollow when tapped, or are found to be soft or otherwise defective, shall be cut in rectangular shape and re-done as directed by the Engineer.

11.13.6 Curing of Finishes

11.13.6.1 Curing shall be commenced as soon as the mortar used for finishing has hardened sufficiently not to be damaged during curing. It shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages.

11.13.7 Scaffolding for Finishes

11.13.7.1 Stage scaffolding shall be provided for the work. This shall be independent of the structure.

11.14 Acceptance of Work

11.14.1 All work shall be true to the lines and levels as indicated on the Drawing or as directed by the Engineer, subject to tolerances as indicated in these Specifications.

11.14.2 Mortar cubes shall be tested in accordance with IS: 2250 for compressive strength, consistency of mortar and its water retentivity. The frequency of testing shall be one sample for every 2 cubic metres of mortar, subject to a minimum 3 samples for a day’s work.

11.14.3 In case of plaster finish, the minimum surface thickness shall not be less than the specified thickness by more than 3 mm.

11.15 Rate & Payment

11.15.1 The contract BOQ item rates shall inclusive of all the operations described above.

12. FLOORING

12.1 Scope

12.1.1 These specifications cover the general requirements of different kinds of floor finishes.

12.2 Brick Soling

12.2.1 Where brick soling is required to be provided, it shall be conform to the following specifications:

It shall either be flat or be laid on edge of the bricks touching each other as per item. Soling where specified in two layers, the line of joints in the bottom layer shall cross those in the top layer. Soling shall be closely packed leaving no interstices or gaps. The interstices to be filled with fine sand and shall be sprayed with water. If crevices appeared between two bricks after spraying with water it shall be mended again by spreading fine sand. Wherever floor concrete is coming on soling, building paper (polythene sheets) is to be laid to receive the concrete.

12.3 Cement Concrete Flooring
12.3.1 The nominal total thickness of floor finish of cement concrete flooring shall be 50 mm or 40 mm, i.e. under-bed & topping. The floor shall be laid on an already laid matured cement concrete base.

12.3.2 Cement Concrete

12.3.2.1 Cement concrete of specified mix shall be used and it shall generally conform to the specifications described in materials for structures.

12.3.3 Base Concrete

12.3.3.1 Flooring shall be laid on base concrete where so provided. The base concrete shall be provided with the slopes required for the flooring. Flooring in verandah, courtyard, kitchens and baths shall have slope ranging from 1:48 to 1:60 depending upon location and as decided by the Engineer. Floors in water closet portion shall have slope of 1:30 or as decided by the Engineer to drain off washing water. Plinth masonry offset shall be depressed so as to allow the base concrete to rest on it.

12.3.3.2 If the base is of lean cement concrete, the flooring shall be commenced preferably within 48 hours of the laying of base concrete. The surface of the base shall be roughened with steel wire brushes without disturbing the concrete. Immediately before laying the flooring, the base shall be wetted and a coat of cement slurry at not more than 2 kg of cement spread over an area of one sqm so as to get a good bond between the base and concrete floor.

12.3.3.3 If the cement concrete flooring is to be laid directly on the RCC slab, the top surface of RCC slab shall be cleaned and the laitance shall be removed and a coat of cement slurry at not more than 2 kg of cement spread over an area of one sqm so as to get a good bond between the base and concrete floor shall be applied.

12.3.4 Thickness

12.3.4.1 The thickness of floor shall be as specified in the description of the item.

12.3.5 Laying

12.3.5.1 Panels

12.3.5.2 Flooring of specified thickness shall be laid in the pattern including the border as given in the drawings or as directed by the Engineer. The border panels shall not exceed 450 mm in width and the joints in the border in line with panel joints. The panels shall be of uniform size and no dimension of a panel shall exceed 2m and the area of a panel shall not be more than 2 sqm.

12.3.5.3 Laying of Flooring with Strips

1) Normally cement concrete flooring shall be laid in one operation using glass/ plain asbestos/ aluminium/ PVC/ brass strips or any other strips as required as per drawing or instructions of the Engineer at the junction of two panels. This method ensures uniformity in colour of all the panels and straightness at the junction of the panels. 4 mm thick glass strips or 5 mm thick plain asbestos sheet, 2 mm PVC strips or 2 mm aluminium or brass strips shall be fixed with their tops at proper level, giving required slopes. Cost of providing and fixing strips shall be paid for separately.

2) Concreting
Cement concrete shall be placed in the panels and be levelled with the help of straight edge and trowel. The blows shall be fairly heavy in the beginning but as consolidation takes place light rapid strokes shall be given. Beating shall cease as soon as the surface is found covered with a thin layer of cream of mortar. The evenness of the surface shall be tested with straight edge and made true to required slopes. While laying concrete, care shall be taken to see that the strips are not damaged/ disturbed by the labourers. The tops of strips shall be visible clearly after finishing with cement slurry.

Laying of Flooring without Strips

Laying of cement concrete flooring in alternate panels may be allowed by the Engineer in case strips are not to be provided.

1) Shuttering

The panels shall be bounded by angle iron or flats. The angle iron/ flat shall have the same depth as the concrete flooring. These shall be fixed in position, with their top at proper level giving required slopes. The surface of the angle iron or flats to come in contact with concrete shall be smeared with soap solution or non-sticking oil (form oil or raw linseed oil) before concreting. The flooring shall butt against the unplastered masonry wall.

2) Concreting

The concreting shall be done in the manner described under relevant clauses. The angle iron/ flats used for shuttering shall be removed on the next day of the laying of cement concrete. The ends thus exposed shall be repaired, if damaged with cement mortar 1:2 (1 cement : 2 coarse sand) and allowed to set for minimum period of 24 hours. The alternate panels shall then be cleaned of dust, mortar, droppings etc. and concrete laid. While laying concrete, care shall be taken to see that the edges of the previously laid panels are not damaged and fresh mortar is not splashed over them. The joints between the panels shall come out as fine straight lines.

12.3.6 Finishing

12.3.6.1 The finishing of the surface shall follow immediately after the cessation of beating. The surface shall be left for some time till moisture disappears from it or surplus water can be mopped up. Use of dry cement or cement and sand mixture sprinkled on the surface to stiffen the concrete or absorb excessive moisture shall not be permitted. Excessive trowelling shall be avoided.

12.3.6.2 Fresh cement shall be mixed with water to form thick slurry and spread at the rate of not more than 2 kg of cement over an area of one sqm of flooring while the flooring concrete is still green. The cement slurry shall then be properly processed and finished smooth.

12.3.6.3 The edges of sunk floors shall be finished and rounded with cement with a floating coat of neat cement.

12.3.6.4 The junctions of floor with wall plaster, dado or skirting shall be rounded off where so specified.

12.3.6.5 The men engaged for finishing operations shall be provided with raised wooden platform to sit on, so as to prevent damage to new work.

12.3.7 Curing
12.3.7.1 Curing shall be done for a minimum period of ten days. Curing shall not be commenced until the top layer has hardened. Covering with empty gunnies shall be avoided as the colour of the flooring is likely to be bleached due to the remnants of cement dust from the bags.

12.3.8 Precautions

12.3.8.1 Flooring in lavatories and bath room shall be laid only after fixing of water closet and squatting pans and floor traps. Traps shall be plugged while laying the floors and opened after the floors are cured and cleaned. Any damage done to WC’s, squatting pans and floor traps during the execution of work shall be made good.

12.3.8.2 During cold weather, concreting shall not be done when the temperature falls below 40°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work re-done. During hot weather, precautions shall be taken to see that the temperature of wet concrete does not exceed 38°C. No concreting shall be laid within half an hour of the closing time of the day, unless permitted by the Engineer. To facilitate rounding of junction of skirting, dado and floor, the skirting/dado shall be laid along with the border or adjacent panels of floor.

12.3.9 Measurement

12.3.9.1 Measurement shall be made as per finished dimensions of the areas where work has been completed. The length and breadth shall be measured in centimeters and be rounded off to the nearest centimeter. The area calculated shall be in sqm and rounded off to the nearest sqm.

12.4 Rate & Payment

The rate shall include the cost of all materials and labour involved in all the operations described above including application of cement slurry on RCC slab or on base concrete including roughening and cleaning the surface and the cost of strips.

The contract BOQ item rates shall inclusive of all the operations described above.

13. GROUTING

13.1 Scope

This section of the specification deals with the requirements of furnishing and placement of grout in pockets and foundation bolt holes and underpinning of base plates.

13.2 General Requirements

The space between the top surface of the foundation and the underside of the base plate shall be filled with appropriate grout.

Crushing strength of grout shall be one grade higher than the foundation concrete. Minimum crushing strength shall be 25 N/mm² unless otherwise specified.

The contact area between the grout and base plate shall not be less than 80%.

13.3 Material

Cement shall be Ordinary Portland Cement conforming to IS :269 /8112 / 12269.

Sand shall be clean and well graded conforming to IS 383. For flowable grout, sand conforming to zone-4 grade shall be used.
Clean potable water as recommended for concrete mix shall be used.

13.4 Admixtures

a) Aluminum powders or non-shrink grouting admixtures of approved make shall be used.

b) Plasticiser conforming to IS :9103 shall be used to increase the workability, wherever required.

13.5 Mixing and Placing

Types of Mix:

a) Ready mixed not-stick cementious grout.

b) Cement-Sand Grout : The proportion of cement to sand shall generally be 1:2, unless otherwise specified.

c) Cement Aggregate Grout : The approximate proportions of cement, sand and coarse aggregate shall be 1:1:25:2, with a maximum size of aggregate as 10mm. This mix shall be used for grout thickness above 40 mm.

Mixing

Depending upon the case of placement and method of application, there shall be following three grout consistencies.

a) Fluid Mix: Water-cement ration shall be between 0.5 to 0.6. Plasticiser may be added to increase workability, wherever required. This grout mix shall be suitable for application with low pressure grouting equipment or self flowing and suitable for grouting of pockets /blockouts etc.

b) Plastic Mix : Water-Cement ratio shall be about 0.5. This grout mix shall be suitable for application with trowel or rod.

c) Stiff Mix : Water cement ration shall generally be 0.4. This grout mix shall be suitable for dry-pack application. The consistency should allow pressuring into firm hard ball without cracking.

Placing

The blockouts, bolt holes etc. which are to be grouted, shall be cleaned thoroughly just prior to taking up the grouting operations.

Cement, sand, aggregate, and anti-shrinkage admixture of approved quality and proven make shall be first blended thoroughly in the required proportion as per the manufacturer’s specifications. The quantity of non shrinking admixture shall be as per the manufacturer’s specification. Grout shall then be prepared by mixing this admixture with water. Any grout which has been mixed for a period longer than half an hour shall not be used on the work.

Immediately after preparation, a grout of suitable mix shall be poured into the blockouts, pockets and bolts holes through the holes provided for this purpose in the base plate, by using special equipment. It shall be ensured by rotting and by tapping of bolts that the blockout is completely fooled without leaving any voids. The pouring shall cease assign as each hauls is filled and any excess grout found on the surface of the concrete foundation shall be completely removed and the surface dried.

The space between the top surface of the foundation concrete and the underside of the base plate shall be filled with grout. Grouting, once commenced, shall be done
continuously. Grout shall be worked from one end to the other (to prevent air entrapment) and until the grout oozes out through the grout holes provided in the base plates.

In case of stiff mix, the space between the top surface of foundation concrete and the underside of the base plate shall be dry packed by firmly pressing or ramping into place against fixed supports.

When it is clear that the centre of base has been properly filled, the grout outside the baseplate shall be briefly rammed to ensure compaction below the edges. Shims provided for the alignment of plant bases shall be positioned at the edges of the base to permit subsequent removal which shall take place not less that 7 days after the grouting has been executed. The resulting cavities shall be made good with the same grade of grout as has been used for grouting under the rest of the base plate.

The work shall be cured for a period of atleast 7 days commencing 24 hours after the completion of the grouting. The curing shall be done by covering the surfaces with wet gunny bags and flooding.

13.6 Pressure Grouting for Repairing

13.6.1 Follow Specification.

13.7 Rate & Payment

13.7.1 The contract BOQ item rates shall inclusive of all the operations described above.

14. Cement Based Waterproofing

14.1 Scope

14.1.1 The treatment shall be laid directly over the R.C.C Slab, the detailed operations are as follows:

a) After the RCC slab has been cleaned slurry coat consisting of the neat cement admixed with specialised acrylic based chemicals which penetrates in the minutest of crevices and fill up all the porosity in the structure shall be used. In case of construction joints between different R.C.C members the chemicals mixed with neat cement slurry shall be injected at joints to make them monolithic.

b) A layer consisting of half cut bricks in cement mortar 1:4 (1 cement : 4 coarse sand) admixed with acrylic based chemicals to necessary gradient for proper flow of water towards the drain is then laid. The treatment will be extended upto 300 mm height of parapet walls also. The average thickness of this brick bat coba shall be 120 mm with a minimum thickness of 75 mm at the drain. After a proper curing for about 3 days once again slurry coat consisting of cement slurry mixed with waterproofing chemicals is provided to fill in the joints.

c) The top is then finished smoothly with cement mortar 1:4 (1 cement : 4 coarse sand) with acrylic based chemicals, such topping shall be of 25 mm thickness marked with 300 x 500 mm false rectangles and the joints between slab and walls shall be rounded off in the form of vata. The whole terrace shall be flooded with water for a period of 2 weeks for curing and for final test.

d) The proportion of the chemicals to be used in respect of cement shall be 1% by weight i.e. 1 Kg of chemicals shall be mixed with 100 Kg ordinary cement and the quantity of cement used shall be a minimum of 5 bags per 9.29 sq.m of the area treated.

14.2 Mode of Measurement

14.2.1 For treatment over terrace
Treatment to Horizontal areas and vertical areas (wattas/core) will be measured together. Horizontal areas will be measured wall to wall faces before application of treatment and vertical areas will be measured from top of horizontal finished treatment to top of wattas/core vertically along wall of face and not girthed.

14.3 Rate & Payment

14.3.1 The contract BOQ item rates shall inclusive of all the operations described above.

15. FINISHING

15.1 Scope

These Specifications cover the general requirements of different kinds of finishes.

15.2 Applicable Codes

| IS: 104-1979 | Ready Mixed Paint, brushing, priming Plaster to Indian Standard Colour No. 361, 631 White and off White (Reaffirmed 1993) (1st Revision) |
| IS: 290-1961 | Coal Tar Black Paint (Reaffirmed 1991) (1st Revision) |
| IS: 337-1975 | Varnish, Finishing Interior (Reaffirmed 1991) (1st Revision) |
| IS: 347-1975 | Varnish, Shellac for General Purposes (Reaffirmed 1991) (1st Revision) |
| IS: 419-1967 | Putty for Use On Window Frames (Reaffirmed 1992) (1st Revision) |
| IS: 1200-1987 | Method of Measurements of Building and Civil Engineering Works: |
| IS: 5410-1992 | Cement Paint (1st Revision) |

15.3 Cement Plastering

15.3.1 The cement plaster shall be 12mm and 15 mm thick for item work.

15.3.2 Scaffolding
15.3.2.1 For all brick work, double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

15.3.2.2 For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/column less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

15.3.3 Preparation of Surface

15.3.3.1 The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Effervescence, if any shall be removed by brushing and scrapping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced.

15.3.4 Mortar

15.3.4.1 The mortar of the specified mix using the type of sand described in the item shall be used. It shall be as specified in Specification. For external work and under coat work, the fine aggregate shall conform to grading IV. For finishing coat work the fine aggregate conforming to grading zone V shall be used.

15.3.5 Application of Plaster

15.3.5.1 Ceiling plaster shall be completed before commencement of wall plaster.

15.3.5.2 Plastering shall be started from the top and worked down towards the floor. All put-log holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 x 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be beaten with thin strips of bamboo about one metre long to ensure through filling of the joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or sandy granular texture is required. Excessive troweling or over working the float shall be avoided. During this process, a solution of lime putty shall be applied on the surface to make the later workable.

15.3.5.3 All corners, arrises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arrises, provision of grooves at junctions etc., where required shall be done without any extra payments. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

15.3.5.4 When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to properly joint together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arrises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arrises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages.

15.3.5.5 No portion of the surface shall be left out initially to be patched up later on.
15.3.6 Finish

15.3.6.1 The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

15.3.7 Thickness

15.3.7.1 The thickness of the plaster specified shall be measured exclusive of the thickness of key i.e. grooves or open joints in brick work. Average thickness of plaster shall not be less than the specified thickness of 12mm. The minimum thickness over any portion of the surface shall not be less than specified thickness by more than 3 mm. The average thickness should be regulated at the time of plastering by keeping suitable thickness of the gauges. Extra thickness required in dubbing behind rounding of corners at junctions of wall or in plastering of masonry cornices etc., will be ignored.

15.3.8 Curing

15.3.8.1 Curing shall be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of seven days. During this period, it shall be suitably protected from all damages at the Contractor’s expense by such means as the Engineer may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

15.3.9 Precaution

15.3.9.1 Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer.

15.3.9.2 When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitable tool when plaster is being done. Similarly when the wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6 mm drawn with any suitable method with the wall while the plaster is green.

15.3.9.3 To prevent surface cracks appearing between junctions of column/beam and walls, the plastering of walls and beam/column in one vertical plane junction should be carried out in one go.

15.3.10 Measurements

15.3.10.1 All operation of plastering and finishing shall be inclusive in the contract price of the work.

15.4 Neat Cement Punning

15.4.1 The cement plaster shall be 12 thick as described in Specification, finished with a floating cement punning coat.

15.4.2 Specification for scaffolding and curing shall be described in Specification respectively.

15.4.3 Specification for Finish and Precaution shall be described in Specification respectively.

15.4.4 Measurements

15.4.4.1 All operation of neat cement punning shall be inclusive in the contract price of the work.
15.5 Cement Water Proofing Compound

15.5.1 It shall be used for cement mortar for plastering/slurry coating or concrete work.

15.5.2 Water Proofing Compound

15.5.2.1 Integral cement water proofing compound conforming to IS: 2645 and of approved brand and manufacture, enlisted by the Engineer from time to time shall be used.

15.5.3 The Contractor shall bring the materials to the site in their original packing. The containers will be opened and the material mixed with dry cement in the proportion by weight, recommended by the manufacturers or as specifically described in the description of the item. Care shall be taken in mixing, to see that the water proofing material gets well and integrally mixed with the cement and does not run out separately when water is added.

15.6 Rate & Payment

15.6.1 The contract BOQ item item rates shall inclusive of all the operations described above.

16. WHITE WASHING, COLOUR WASHING AND OTHER PAINTING WORK

16.1.1 Applicable Codes

<table>
<thead>
<tr>
<th>IS</th>
<th>Description</th>
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<td>Shellac – Specification</td>
</tr>
<tr>
<td>IS:75</td>
<td>Specification for linseed oil, raw and refined</td>
</tr>
<tr>
<td>IS:77</td>
<td>Specification for linseed oil, boiled, for paints</td>
</tr>
<tr>
<td>IS:104</td>
<td>Ready mixed paint, brushing, zinc chrome, priming</td>
</tr>
<tr>
<td>IS:109</td>
<td>Specification for ready mixed paint, brushing, priming, plaster to Indian Standard Colour No. 361 light stone, and No. 631 light grey</td>
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<tr>
<td>IS:133</td>
<td>Enamel, Interior : (a) under coating (b) finishing – Specification</td>
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<tr>
<td>IS:137</td>
<td>Ready mixed paint, brushing, matt or eggshell flat, finishing, interior to Indian Standard Colour as required</td>
</tr>
<tr>
<td>IS:158</td>
<td>Ready mixed paint, brushing, bituminous black, lead free, acid, alkali and heat resisting</td>
</tr>
<tr>
<td>IS:217</td>
<td>Specification for cutback bitumen</td>
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<td>IS:218</td>
<td>Specification for creosote oil for use as wood preservatives</td>
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<td>IS:337</td>
<td>Varnish, finishing interior</td>
</tr>
<tr>
<td>IS:341</td>
<td>Black japan, types ‘A’, ‘B’ and ‘C’</td>
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<td>IS:419</td>
<td>Putty, for use on window frames</td>
</tr>
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<td>Distemper, dry, colour as required</td>
</tr>
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<td>IS:428</td>
<td>Washable distemper – Specification</td>
</tr>
<tr>
<td>IS:524</td>
<td>Varnish, finishing, exterior, synthetic, air drying</td>
</tr>
<tr>
<td>IS:533</td>
<td>Gum spirit of turpentine (oil of turpentine) – Specification</td>
</tr>
<tr>
<td>IS:712</td>
<td>Specification for building limes</td>
</tr>
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<td>IS:1200</td>
<td>Method of measurement of building and Civil Engineering works</td>
</tr>
<tr>
<td>IS:2339</td>
<td>Aluminum paint for general purposes, in dual container</td>
</tr>
<tr>
<td>IS:2932</td>
<td>Enamel, synthetic, exterior : (a) undercoating, (b) finishing – Specification</td>
</tr>
<tr>
<td>IS:2933</td>
<td>Enamel, exterior - (a) undercoating, (b) finishing</td>
</tr>
<tr>
<td>IS:5410</td>
<td>Cement paint</td>
</tr>
<tr>
<td>IS:6278</td>
<td>Code of practice for white washing and colour washing</td>
</tr>
<tr>
<td>IS:13607</td>
<td>Ready mixed paint, finishing, general purposes, synthetic – Specification</td>
</tr>
</tbody>
</table>

16.2 Painting Works

16.2.1 Materials

16.2.1.1 Paints, varnishes, oil etc. shall be of approved quality and procured from reputed manufacture (ISO:9000/ 14000 certified organization). Only ready mixed paint (exterior grade) as received from the manufacturer without any admixture shall be used.

16.2.1.2 If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer shall be used.

16.2.1.3 Approved paints, oil or varnishes shall be brought to the site of work by the Contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least of fortnight’s work. The empties shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer.

16.2.1.4 External Acrylic emulsion paint shall be of approved quality and procured from reputed manufactures (ISO:9000/ 14000 certified organization). Mixing of paint and priming coat shall be as recommended by manufacturer.

16.2.2 Commencing Work

16.2.2.1 Painting shall not be started until the Engineer has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work. Painting of external surface shall not be done in adverse weather condition like hail storm and dust storm.

16.2.2.2 Painting, except the priming coat, shall generally be taken in hand after practically finishing all other construction work.

16.2.2.3 The room shall be thoroughly swept out and the entire building cleaned up, at least one day in advance of the paint work being started.

16.2.3 Preparation of Surface

16.2.3.1 Oil Painting Works

The surface shall be thoroughly cleaned and dusted off (in case of new shop painted steel work). For old steel work all rust, dirt, scales, smoke splashes, mortar droppings and grease shall be thoroughly removed before painting is started. The surface shall be rubbed off with sand paper and rotary power operated iron bristle grinder to remove rust etc. It shall be wiped clean. The prepared surface shall have received the approval of the Engineer after inspection, before painting is commenced. Paint shall then be applied as per item in BOQ.

16.2.3.2 External Acrylic Paint Application to Plastered/ Unplastered Surface
The surface shall be thoroughly scraped, cleaned as dusted off and repaired where necessary as per details of surface preparation in BOQ. Together with this fungal growth shall be removed with 5% bleaching powder solution wipe on the surface. Any tree root shall be removed from the base and necessary repair to masonry shall be done. Paint application shall be done thereafter after approval of surface by the Engineer.

16.2.4 Application

16.2.4.1 Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform.

16.2.4.2 The painting shall be laid on evenly and smoothly by means of crossing and laying off, the latter in the direction of the grains of wood. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

16.2.4.3 Where so stipulated, the painting shall be done by spraying. Spray machine used may be – (a) high pressure (small air aperture) type, or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out.

16.2.4.4 Spraying should be done only when dry condition prevails. Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This shall be facilitated by thorough ventilation. Each coat except the last coat shall be lightly rubbed down with sand paper or fine pumice stone and dust cleaned off before the next coat is laid.

16.2.4.5 No left over paint shall be put back into the stock tins. When not in use, the containers shall be kept properly closed.

16.2.4.6 No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of mouldings etc. shall be left on the work.

16.2.4.7 In painting doors and windows, the putty round the glass panes must also be painted but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting. However, bottom edge of the shutters where the painting is not practically possible, need not be done nor any deduction on this account will be done but two coats of primer of approved make shall be done on the bottom edge before fixing the shutters.

16.2.4.8 On painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

16.2.4.9 The additional specifications for primer and other costs of paints shall be according to the detailed specifications under the respective headings.

16.2.5 Brushes and Containers

16.2.5.1 After work, the brushes shall be completely cleaned of paint and linseed oil by rinsing with turpentine. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers when not in use shall be kept closed and free from air so that paint does not thicken and also shall be kept safe from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean, and can be used again.
16.3 Painting Priming Coat on Wood, Iron or Plastered Surfaces

16.3.1 Primer

16.3.1.1 The primer for wood work, iron work or plastered surface shall be as specified in the description of item.

16.3.1.2 Primer for plaster/ wood work/ iron and steel/ aluminium surfaces shall be as specified below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Surfaces</th>
<th>Primer to be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Wood work (hard and soft wood)</td>
<td>conforming to IS:3536</td>
</tr>
<tr>
<td>2.</td>
<td>Resinous wood and plywood</td>
<td>Aluminium primer conforming to IS:3585</td>
</tr>
<tr>
<td>3.</td>
<td>(a) Aluminium and light alloy</td>
<td>Zinc chromate primer conforming to IS:104</td>
</tr>
<tr>
<td></td>
<td>(b) Iron, steel, galvanized steel</td>
<td>Oxide Zinc chromate Primer conforming IS:2074</td>
</tr>
<tr>
<td></td>
<td>to receive oil bound distemper or paint finish</td>
<td></td>
</tr>
</tbody>
</table>

16.3.1.3 The primer shall be ready mixed primer of approved brand and manufacture.

16.3.2 Preparation of Surface

16.3.2.1 Wooden Surface

The wood work to be painted shall be dry and free from moisture. The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue, sized and used hot. Appropriate filler material conforming to relevant Indian Standard with same shade as paint shall be used where specified. The surface treated for knotting shall be dry before paint is applied. After obtaining approval of the Engineer for wood work, the priming coat shall be applied before the wood work is fixed in position. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glazier’s putty or wood putty. Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in stopping and the latter is therefore liable to crack.

16.3.2.2 Iron & Steel Surface

    a) All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed.

    b) All dust and dirt shall be thoroughly wiped away from the surface.

    c) If the surface is wet, it shall be dried before priming coat is undertaken.

16.3.2.3 Plastered Surface
The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and when drying is satisfactory, painting shall be taken in hand. Before primer is applied, holes and undulations shall be filled up with plaster of paris and rubbed smooth.

16.3.3 Application

The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off.

16.3.4 Treatment on Steel for Aggressive Environment

16.3.4.1 A second coat of ready mixed red oxide zinc chromate primer may be applied where considered necessary in aggressive environment such as near Industrial Establishment and Coastal regions where the steel members are prone to corrosion. The second coat (which shall be paid for separately) is to be applied after placing the member in position and just before applying paint. The second coat of primer is not necessary in case of painting with synthetic enamel paint as it is applied over an under coat of ordinary paint.

16.4 Oil Emulsion (Oil Bound) Washable Distempering

16.4.1 Materials

16.4.1.1 Oil emulsion (oil bound) washable distemper conforming to IS:428 of approved brand and manufacture shall be used. The primer, where used as on new work shall be cement primer or distemper primer as described in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day's works shall be prepared.

16.4.1.2 The distemper and primer shall be brought by the Contractor in sealed tins in sufficient quantities at a time to suffice for a fortnight’s work. The empty tins shall not be removed from the site of work till this item of work has been completed and passed by the Engineer.

16.4.2 Preparation of the Surface

16.4.2.1 For new work the surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry.

16.4.2.2 Pitting in plaster shall be made good with plaster of paris mixed with the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patches on the surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

16.4.3 Application

16.4.3.1 The priming coat shall be with distemper primer or cement primer, as required in the description of the item.

*Note: If the wall surface plaster has not dried completely, cement primer shall be applied before distempering the walls, but if distempering is done after the wall surface is dried completely, distemper primer shall be applied.*

16.4.3.2 Oil bound distemper is not recommended to be applied within six months of the completion of wall plaster. However, newly plastered surfaces, if required to be distempered before a period of six months, shall be given a coat of alkali resistant priming paint conforming to IS:109 and allowed to dry for at least 48 hours before distempering is commenced.
16.4.3.3 Distemper Coat

1) For new work, after the primer coat has dried for at least 48 hours, the surface shall be lightly sandpapered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. One coat of distemper properly diluted with thinner (water or other liquid as stipulated by the manufacturer) shall be applied with brushes in horizontal strokes followed immediately by vertical ones which together constitute one coat.

2) The subsequent coats shall be applied in the same way. Two or more coats of distemper as are found necessary shall be applied over the primer coat to obtain an even shade.

3) A time interval of at least 24 hours shall be allowed between successive coats to permit proper drying of the preceding coat.

4) 15 cm double bristled distemper brushes shall be used. After each day’s work, brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

16.5 Cement Primer Coat

16.5.1 Cement primer coat is used as a base coat on wall finish of cement, lime or lime cement plaster or on asbestos cement surfaces before oil emulsion distemper paints are applied on them. The cement primer is composed of a medium and pigments which are resistant to the alkalis present in the cement lime or lime cement in wall finish and provides a barrier for the protection of subsequent coats of oil emulsion distemper paints.

16.5.2 Primer coat shall be preferably applied by brushing and not by spraying. Hurried priming shall be avoided particularly on absorbent surfaces. New plaster patches in old work shall also be treated with cement primer before applying oil emulsion paints etc.

16.5.3 Preparation of the Surface

16.5.3.1 The surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sandpapered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of paris mixed with water on the entire surface including filling up the undulations and then sandpapering the same after it is dry.

16.5.4 Application

16.5.4.1 The cement primer shall be applied with a brush on the clean, dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before oil emulsion paint is applied.

16.6 Cement Paint

16.6.1 Materials

16.6.1.1 The cement paint shall be of approved brand and manufacture conforming to IS:5410.

16.6.1.2 The cement paint shall be brought to the site of work by the Contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight’s work.
16.6.2 Preparation of Surface

16.6.2.1 For new work, the surface shall be thoroughly cleaned of all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing. Pitting in plaster shall be made good and a coat of water proof cement paint shall be applied over patches after wetting them thoroughly.

16.6.3 Preparation of Mix

16.6.3.1 Cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish. Cement paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer’s instructions shall be followed meticulously.

16.6.3.2 The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities.

16.6.3.3 In case of cement paint brought in gunny bags, once the bag is opened, the contents should be consumed in full on the day of its opening. If the same is not likely to be consumed in full, the balance quantity should be transferred and preserved in an airtight container to avoid its exposure to atmosphere.

16.6.4 Application

16.6.4.1 The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that direct heat of the sun on the surface is avoided. The method of application of cement paint shall be as per manufacturer’s specification. The completed surface shall be watered after the day’s work.

16.6.4.2 The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted.

16.6.4.3 For new work, the surface shall be treated with three or more coats of water proof cement paint as found necessary to get uniform shade.

16.6.5 Precaution

16.6.5.1 Water proof cement paint shall not be applied on surface already treated with white wash, colour wash, distemper dry or oil bound, varnishes, paints etc. It shall not be applied on gypsum, wood and metal surfaces.

16.7 White Washing with Lime

16.7.1 Scaffolding

16.7.1.1 Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being white washed.

16.7.1.2 For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.
Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

16.7.1.3 Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

16.7.1.4 For white washing the ceiling, proper stage scaffolding shall be erected.

16.7.2 Preparation of Surface

16.7.2.1 Before new work is white washed, the surface shall be thoroughly brushed free from mortar droppings and foreign matter.

16.7.3 Preparation of lime wash

16.7.3.1 The lime wash shall be prepared from fresh stone white lime. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth, 40 gm of gum dissolved in hot water, shall be added to each 10 cubic decimeter of the cream. The approximate quantity of water to be added in making the cream will be 5 litres of water to one kg of lime.

16.7.3.2 Indigo (Neel) upto 3 gm per kg of lime dissolved in water, shall then be added and stirred well. Water shall then be added at the rate of about 5 litres per kg. of lime to produce a milky solution.

16.7.4 Application

16.7.4.1 The white wash shall be applied with moonj brushes to the specified number of coats. The operation for each coat shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first stroke, and similarly one stroke horizontally from the right and another from the left before it dries.

16.7.4.2 Each coat shall be allowed to dry before the next one is applied. Further each coat shall be inspected and approved by the Engineer-n-Charge before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on.

16.7.4.3 For new work, three or more coats shall be applied till the surface presents a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any signs of cracking and peeling nor shall it come off readily on the hand when rubbed.

16.7.5 Protective Measures

16.7.5.1 Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed, shall be protected from being splashed upon. Splashings and droppings, if any shall be removed by the Contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings or fixtures shall be recoverable from the Contractor.

16.7.5.2 The number of coats of each treatment shall be stated and approved by the Engineer. The contract price shall include removing nails, making good holes, cracks, patches etc. not exceeding 50 sqcm each with material similar in composition to the surface to be prepared.

16.8 Epoxy Based Primer Paints

16.8.1 Materials

16.8.1.1 These resin paints have good adherence to a well prepared sub-strata. They are mechanically strong and resistant to chemicals. A disadvantage of epoxy resin paints is
that it can rapidly become dull when exposed to strong sunlight. These disadvantages do not, however, greatly influence their protective power.

16.8.2 Surface Preparation

16.8.2.1 Remove oil/grease by use of petroleum hydrocarbon solution conforming to IS:1745 and grit blasting to near white metal surface.

16.9 Exterior Painting with Polyvinyl based Acrylic Emulsion Paint

16.9.1 Materials

16.9.1.1 External acrylic emulsion paint shall be of approved quality and of reputed manufactures (ISO:9000/14000 certified organization).

16.9.1.2 These are based on polyvinyl resins such as polyvinyl-chloride (PVC) and polyvinyl-acetate etc. Certain types of vinyl resin paints yield thick, relatively soft and rubber like coatings with good chemical resistance.

16.9.1.3 The acrylic emulsion paint shall be brought to the site of work by the Contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight’s work.

16.9.2 Preparation of Surface

16.9.2.1 For new work, the surface shall be thoroughly cleaned of all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing. Pitting in plaster shall be made good and a coat of primer paint shall be applied over the wall after wetting them thoroughly.

16.9.3 Preparation of Mix

16.9.3.1 Mixing of paint and priming coat shall be as recommended by the manufacturer.

16.9.4 Application

16.9.4.1 The solution shall be applied on the clean surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. The method of application of paint shall be as per manufacturer’s specification.

16.10 Painting with Enamel Paint

16.10.1 Enamel paint conforming to IS:2933 of approved brand and manufacture and of the required colour shall be used.

16.10.2 For the under coat, the paint of same quality but of shade to suit that of the top coat shall be used.

16.11 Painting with Synthetic Enamel Paint

16.11.1 Synthetic enamel paint conforming to IS:2932 of approved brand and manufacture and of the required colour shall be used for the top coat and an undercoat of ordinary paint of shade to match top coat as recommended by the same manufacturer as for the top coat shall be used.

16.12 Painting of New/ Old Surface

16.12.1 Preparation of surface shall be as per standard practice and as specified elsewhere in this specification.
16.13 **Application**

16.13.1 The number of coats including the under coat shall be as stipulated in the item.

16.13.2 **Under Coat**

One coat of the specified paint of shade suited to the shade of the top coat shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface free from brush marks and all loose particles dusted off.

16.13.3 **Top Coat**

Top coats of synthetic enamel paint of desired shade shall be applied after the undercoat is thoroughly dry. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface.

16.14 **Measurements**

16.14.1.1 The length and breadth shall be measured correct to a cm. The area shall be calculated in sqm (correct to two places of decimal), except otherwise stated. IS:1200 shall be followed for any discrepancy that may arise.

16.15 **Rate & Payment**

16.15.1.1 BOQ item Rates shall include cost of all labour and materials involved in all the operations described above.

16.16 **Lettering with Paint**

16.16.1 Ready mixed paint (conforming to IS: 341) or as ordered by the Engineer shall be used. The paint shall be of approved brand and manufacture. Ordinary ready mixed paint shall be of the shade required by the Engineer.

16.16.2 **Lettering on New Surface**

16.16.2.1 **Application**

1. The letters and figures shall be to the heights and width as ordered by the Engineer. These shall be stenciled or drawn in pencil and got approved before painting. They shall be of uniform size and finished neatly. The edges shall be straight or in pleasant smooth curves. The thickness of the lettering shall be as approved by the Engineer. Lettering shall be vertical or slanting as required.
2. Two or more coats or paint shall be applied till uniform colour and glossy finish are obtained.

16.16.3 **Rate & Payment**

16.16.4 The contract BOQ item rates shall inclusive of all the operations described above for carriage, stacking and protection of the material.

16.16.5 The contract BOQ item rates shall inclusive of all the operations described above.

17. **INSTRUCTION, TESTING AND QUALITY CONTROL FOR GENERAL CIVIL WORKS**

Sampling and testing for major items of civil works viz., earthwork, concreting, structural steel work (including welding), Hydraulic testing etc. shall be carried out in accordance with the requirements of this specification. Wherever nothing is specified relevant Indian
Standard shall be followed. In absence of Indian Standard equivalent International Standards may be used.

The Bidder shall submit for Employer's approval a detailed Field Quality Assurance Programme for civil works before starting of the construction work. This shall include frequency of sampling and testing, nature / type of test, method of test, deployment of qualified / experienced manpower, and preparation of format for record, field Quality Plan etc. Tests shall be done in the field and / or at a laboratory approved by the Employer and the Bidder shall submit to the Employer, the test results in triplicate. In addition, the Bidder shall furnish the original test certificate from the manufacturer's of various materials to be used in the construction,

16.17 Unacceptable Work

All defective works are liable to be demolished rebuilt and defective materials are to be replaced by the contractor at his own costs. In the event of such works being accepted by carrying repairs, as approved by the Employers representative, the costs of repairs will be borne by the Contractor, unless otherwise specifically mentioned elsewhere in the contract.

16.18 Permissible Tolerances for Civil Works

Workmanship and dimensional tolerances shall be checked as stipulated below:

16.18.1 Cast-In-Situ Concrete Works.

The dimensions of concrete as cast when compared with those on the drawings shall be within the tolerances as specified in Specification.

16.18.2 Formwork

<table>
<thead>
<tr>
<th>Description of Item</th>
<th>Permissible Deviation in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels and heights</td>
<td>+6</td>
</tr>
<tr>
<td>Plumb</td>
<td>3 mm for every meter subject to a maximum of 10 mm</td>
</tr>
<tr>
<td>Unevenness of any surfaces</td>
<td>+3</td>
</tr>
<tr>
<td>Length or breadth</td>
<td>+12</td>
</tr>
<tr>
<td>Diagonals</td>
<td>+15</td>
</tr>
</tbody>
</table>

In case of inclined surfaces the deviation in the alignment of inclined surfaces, shall not exceed 3 mm with reference to the theoretical alignment, for a length of 1000 mm measured vertically, subject to a maximum of 10 mm.

16.18.3 Masonry

All masonry shall be built true and plumb within permissible tolerance. Care shall be taken to keep the perpendiculars properly aligned.

16.18.4 Structural Steel Work

Tolerances on dimensions for fabrication of steel structures shall be according to IS: 7215. Tolerances on dimensions for erection of steel structures shall be according to IS: 12843.
Technical Specification
For
Installation of Tube well
TECHNICAL SPECIFICATION FOR INSTALLATION OF T.W.

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TECHNICAL SPECIFICATION FOR INSTALLATION OF T.W.

The state government has appointed State Investment Program Management and Implementation Unit (SIPMIU) under Urban Development Department, Government of Tripura for implementation the Project. In this water supply subproject, a part of the loan shall be utilized for replacement/ construction of 1 no. tube wells, installation of required capacity submersible pumping machineries, construction of pump houses and inter connection with rising mains/OHT etc. The drilling of tube wells shall be carried with Rotary rig machines to finish the tube well to 300/200 mm diameter liner assembly and slotted MS pipe/stainless steel frame at the depth of110-200 meter approximately. The hand operated chain pulley block suitable for single girder has been proposed in the package. The package shall improve the efficiency of the existing water supply system of the city.

The bidder shall be having all arrangement/machinery for drilling of tube wells including development work e.g. rig machines and its accessories, high capacity compressors, transport vehicles etc. and contractor shall procure/arrange all required material such as Strainer, Blank pipe, Housing pipe, Pea gravels for packing, pumping units, panels, AVR’s, cables, switches other mechanical, electrical related items as per laid down specification and installation/construction of the same for completion of the package with in the stipulated time period.

1. INTRODUCTION

1.1 Scope of Work

Supplying the MS pipes and all materials for TW. Drilling of Tube Wells, Suppling and installation of pumping machinery along with other equipments, such as electric panel, voltage stabilizer, power transformer, electric connections, sluice valves, non return valves, etc., testing & commissioning complete job in different parts of Agartala City. Categorically the work can be described as:

i) Supplying of MS casing pipe, liner assembly pipe and pipe for Strainer. The pipes will be conforming to IS 4270:2001.

ii) Construction of 1 (one) Tube well by drilling of bore hole, lowering of liner assembly, development, performance (yield) test of tube well and procurement and fixing of sluice valve, gate valve, bell plug, strainer etc mechanical equipments as required complete.

iii) Supplying fitting fixing as per specification mentioned all electrical equipments, testing commissioning complete 1 (one) tube well The location is tentative and may be changed by the Authority according to the requirement.

1.1.1 The 1(one) number of tube well is to be constructed in Agartala city. Tube well consists of drilling, construction & development of Tube well, Procurement, Installation of all Mechanical/Electrical equipment, testing, commissioning etc complete.

1.1.2 The contractor has to adhere to the programmed as detailed below and shall be deemed responsive only if he undertakes to schedule, execute and complete the construction of tube wells as under:

1.1.3 The scope of work under this tender document shall include the following:
1.1.3.1 Procurement and installation of pipes, Valves and other materials including mechanical/ electrical equipment for the construction of Tube well.

a) All preliminary work such as site clearance in all types of conditions, marking of alignment etc. as described elsewhere in these specifications. The Contractor is advised to inspect the sites before tendering to ascertain the quantum and cost of work and include this cost in their offer;

b) Drilling of tube well with Rotary/ Dual Rotary Rig machine to accommodate the liner assembly with gravel packing as per IS specification.

c) Collection of samples of strata encountered during drilling, its segregation and preservation;

d) Designing of liner assembly on the basis of strata with sieve result and aquifer zone encountered during drilling for approval of Engineer before lowering. Lowering of liner assembly in bore hole and shrouding with pea size gravel.

e) Lowering the casing, liner assembly and strainer pipe to the required depth. Developing of Tube well with high capacity air compressor till the water gets sand free/clear water. Packing of gravel to fill up the annular space during the development;

f) Pump test till clear/sand free water is drawn and to determine the yield (discharge) of tube well, quality of the water, draw down etc. and capping of tube well;

g) Disposal of water encountered during development/yield test to nearest storm drain by laying pipe line or constructing temporary drain;

h) Supply of reputed make mechanical and electrical equipment such as submersible pump sets, Electric panels, cables, switches etc. depending on the parameters after yield test with the approval of Engineer;

i) Supply of MS pipe for Casing, Liner assembly & strainer, manual chain pulley block etc.;

j) Construction of Pump House for the Tube wells as per the design of the Deptt.

k) Installation of all electrical and mechanical equipment, testing and commissioning.

l) Supply, storage, handling, laying and jointing of pipes, valves, appurtenances, specials and all other materials required as per specifications and drawings;

m) Inter-connections with delivery pipes of the existing water supply system as per the site requirement and direction of the Engineer;

n) Arranging power connection special feeder for each tube well from Electricity Department;

o) Defect liability period of one year, removal of defects in pumping machinery, pipelines, valves and specials till the final commissioning and during the defect notice period.

p) Some of the M.S pipe for casing, liner assembly / Strainer may be issued from the Departmental store at free of cost. The Contractor will have to carry those pipes to the site at free of cost.
1.1.3.2 General

a) Compliance of all safety rules at work sites;

b) To take all safe guards to avoid accidents at site, prevent loss/damage to all existing utilities like pipelines, telephone/electric cables, poles etc and any government or private property during the contract period.

c) The contractors shall co-ordinate with each other for successful completion of the package;

d) Liaison with agencies such as TSECL, BSNL, PHED, PWD, AMC and other agencies as necessary so as to carry on with the job smoothly;

e) Provisional sum is provided to deposit with concerned authorities for taking electric connection and in order to carry out shifting of utilities, third party inspection etc.;

f) The number of tube well may increase and location of tube well may also be altered as per the requirement of the line agency/ feasibility report

g) Bill of Quantities provided with the Bid Document is indicative and the quantity, rating of pumping machinery with electrical equipment and other items/material may vary as per the site condition and the Contractor should satisfy himself about this aspect before quoting.

h) Only ISI marked materials and instrument e.g pump, motors, electrical item, pipes, valves etc has to be provided unless and otherwise specified.

1.2 Specific scope

1.2.1 Construction of tube Well

Drilling of gravel packed deep depth tube wells with Rotary/Dual Rotary Rig machine for drinking purpose, designing of liner assembly, lowering, development of Tube well with high capacity air compressor to free water aquifer zone from compaction of unconsolidated materials during drilling and to get sand free water, yield test. Capping of tube well. The construction of Pump House for the Drilled Tube wells.

1.2.2 Procurement and Installation of Machinery

Procurement/supply of pumping machinery, cables, MCCB, valves pipes etc. of required parameter after designing the same as per the approval of the Engineer. Installation of all mechanical and electrical equipment, testing commissioning complete job.

Inter connection of individual delivery of pipe lines and rising main as per site condition.

1.2.3 Work Plan

Though the work has been defined in the detailed specifications, drawings and BOQ, the contractor shall prepare a list of all the materials for drilling of tube wells, mechanical and electrical items along with a procurement plan well in advance and get approval from Engineer. The pumps, motors pipes & specials should be stored in the stores for a period commensurate with the work plan.

1.2.4 Interfaces with other packages/works

The tube well will be connected with the existing or newly laid transmission/distribution pipeline under this package or to be laid other packages. Contractor will be responsible to
connect the delivery of tube wells to the pipelines.

1.2.5 Service to be rendered by the Bidder

a) The service to be rendered by the bidder shall include furnishing of all construction documents, drawings, operation/ instruction manuals;

b) Any other services although not specifically called for but required for successful completion of the work

1.2.6 Specifications

Specifications for the items are included under this section of the bidding document. Specifications for other items of Bill of quantity, which are not included in Employer’s requirement, will be governed by relevant Indian Standard code, or State PWD/DWS specifications, which are stronger and favorable to the Employer, and shall be followed for construction works.

In the event of any discrepancy between the specifications under Employer’s requirement and the Specifications indicated above, then the provisions of the Employer’s requirement will prevail.

1.3 Measurement and Payments

1.3.1 The methods of measurement and payment shall be as described under various items and in the bill of quantity. Where specific definitions are not given, the methods described in IS Codes shall be followed. Should there be any detail of construction or materials which has not been referred to in these Specification or in the bill of quantities and Drawings but the necessity for which may be implied or inferred wherefrom, or which are usual or essential to the completion of the work in the trades, the same shall be deemed to be included in the rates and prices quoted by the Contractor in the bill of quantities.

1.4 Unacceptable Work

1.4.1 All defective Works are liable to be demolished, rebuilt and defective materials replaced by the Contractor at his own cost. In the event of such Works being accepted by carrying out repairs/rectification etc. as specified by the Engineer, the cost of repairs/rectification shall be borne by the Contractor.

1.4.2 In the event of the work being accepted by giving ‘Design Concession’, arising out of but not limited to under sizing, under strength, shift in location and alignment, etc. and accepting design stresses in members which are higher than those provided for in the original design or by accepting materials not fully meeting the Specifications, etc. the Contractor will be paid for the Works actually carried out by him at the suitable reduced rate of the tendered rates for the portion of the work thus accepted.

1.5 Drilling of Tube well under Water Supply

1.5.1 All items covered under the above head shall conform to the detailed Specifications given for each of the items in addition to the by-laws of the local bodies within whose jurisdiction the Works are executed. The Works shall be carried out as per the relevant IS Codes and as per the instructions of the Engineer.

1.6 Maintaining Utility Service and Traffic
1.6.1 Public Utilities

1.6.1.1 The Contractor may be required to carry out the removal or shifting of certain services/utilities on specific orders from the Engineer for which payment shall be made to him. Such workers shall be taken up by the Contractor only after obtaining clearance from the Engineer and ensuring adequate safety measures.

1.6.1.2 No clearance or alterations to the utility shall be carried out unless specially ordered by the Engineer.

1.6.1.3 Any services affected by the Works must be temporarily supported by the Contractor who must also take all measures reasonably required by the various bodies to protect their services and property during the progress of the Works.

1.6.1.4 The Contractor may be required to carry out certain Works for and on behalf of the various bodies and he shall also provide, with the prior approval of the Engineer, such assistance to the various bodies as may be authorized by the Engineer.

1.6.1.5 The work of temporarily supporting and protecting the public utility services during execution of the Works shall be deemed to be part of the Contract and no extra payment shall be made for the same.

1.6.2 Avoidance of existing services

1.6.2.1 Adequate arrangements shall be made by Contractor to protect and support other services during all phases of the work. If the Contractor fails to protect the other services/utilities and any damage occurs to any services/material, Contractor shall reinstate such utilities to existing conditions at his own cost or pay for the rectification of damages so caused.

1.6.3 Arrangement for Traffic during Construction

1.6.3.1 General

The Contractor shall at all time carry out work on the roads in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. For all Works involving improvements to the existing roads, the Contractor shall, in accordance with the directives of the Engineer, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the road. The Contractor shall take prior approval of the Engineer regarding traffic arrangements during construction.

1.6.3.2 On both sides, suitable regulatory/warning signs as approved by the Engineer shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be of approved design and of reflectory type, if so directed by the Engineer.

1.7 Approval of Materials

1.7.1 Approval of all sources of material for Works shall be obtained in writing from the Engineer before their use on the project.
1.7.2 Quality assurance plan of the material such as pumping machinery, pipe, pipe fittings, valves etc. shall be submitted before the dispatch of the material from the works for the approval of the Engineer.

1.8 **Access to Abutting Properties**

1.8.1 For the duration of the Works the Contractor shall at all times provide convenient access to paths, steps, bridges or drives for all entrances to property abutting the site and maintain them clear, tidy, and free from mud and objectionable matter.

1.8.2 In addition to the above, in order to ensure uninterrupted traffic flow in the cross roads, the Contractor has to provide and maintain suitable crossing arrangement for the existing traffic to move across the construction work for all categories of roads crossing the roads under construction/improvement during the entire period of construction or till such time that alternative arrangement for the traffic is made.

1.9 **Use of Equipment on Works**

1.9.1 The following conditions regarding use of equipment’s on works shall be followed:

1. The Contractor shall be required to give a trial run of the equipment(s) or establishing their capability to achieve the required Specifications and tolerance to the satisfaction of the Engineer before commencement of the work.

2. All equipment's provided shall be proven efficiency and shall be operated and maintained at all times in a manner acceptable to the Engineer.

3. No equipment or personnel will be removed from site without permission of Engineer.

1.10 **Quality Control on Works and Materials**

1.10.1 The Contractor shall be responsible for the quality of the work in the entire construction work within the contract. He shall, therefore, have his own independent and adequate set-up for ensuring the same.

1.10.2 The Engineer shall inspect the work from time to time during and after construction and ascertain the quality of the work tested (by himself, by his Testing and Quality Control Units or by any other agency deemed fit by him), procedures and tests as directed by the Engineer shall be followed.

1.10.3 The Contractor shall provide necessary cooperation and assistance in conducting the tests and obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This may include provision of labour, attendance, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests.

1.10.4 The Contractor shall carry out modification in procedure of work, if any, as directed by the Engineer during inspection.

1.10.5 Works falling short of quality as per tests indicated in Clause 1.10.2 above shall be rectified by the Contractor as directed by the Engineer at his own cost.
1.10.6 Where the Engineer considers that in the interest of the control of the quality on materials or workmanship, modifications, if any, are necessary, such modifications shall be carried out by the Contractor at no extra cost.

1.10.7 The Contract rate quoted for various items of work in the Bill of Quantities shall be deemed to be inclusive of all costs of the provisions indicated in the above mentioned clauses.

1.11 Surveying and measuring equipment’s

1.11.1 Equipment for surveying and measurement on the work shall be procured by the Contractor for his use. The same shall also be made available to the Engineer at site for any work connected with the Contract without any additional charge.

1.12 Completion Drawings

1.12.1 The Contractor shall submit to the Engineer within two months of actual completion, “Completion” Drawings as specified below and operation and maintenance instructions for the whole of the works. These Drawings shall be accurate and correct in all respects and shall be shown to and approved by the Engineer.

1.12.2 Completion Drawings on two prints & Two C.D. shall be supplied by the Contractor.

1.13 Protection of Environment & Natural Habitat

1.13.1 Site Environmental Plan (SEP)

1.13.1.1 The contractor shall carry out the work for fulfilling the requirement of environmental impact assessment and management plan as related to construction of work as per annexure ‘A’ and as per clause 1.13

1.13.1.2 The Contractor shall prepare a detailed Site Environmental Plan (SEP) for the work site, base camp, etc., showing arrangements for disposal of sanitary and other waste, location of fuel, oil and lubricant depots, sheds for equipment, labour and housing facilities, etc., prior to the construction for approval of the Engineer.

1.13.2 Safety, Security and Protection of the Environment

1.13.2.1 The Contractor shall take all necessary precautions against pollution or interference with the supply or obstruction of the flow of, surface or underground water. These precautions shall include but not be limited to physical measures such as earth bunds of adequate capacity around fuel, oil and solvent storage tanks and stores, oil and grease traps in drainage systems from workshops, vehicle and plant washing facilities and service and fueling areas and kitchens, the establishment of sanitary solid and liquid waste disposal systems, the maintenance in effective condition of these measures, the establishment of emergency response procedures for pollution events, and dust suppression, all in accordance with normal good practice and to the satisfaction of the Engineer. Should any pollution arise from the Contractor’s activities he shall clean up the affected area immediately at his own cost and to the satisfaction of the Engineer, and shall pay full compensation to any affected parties.

1.13.3 Protection of Trees and Vegetation

1.13.3.1 The Contractor shall ensure that no trees or shrubs are felled or harmed except for those required to be cleared for execution of the Works. No tree shall be
removed without the prior approval of the Engineer and any competent authorities.

1.13.4 Use of Wood as Fuel

1.13.4.1 The Contractor shall not use wood as a fuel for the execution of any part of the Works, including but not limited to the heating of bitumen and bitumen mixtures and the manufacture of bricks for use in the Works, and to the extent practicable shall ensure that fuels other than wood are used for cooking, and water heating in all his camps and living accommodations.

1.13.5 Water Supply

1.13.5.1 The Contractor shall make his own arrangements at his own expense for water supply for construction and other purposes. Only clean water free from deleterious materials and of appropriate quality for its intended use shall be used. In providing water the Contractor shall ensure that the rights of and supply to existing users are not affected either in quality, quantity or timing. In the event of a dispute over the effect of the Contractor’s arrangements on the water supply of others, the Engineer shall be informed immediately and shall instruct the Contractor as to appropriate remedial actions to be undertaken at the Contractor’s expense.

1.13.6 Power Supply

1.13.6.1 The Contractor shall make his own arrangements at his own expense for power supply for construction and other purposes. Only power from authorized connections or from well operational generator sets shall be used. In case of work in night shifts the Engineer shall be informed well in advance and all arrangements should be get approved by the Engineer in charge.

1.13.7 Relations with Local Communities and Authorities

1.13.7.1 In sitting and operating his plant and facilities and in executing the Works the Contractor shall at all time bear in mind and to the extent practicable minimize the impact of his activities on existing communities. Where communities are likely to be affected by major activities such as road widening or the establishment of a camp, large borrow pit or haul road, he shall liaise closely with the concerned communities and their representatives and if so directed, shall attend meetings arranged by the Engineer or Employer to resolve issues and minimize impacts on local communities.

1.13.8 Fire Prevention

1.13.8.1 The Contractor shall take all precautions necessary ensure that no vegetation along the line of the road outside the area of the permanent works is affected by fires arising from the execution of the Works. The Contractor shall obtain and follow any instructions of the competent authorities with respect to fire hazard when working in the vicinity of gas installations. Should a fire occur in the natural vegetation or plantations adjacent to the road for any reason the Contractor shall immediately suppress it. In the event of any other fire emergency in the vicinity of the Works the Contractor shall render assistance to the civil authorities to the best of his ability. Areas of forest, scrub or plantation damaged by fire considered by the Engineer to have been initiated by the
Contractor’s staff or labour shall be replanted and otherwise restored to the satisfaction of the Engineer at the Contractor’s expense.

1.14 Issue of Departmental materials

1.14.1 The department may issue the Casing pipe / liner pipes and pipe for making Strainer (Slotting) for some length free of cost. The Contractor has to carry the afore said materials to site and for making Strainer (Slotting) in the factories and again to site after slotting is completed at their own cost. Once the materials issued to the contractor he will be the custodian of the materials and will be responsible for protection. Any missing / theft / damage will be his responsibility and in such cases the department will recover twice the cost of book value.
Specifications of MS Pipes

(Casing Pipes, Liner Pipe, Pipe for Strainer)

1.1 Casing Pipes

MS casing pipes will be conforming to IS 4270: 2001.

1.2 Electric Resistance Welded Pipe

The pipes will be Electric Resistance welded tubes made from steel strips/plates conforming to IS 10748: 1995 formed into tubular shape and welded by passing a heavy current across the longitudinal joint. General requirements related to the supply of steel tubes for water wells shall conform to IS 4270: 2001 except that maximum minus tolerance in pipe thickness up to 2% only will be permitted.

1.3 Joints

The pipes will be with plain ends and shall be supplied with both ends beveled. The angle of bevel shall be 30° ± 5° when measured from a line drawn perpendicular to the axis of the pipe.

1.4 Manufacture

Steel used for the manufacture of tubes shall be grade Fe 410 made by open-hearth, electric or any oxygen process.

The tube shall be manufactured from steel which, when analyzed shall show not more than 0.04 percent sulphur or phosphorus.

1.5 Dimensions and Masses

Dimensions and masses of tubes shall be as follows:

<table>
<thead>
<tr>
<th>For nominal bore size of 200 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal bore diameter          : 200  mm</td>
</tr>
<tr>
<td>Outside Diameter              : 219.1 mm</td>
</tr>
<tr>
<td>Thickness of pipe              : 8.0   mm</td>
</tr>
<tr>
<td>Mass of plain tube             : 41.65 kg/m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For nominal bore size of 300 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal bore diameter          : 300  mm</td>
</tr>
<tr>
<td>Outside Diameter              : 323.9 mm</td>
</tr>
<tr>
<td>Thickness of pipe              : 9.5   mm</td>
</tr>
<tr>
<td>Mass of plain tube             : 73.67 kg/m</td>
</tr>
</tbody>
</table>

1.6 Tolerances

Permissible tolerances on outside diameter of pipe shall be (±) 1 percent. The permissible tolerance on the welded tube thickness shall be up to and including (+) 15 percent and O.D. (–) 12.5 percent. No single tube shall deviate from the mass specified above with a tolerance of (+) 10 percent and (-) 8 percent.
1.7 **Lengths of Pipes**
The pipes shall be supplied in lengths of 4 to 7 meters.

1.8 **Conditions of pipes**
All pipes shall be free from harmful defects, of good commercial finish and free from loose scale and rust. When required, the ends shall be cut square with the axis of the pipe.

1.9 **Mechanical Properties**
The manufacturer shall undertake the mechanical tests specified on a sufficient number of pipes to ensure that they comply with the requirements of the standard.

1.10 **Tensile Test**
The tube / pipe sample when tested in accordance with IS: 1608 yield strength, tensile strength and percentage elongation shall not be less than that specified below.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Yield strength Minimum (MPa)</th>
<th>Tensile strength Minimum (MPa)</th>
<th>Percentage elongation Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe 410</td>
<td>235</td>
<td>410</td>
<td>15</td>
</tr>
</tbody>
</table>

1.11 **Coating of tubes**
The tubes shall be externally coated with a bituminous solution or any other protective anti-corrosion coating. The bituminous solution shall be of a quality such as to produce a coating which, when dry, shall be smooth, tough and tenacious and sufficiently hard not to flow on exposure to a temperature of 63°C and shall not be brittle at 0°C. It shall not be such as will impart a taste to the water.

1.12 **Protection of ends**
During transportation, pipe ends will be protected to prevent damages such as cuts, bends or deformation.

1.13 **Quality of Steel**

1.14 **Grade of Steel**
Fe 410
Should be followed as per clause 4.2 of Is 4270 : 2001

1.15 **Protective coating :-**
Should be followed as per clause12.1 and 12.2 of IS 4270:2001.

1.16 **Workmanship:-**
All pipes shall be cleanly finished and when visually inspected shall be free from injurious defects and shall be cleanly cut. The end of the pipes shall be supplied with both ends bevelled as required by the purchaser. If the pipe is bevelled at both ends the angle of bevel shall be 30° ± 0.5° when measured from a line drawn perpendicular to the axis of the pipe and with root face of 1.6 ± 0.8 mm (Fig - 1).

1.17 **Mode Of Measurements**
M.S ERW pipes 300 mm dia and 200 mm dia will be measured in running meters.

1.18 **Transportation, Loading, Unloading and Stacking:-**
The cost of pipe should include cost of Transportation of pipes up to the Stack yard / sites as per sites selected, which would be in and around the city of Agartala. During transportation padding shall be
provided between coated pipes and timber skids to avoid damage to the coating. Stacking should be done with suitable gaps in the pipe stacks at intervals to permit access from one side to the other. It is essential to avoid damage to the pipes at all stages during handling. The pipes shall be handled in such a manner as not to distort their circularity or cause any damage to their outer coating. Pipes should not be thrown down from the trucks nor shall they be dragged or rolled along hard surface. Slings of canvas on equally non-abrasive material of suitable width or special attachment shaped to fit the pipe ends shall be used to lift and lower coated pipes so as to eliminate the risk of damage to the coating.

1.19 Inspection of Test.
The Supplier shall at its own expense and at no cost to purchaser carry out all such test and/or inspections of the goods and Related Services as per clauses and conditions of bid document. The pipes shall be inspected and defects noticed, if any, such as protrusions, grooves, dents, notches, etc, shall be rectified. Care should be taken that resulting wall thickness does not become less than the minimum specified.
PARTICULAR SPECIFICATION FOR MECHANICAL & ELECTRICAL WORKS for TW.

2. MECHANICAL WORKS

The drilling of tube well shall be carried with Rotary rig machine as per the geotechnical condition/requirement to drill gravel packed bore wells. Drilling of gravel packed bore holes of appropriate size to accommodate M.S. liner assembly (combination of blind & strainer pipe) of 300/200mm diameter in all type of strata. Depth of the tube well shall vary 150 to 210 meter depending upon the soil strata & aquifer zone encounter during drilling and at some places it may required to go up to 220 meters or more. Development of tube well and pump testing for yield of tube well shall be done for designing of the pumping machinery. The contractor has to arrange all material and personnel required to complete the work including supply.

2.1 Drilling Work

1. Drilling of Gravel Pack Bore holes using Rotary Rig machines to accommodate 300/200mm liner assembly

2. Development of tube well with high capacity air compressor till it gives sand free/clear water and testing for yield by submersible pump motor set or V.T pump set with variable speed operated on diesel engine or diesel generator.

3. Supply and lowering of liner assembly of 300/200mm blind pipe and strainer pipes.

4. Supply and filling gravel as per specifications in the annular space between outer casing and liner pipe assembly, developing testing and commissioning of the tube well. Minimum thickness of the gravel around liner assembly shall be 100 mm. as per IS: 11189-1985

2.2 Pumping Machinery

1. Supply and installation of submersible pump motor sets with suitable rating 3-core flat cable of various discharges along with supply of a standby pump set. Approx. Total Head and discharge is as under:(Only 5 Star rating category of motors will be considered)

<table>
<thead>
<tr>
<th>Name of Group</th>
<th>Discharge in cum/hr</th>
<th>Pressure head of pump</th>
<th>No. of Pump required</th>
</tr>
</thead>
<tbody>
<tr>
<td>no TW</td>
<td>85 cum / hr to 95 cum / hr</td>
<td>Between 65 meter to 70 metre</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>65 cum / hr to 75 cum / hr</td>
<td>Between 65 meter to 70 metre</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>40 cum / hr to 50 cum / hr</td>
<td>Between 65 meter to 70 metre</td>
<td>3</td>
</tr>
<tr>
<td>Lot – 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 no. TW</td>
<td>85 cum / hr to 95 cum / hr</td>
<td>Between 65 meter to 70 metre</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>65 cum / hr to 75 cum / hr</td>
<td>Between 65 meter to 70 metre</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>40 cum / hr to 50 cum / hr</td>
<td>Between 65 meter to 70 metre</td>
<td>2</td>
</tr>
</tbody>
</table>
2. Supply and fixing of mild steel both end flanged (D/F) riser pipes of size equal or higher the size of delivery of pump set for lowering of submersible pump sets, Riser Pipe size 100mm.

3. Supply and installation of manually operated sluice valves and non-return valve of size equal to delivery, size 150mm and sluice valve for wash out line of 100mm.

4. Providing, laying and jointing of M.S. pipelines to connect tube well delivery pipe line to the existing water supply network.

2.3 Electrical Equipment

1. Supply and installation of 415 volts LT sheet metal enclosed motor control starter panel for pump sets having incoming and outgoing MCCB arrangement with overload relay, over current relay, low voltage relays etc.

<table>
<thead>
<tr>
<th>Starter Panel Rating in Ampere</th>
<th>Changeover switch in Ampere</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Cabling work from power transformer to the electric change over switch 3.5 Core 1100 volt aluminum and copper LT cable. As per direction of Engg-in-Charge.

2.4 Instrumentation Work

1. Installation of 150 mm dia. pressure gauge of rating 0-10 kg/cm dia.

2.5 Description of work and specifications

2.5.1 Drilling of Tube Wells

The following Indian Standards shall be applicable for various components relating to construction and testing of tube wells.

<table>
<thead>
<tr>
<th>IS Code No.</th>
<th>Relating to</th>
</tr>
</thead>
<tbody>
<tr>
<td>9439 : 1980</td>
<td>Glossary of terms used in water well drilling technology</td>
</tr>
<tr>
<td>2800 : 1979</td>
<td>Construction of tube wells – Parts I and II</td>
</tr>
<tr>
<td>11189 : 1985</td>
<td>Methods of tube well development</td>
</tr>
<tr>
<td>226 : 1975</td>
<td>Structural Steel (fifth revision)</td>
</tr>
<tr>
<td>4270 : 2001</td>
<td>Steel Tubes for water wells (first revision)</td>
</tr>
<tr>
<td>8110 : 2000</td>
<td>Well screens and slotted pipes (first revision)</td>
</tr>
<tr>
<td>4097 : 1988</td>
<td>Gravel for use as pack in tube wells</td>
</tr>
</tbody>
</table>

2.5.2 Drilling of bore hole shall be carried out with Rotary/Dual rotary/ Rotary cum Percussion rig machine in all kind of strata to accommodate the M. S. Liner assembly and gravel packing around the assembly pipe.

2.5.3 Purpose of Tube Wells

The tube wells constructed under this project shall be used for water production for drinking
2.5.4 Expected yields of Tube Well

Tube well in the Agartala city is expected to yield 80–95 cum / hrs.

2.5.5 Depth

Depth of drilling in the project area is generally expected to vary between 190 to 210 meters range and some times may be required to go 220 meters or more. The rig machines suitable as per the geotechnical condition/requirement to drill gravel packed bore wells.

2.5.6 Liner Assembly

The liner assembly mild steel pipe conforming to IS: 4270 shall be used to be issued by the Deptt. free of cost for this work . The size of the liner shall be combination 300/200mm depending as per the strata and aquifer zone The blind pipe and the strainer pipe shall be designed keeping in view the strata, aquifer zone and sieve analyses of the tube well. Slot size of strainer pipe shall vary from 1.5 MM to 1.6 MM confirming to IS: 8110.

2.5.7 Gravel Packing

The gravel to be used will be Pea gravel as per design and will be of size suitable to screen and formation. All gravel pack in tube well construction shall be as specified in IS 4097: 1988 from the query located near Agartala.

2.5.8 Physical characteristics

The gravel for packing shall consist of hard quartz (about 96 % SiO₂) or other suitable material with an average specific gravity of not less than 2.5. Not more than 10 % by weight of the material shall have a specific gravity of less than 2.50. The gravel shall contain not more than 2 percent by weight of thin flat or elongated pieces. In the case of such pieces, larger dimensions shall not be more than 3 times the smallest dimensions. The quartz shall be of sub-rounded to rounded grains with minimum angular features. The gravel for use as pack shall be free from impurities such as Shale, Mica, Felspar, Clay, Sand, Loam, Haematite and organic materials.

2.5.9 Porosity

The porosity of gravel when laid as a pack shall not be less than 25 percent.

2.5.10 Gravel sizes

The gravel conforming to IS 4097: 1967 shall be followed.

2.5.11 Particle size distribution

The particle size distribution of gravel shall be determined by screening through standard sieves in accordance with IS 460: 1962.

The Uniformity Coefficient (UC) of the gravel that is ratio of D₆₀ to D₁₀ sizes shall not exceed 2. A material with UC less than 2 shall be treated as uniform and greater than 2 as non-uniform.

2.5.12 Hardness

The gravel shall have a hardness of not less than 5 in Moh’s scale.
2.5.13 Design criteria for gravel pack

Criteria for design of artificial gravel pack as generally expressed in terms of gravel pack ratio which will be the ratio between the average size of the gravel pack material and the average size of the aquifer material. However following design criterion for gravel pack will be adopted based on minimum head loss through gravel pack and minimum sand movement:

<table>
<thead>
<tr>
<th>Pack</th>
<th>Aquifer Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniform aquifer with uniform Gravel pack</td>
<td>9:12.5</td>
</tr>
<tr>
<td>Non – uniform aquifer with uniform Gravel pack</td>
<td>11:15.5</td>
</tr>
</tbody>
</table>

The size of the slot opening will be governed by the size of gravel or aquifer material which it has to retain. The slot size for gravel packed well should be such that it retains about 90 percent of the gravel.

2.5.14 Pack Aquifer Ratio

The Pack Aquifer Ratio (P/A ratio) will be the ratio of 50 percent size \( D_{50} \) of the gravel pack to the 50 percent size of the aquifer. The size of gravel when used as pack in tube wells shall be decided in accordance with the size of aquifer material proposed to be tapped. The thickness of gravel shroud around the screen shall not be less than 10 cms as prescribed in clause 9.2.1 of IS code 2800 (Part I): 1991. As the tube well is developed till water becomes clear, more gravel will be fed and the process will be repeated till water becomes clear.

2.5.15 Development of tube well

Development of tube wells shall be an essential operation for stabilization of tube well after the completion of drilling and lowering of Liner assembly. It will be done in order to remove the finer material and opening up the passage in the formation so that water can enter the tube well through screen more freely. The Development will be treated as having been satisfactorily done when:

(i) Stabilization of alluvial formation has taken place and there is no further sinking of gravel and discharge is sand free.

(ii) Permeability of formation will be increased by removing finer material.

(iii) Development shall be done by putting educator pipe and air pipe.

(iv) Development of the tube wells will be done as per IS 11189: 1985. The tube well will be developed to establish maximum rate of usable water yield without sand content. Packing of gravel to fill up the annular space during the development;

The tube well shall be developed with high capacity air compressor of 1100/900cfm @ 350/300 psi at different aquifer zones to achieve sand free clear water having 50-20 PPM. The gravel if required shall be packed during development. Development shall be done using back washing method.

The development shall be started as far as possible from the bottom of screen. Adequacy of development shall be determined from sand samples collected during drilling.

2.5.16 Plumb and alignment

The verticality of the tube well shall be as conforming to IS 2800 (Part II) 1979. Verticality of the tube well shall have a deviation so as to provide clear cylindrical space not less than the clear cylindrical space available in a hypothetical tube well of the same size but having deviation of 10 cm per 30 m in one direction and in one plane only. The tube well should not be out of alignment and contain kinks, bends or cork screws. The tube well deviation shall be in one direction and in one plane only. The plumb or plunger shall have diameter 6 mm smaller than the well casing. The verticality test report shall be submitted in the format to be
developed at later date.

2.5.17 Pump test

The pump test shall be carried out in accordance with IS 2800 (Part II): 1991, by installing a Vertical turbine with variable speed or submersible pump set and pumping out water. The yield of tube well will depend upon geological formations, data of pumping rates from nearby tube wells and such other factors. The same pump may be used for varied discharge by throttling the valve. Pump has to be operated at three different discharges namely, at the normal expected discharge, 20 % higher discharge and 50 % higher discharge. Draw down in each case will be noted. At each rate of discharge, pumping will have to be done for at least 30 minutes. Sand particles after 20 minutes of pump start in each case should not exceed 20 ppm by volume. At no stage, the sand contents should exceed 50 ppm by volume. The contractor record pump test results in the following format.

Table for Normal Test Results

<table>
<thead>
<tr>
<th>S. No</th>
<th>Rated Discharge</th>
<th>Depression at rated discharge</th>
<th>Specific yield 2/3</th>
<th>Total Hours run</th>
<th>Sand in PPM at end of test</th>
<th>Static water level</th>
<th>Pumping water level</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
</tr>
</tbody>
</table>

2.5.18 Disinfection

The tube well will be disinfected after the yield test. Chlorine solution of the strength of 2 ppm shall be applied.

2.5.19 Information to be furnished by drilling agency on completion of tube well

The contractor shall supply following information on completion of each tube well. A drawing indicating the strata observed at every change and the assembly used shall also be attached. The contractor shall supply the information stated below and the test results in three hard copies.

1. Location of the tube well .................................................................
2. Method of drilling adopted ............................................................
3. Date of starting ...............................................................................
4. Date of completion ............................................................................
5. Lithological data ............................................................................
   From To Formations
   ...................................................................................................
   ...................................................................................................
   ...................................................................................................
6. Total depth of tube well drilled .....................................................
7. Assembly required of production well
   I. Size of casing pipe ............
   II. Size of strainer pipe .........
   III. Lengths from top ............
       From To Type of pipe
       ...................................................................................................
       ...................................................................................................
   8. Perforations per meter .................................................................
9. Total length of Casing pipes .........................................................
10. Total length of Strainer pipes .......................................................
11. Whether Bail plug provided .........................................................
12. Size of gravel .................
13. Quantity used before development ................................................
14. Quantity used during development ...............................................
15. Particulars of compressor used for development ……………………………
16. Total hours of testing ………………………………………………………
17. Development discharge ……………………………………………………..
18. Static Water Level ……………………………………………………………
19. Safe yield in litres per hour …………………………………………………
20. Draw down at safe yield ……………………………………………………..

2.6 Specifications for strainer pipes

2.6.1 Strainer Pipes

The Strainer Pipes will be manufactured out of the MS pipes conforming to IS 4270: 2001.

2.6.2 Material

The slotted pipes shall be made out of steel pipes having same thickness of that of blank pipe. The material for the slotted pipe is mild steel and to be issued from the Deptt.

2.6.3 Length of Screen

The length of screen shall be governed by the thickness of aquifer and shall be sufficient to obtain the designed specified yield from the tube well. However, the minimum total lengths shall be such that the entrance velocity is less than the permissible entrance velocity of 0.03 m/s to ensure longer life of the well. The length of individual pipes shall be such as to afford easy handling for transport and lowering into wells, and removal in the case of recovery. The lengths shall be such there is minimum wastage in using of various length inside the well and to ensure that the combinations from the nearest requirement to obtain the estimated specific yield of the well. They may be in random lengths.

2.6.4 Diameter of the screen and thickness of pipe

The diameter and thickness of the screen will be the same as that of casing/liner pipe. It shall be ensured that area of opening available in the screen for flow of water after giving allowance for possible coverage of gravel, clogging, incrustation shall produce a screen velocity of not more than 0.03 m/s. The slot size shall be so selected that the percentage of slot area to screen surface area is generally between 15 and 22 percent.

2.6.5 Slot size

The shapes and size of the slot shall be such that the gravel or aquifer material is not allowed to block the open space. Based on the sieve analysis of the aquifer material the size of the slot opening shall be determined in such a way that finer fraction of the formations are removed during the development stage of the well and the coarser fractions remain outside the slots. The slot shall not be too wide to cause entry of the gravel and result in plugging. Sharp edges on the periphery of the pipe may offer resistance to flow and hence it is preferable to have smooth rounded edges.

2.6.6 Shape of slots

The shape of slot shall be such as to give no clogging property and shall have minimum geometrical resistance to water flow to reduce frictional head losses.

2.6.7 Percentage Opening

The percentage slot opening shall be such that the screen length provides sufficient inlet area to limit the entrance velocity as specified above. This is the minimum criterion. But the percentage open area shall be selected as high as possible for better transitivity and minimum resistance to water flow and minimum possible entrance velocity to achieve optimum well efficiency, higher specific capacity, less incrustation and minimum draw down...
to result into saving of pumping energy.

2.6.8 Distribution of Slots

The slots shall be cut in a pattern designed to get even distribution of flow all over the periphery of the pipe. The slot shall be distributed in rows as closely and evenly as possible, staggering the slots between each row. The screens with evenly spaced continuous horizontal slot (perpendicular to screen axis) throughout the periphery without leaving blind spots shall be preferred for improved well performance.

2.6.9 Specific Design Feature

The slots in the pipes shall be cut by milling machine. Typical slot pattern of well screen shall be as per IS code. The slots shall not be cut within 12 mm on either side of the longitudinal welded joints of the pipes.

2.6.10 Guidelines for selection of slot size

The selection of slot size will be as per Annex B of IS 8110: 2000. The size of slot openings suitable for different formation shall be based on sieves analysis of the aquifer material.

2.6.11 MS riser pipes for pump sets

The riser pipes shall be manufactured and supplied as per IS: 1239–2001, of medium class (Class B) MS pipes. Pipes shall be fabricated from steel plates conforming to relevant IS. It will be of size of delivery of pump or one size higher as directed by the Engineer. Pipes will be fitted with flanges and welded at both ends. Pipes will be provided in length of 3.00 meters.

2.7 Machinery Equipment

The scope includes design, manufacture, supply, delivery to site, installation, testing at site, and commissioning, final painting at site for all Mechanical works related to Tube Well in different locations. Final machinery equipment shall be determined on the basis of discharge of the tube well and other parameters. Tentative requirement is given in this chapter.

2.7.1 Specifications of Submersible Pumping Sets

- The Submersible pumping sets should be in accordance with the provisions of IS: 8034-1989 (specification for Submersible Pumping Sets for clear, cold fresh water) (amended or revised up to date) except for the provisions/ specifications mentioned hereunder.
- The electric motor is to operate at 3 phase 50 c/s A. C. Supply of 415 + 15 % volts. The preferred speed shall correspond to 2 pole motors [(2900 rpm (synchronous)].
- The Pump sets shall be installed in bore wells and should be suitable for conditions existing for ground water generally available in the city. The water to be handled by the Pump sets may have Total dissolved Solids 3000 ppm (max), Turbidity 80 ppm (silica scale) Chlorides 150 ppm (max) and PH value between 6.0 to 7.5.
- The material of construction of various components of the pump shall be as under:

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge casing</td>
<td>Cast Iron Grade FG 200 of IS: 210-1993</td>
</tr>
<tr>
<td>Suction casing</td>
<td>Cast Iron Grade FG 200 of IS: 210</td>
</tr>
<tr>
<td>Pump bowl</td>
<td>Cast Iron Grade FG 200 of IS: 210</td>
</tr>
<tr>
<td>Diffuser</td>
<td>Cast Iron Grade FG 200 of IS: 210-1993</td>
</tr>
<tr>
<td>Pump Shaft</td>
<td>Stainless steel 04 Cr 13 or 12 Cr 13 or 20 Cr 13 of IS: 1570 (Part – 5) – 1985</td>
</tr>
</tbody>
</table>
Bearing sleeves | Stainless steel 04 Cr 13 or 12 Cr 13 or 20 Cr 13 of IS: 1570 (Part – 5) – 1985
---|---
Impeller for radial flow/ mixed flow | Bronze grade LTB 2 to IS 318-1981
Casing wear ring (if provided) | Leaded tin bronze grade 4 of IS: 318-1981
Bearing bush in discharge & suction | Leaded tin bronze grade 4 of IS: 318-1981

- The thickness of impeller vanes shall be not less than 1.5 mm at tips and 3 mm at the base.
- The motor shall conform to IS: 9283 –1995 (amended up to date).
- The stator body should preferably be shrunk fitted instead of being only press fitted. The stator body should be tightly welded on the stamping assembly and adequate arrangement should be provided for stopping of rotation or shifting of stampings inside the stator body preferably by providing matching grooves in the stamping assembly and the stator body. Metal rings with rounded fingers should be provided on both ends of stamping.
- Threaded joints in the motor should be avoided to prevent damage due to rusting. Bearing housing should not be threaded but located on spigot and held by suitable bolts.
- The rotor as well as stator should be impregnated under vacuum of air drying and both should be baked repeatedly under controlled conditions to ensure long life of varnish/epoxy and to give a hard finish to the motor surface. The rotor should be dynamically balanced at high speed.
- All the material and components for the motors shall be suitable for application in respect of corrosion resistance and mechanical performance continuously under water. The typical materials to be used for various parts of motor are given below:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing housing &amp; base</td>
<td>Grey cast iron Gr. FG-200 of IS 210-1993</td>
</tr>
<tr>
<td>Motor shaft</td>
<td>Chromium steel Gr. 04 Cr 13, or 12 Cr 13, or 20 Cr 13 of IS: 1570 (aprt-5) 1985.</td>
</tr>
<tr>
<td>Bearing bush</td>
<td>Leaded tin bronze LTB 3, LTB 4 or LTB 5 of IS 318:1981 or Resin bonded carbon metal or rubber or rubber lined.</td>
</tr>
<tr>
<td>Rotor laminations</td>
<td>Electrical sheet steel of IS 648: 1994</td>
</tr>
<tr>
<td>Rotor conductor core</td>
<td>Electro grade copper of IS 613:1984</td>
</tr>
<tr>
<td>Stator laminations</td>
<td>Electrical sheet steel of IS 648:1994</td>
</tr>
<tr>
<td>Stator winding wire conductor</td>
<td>Electro grade copper of IS 613: 1984</td>
</tr>
<tr>
<td>Stator winding wire insulation</td>
<td>PVC or with polymer of IS 8783: 1978</td>
</tr>
<tr>
<td>Breather diaphragm</td>
<td>Nitrile rubber</td>
</tr>
<tr>
<td>Thrust bearing</td>
<td>Vulcanized fibre V/s chromium steel or vulcanized fibre V/s bronze.</td>
</tr>
<tr>
<td>Cable gland</td>
<td>Nitrile rubber</td>
</tr>
<tr>
<td>Stator Casing</td>
<td>Grey Cast iron FG 200 of IS 210:1993 or carbon steel (sheet or pipe) or stainless steel sheet Gr. 20 Cr 13 of IS 1570: (Part 5): 1985</td>
</tr>
</tbody>
</table>

- The materials indicated are typical. Manufacturers may use materials of properties superior as per the properties of materials indicated in manufacturing submersible motor.
- The motor shall be suitable for entire working range of pump from + 10% to – 25% of the rated head. Motor rating should be higher or equal to higher of the following:
  a. Consumption at + 10% of the duty head of pump.
  b. Consumption at - 25% of the duty head of pump.
  c. The drive rating of motor shall be 115% of the BKw required at the operating point.
The thrust bearing should be water lubricated and of hydrodynamic Mitchell type and should be able to take all untoward loads at most un-favorable running conditions. It should have swiveling metallic thrust pads.

The rotating element (as assembled rotors) of pumps should be dynamically balanced at high speed. The impeller shall be dynamically balanced ensuring smooth performance free of vibrations.

The manufacturer should have facilities for dynamic balancing at high speed, vacuum impregnation/air drying of rotors and stator, high tension electrical testing and pump performance testing.

The cable shall be water proof PVC insulated and PVC sheathed, flexible, 3 core flat type having copper conductors. It should be suitable for working voltage upto and including 1100 volts.

The coupling shall be preferably of mesh type rigid sleeves coupling of stainless steel non slip type with matching groove, collar and key way arrangement.

The duty point of pumps shall be located near the peak efficiency and there should not be steep fall in Q V/S H, efficiency curve in the head range of + 10% and – 25% of duty point lead This entire range should be on the stable portion of the curve.

2.7.2 Efficiency

The pump efficiency without minus tolerance shall be minimum 74% and motor efficiency minimum as 85%. Pump efficiency, Motor efficiency and Overall efficiency should be clearly mentioned in the offer.

2.7.3 Testing & Inspection

The prescribed performance at duty point shall be checked and guaranteed at 415 ± 15 % Volts. The actual performance shall however also are recorded at the lowest volts by the inspecting agency in the inspection certificate and it shall be ensured that motor does not get overloaded.

Testing of the pump sets shall be carried out as per relevant IS codes. However, wherever there is variation of specification from IS code the specification mentioned herein shall prevail and any subsequent fall out due to variation in specifications beyond IS code shall also be applicable.

The marking shall be as per relevant IS code. Purchaser’s mark “AMC-SIPMIU” & “Year of Supply” shall be mentioned on each pump & motor.

2.7.4 General

Minimum size of cable shall be 3-Core (2 x 6 sqmm) suitable for star delta starting or otherwise of higher rating as suggested by manufacturer. Each motor will include cable of suitable size for total length of 35 meters. If extra length is required, it will be paid extra.

The technical details of motor pump should be given in the format enclosed. Part submission or non submission of details asked for shall make the offer liable for rejection.

2.7.5 Motors

Design parameters

- Electrical system: ac, 415 v + 15%, 50 c/s + 3%, 3 phase and wire system
- ambient temperature: 50 degrees centigrade

Construction Details
a. All the materials and components for the motors shall be suitable for application in respect of corrosion resistance and mechanical performance continuously under water.
b. The motor will be of wet type submersible motor which shall be provided with suitable epoxy paint to protect it from corrosion under water.
c. Thrust bearing shall be provided.
d. The motor shall be protected by means of cable glands, rubber seals, etc., from ingress of bore well water, sand and other foreign material.
e. Motor shall be provided with earthing arrangement to facilitate earthing of motor as per IS 3043 (latest revision) during the time of installation.
f. The motor shall be capable of delivering rated output with the terminal voltage and frequency described under S. No. 3 in the data sheet 3.4.
g. The motor shall be of continuous duty (type SI) as per IS 12824 (latest revision).
h. The class of insulation of the winding shall be ‘F’ and the temp rise above the ambient temperature shall be restricted to that of class B insulation.

2.7.6 Requirements for the Pump Motor set

<table>
<thead>
<tr>
<th>1.0</th>
<th>Purpose</th>
<th>For Tube wells at different locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Pump type</td>
<td>Submersible Pumps ISI Marked</td>
</tr>
<tr>
<td>1.2</td>
<td>Number of pumps</td>
<td>1 in each Tube well</td>
</tr>
<tr>
<td>1.3</td>
<td>Pump discharge</td>
<td>70 M³/hr</td>
</tr>
<tr>
<td>1.4</td>
<td>Total duration of operation</td>
<td>Continuos</td>
</tr>
<tr>
<td>1.5</td>
<td>Synchronous Speed</td>
<td>2900 RPM</td>
</tr>
<tr>
<td>1.6</td>
<td>Location</td>
<td>Inside Tube Well</td>
</tr>
<tr>
<td>1.7</td>
<td>FEATURES OF CONSTRUCTION</td>
<td></td>
</tr>
<tr>
<td>1.8</td>
<td>Type</td>
<td>Redial/Mixed flow submersible type</td>
</tr>
<tr>
<td>1.9</td>
<td>Casing</td>
<td>Turbine bowl type</td>
</tr>
<tr>
<td>2.0</td>
<td>Impeller</td>
<td>Enclosed</td>
</tr>
<tr>
<td>2.1</td>
<td>Shaft</td>
<td>Coupled</td>
</tr>
<tr>
<td>2.2</td>
<td>Drive Transmission</td>
<td>Direct</td>
</tr>
<tr>
<td>2.21</td>
<td>Prime mover</td>
<td>Electric motor to operate on 415 V, 50 Hz. 3 Phase AC supply</td>
</tr>
</tbody>
</table>

3.0 LIQUID DATA
3.1 Liquid handled | Water |
3.2 Specific gravity | 1.0 |
3.3 Temperature | Ambient temp. |

4.0 MATERIAL OF CONSTRUCTION
4.2 Pump Casing | C.I. IS 210 Grade FG 200 |
4.3 Impeller | Bronze IS 318 Gr LTB2 |
4.4 Shaft | S.S AISI 410 |
4.5 Wearring Ring | Bronze IS 318 Gr LTB2 |

2.8 Electrical

Special Terms & Conditions

Pump should be from the original Manufacturers of BEE (Bureau of Energy Efficiency) awarded 5(Five) Star rated Submersible pump & Motor having valid license for BIS certification marks / Authorized Dealer of original Manufacturers of aforesaid category with experience in supply of BEE awarded 5(five) Star rated/BIS approved submersible pump & motor to any department of State / Central Government and/or PSU of State / Central Government and also having good credential for supplying of Submersible pump & Motor are eligible to compete this tender.
2.8.1 Electrical Scheme

The scheme involved in providing electrical power supply is furnished below:

- The required electric power line of 415 volts 3 phase will be drawn by the Electricity department. The amount of their demand note will be deposited by the contractor with the Electricity department, which will be reimbursed to the contractor in next running bill. ERA will provide full assistance in getting power connection from the concerned department.
- Electrical Power supply will be tapped from the LT Electric pole or the power meter installed by Electricity department. Power from LT pole / meter board shall be fed up to the switch by laying required size 3.5 C LT PVC insulated, PVC sheathed, armored aluminum conductor cable. Power starter panel shall be fed by laying 3.5 C LT PVC insulated, PVC Sheathed, armored copper conductor cable.
- The tube well motor shall be connected to the starter panel by the flexible cable supplied along with the motor. Required additional cable will be provided by contractor.

2.8.2 Electrical equipment / items

The following electrical equipment and items form the part of the work:

- Indoor mounted motor starter Panel with all required electrical components and erecting it at suitable location in room including required hardwares and accessories.
- LT Power Cables for feeding power supply to starter panel.
- Earthing station with earth pits and pipe electrodes as well as other earthing materials like wires & flats and earthing the starter panel, tube well etc.

2.8.3 Details of works to be carried out

- Construction of foundation for installation of motor starter panel
- Supply & installation of motor starter panel for operating tube well pump motor.
- Supply and laying and connecting of LT Power cable between Electric pole / D.G. set to the change over switch fuse, AVR and upto motor starter panel.
- Construction of Earth pit stations with GI pipe electrodes and associated hard wares & accessories.
- Supplying, laying and interconnection of Earth pit stations (a) with the starter panel and (b) with the pump motor body by means of GI earth flats and copper wires.

2.8.4 System design parameters

The electrical equipments / items selected for this project shall be suitable for operation of technical parameters specified below:

- a) Incoming Power Supply : AC, 415 V, 3Ph, 4 wires, 50 Hertz
- b) Lighting : AC, 230 V, 1Ph, 2 wires
- c) Control system : AC, 230 V, 1Ph, 2 wires
- d) Ambient temperature : 50 degrees Centigrade
- e) System earthing : Solidly earthed
- f) Voltage Variation : ± 15% of rated voltage
- g) Frequency Variation : ± 5% of rated frequency
- h) Combined voltage and Frequency variation : ± 15%

2.8.5 Technical specifications

2.8.6 Motor starter panel
Wooden Panel shall be of all doors, panels, removable covers, gland plates etc., shall be gasketed using Neoprene gaskets all round the perimeter. Door or cover shall be provided with concealed type of hinges or and captive screws. Colour finish shade shall be as per IS 5. The colour of the interior shall be glossy white and the exterior shall be battle ship grey. Degree of protection (Class of enclosure) shall be IP54. Cable entry shall be from bottom. All electrical components shall be suitable to operate at an ambient temp of 50 deg Centigrade. Earthing conductor shall be connected at the bottom of the panel.

The starter panels with automatic star – delta components are considered. The starter panel will be provided with the motor starter components namely the incomer MCCB, Power and Auxiliary Contactors, over voltage relay, under voltage relay, over current relay with single phase preventor, on / off / trip (Overload) indicating lamps on/off PB's, ammeter, voltmete with selector switches, flow display unit etc.

- Incomer MCCB of required rating.
- Motor starter contactors shall be of single throw, electromagnetic type and AC3 duty. These contactors shall not dropout at voltages down upto 70 % of the rated coil voltage.
- The overload relays shall be rated to operate both at 70 % and 110 % of the rated voltage.
- Selector switches shall be flush mounted of the stay put maintained contact type.
- Indicating instruments and meters shall be mounted flush with panel. These instruments dial shall be white with black numbers. Meters shall have provision for zero adjustments outside the cover. Normal maximum meter reading shall be of the order of 60 % of normal full scale deflection. The accuracy class shall be 1. Ammeters for motors shall have suppressed extended scale to read upto six times rated current. The size of the ammeter & voltmete shall be 96 x 96 sq. mm.
- The panel is provided with over load and under voltage relays for protecting the motor on overload and also in under voltage conditions. Hence, the motor gets isolated and gets protected totally.
- Indicating lamps shall be of the filament type with low watt consumption. Indicating lamps shall be of the double contact bayonet cap type rated for operation on 230V AC. Indicating lamps shall be provided with series resistances to avoid short circuiting of control supplies in the event of fusing of the filament. Lamps shall be provided with translucent lamp covers. Bulbs and lenses shall be interchangeable and easily replaceable from the front.
- Start and stop push buttons shall be coloured green and red. Push buttons shall be of the push to actuate the contact type and shall be lockable.
- All wiring for control, protective, alarm and indication circuits on all equipments shall be carried out with at least 650V grade, PVC insulated, stranded tinned copper, 2.5/1.5 sq. mm conductors. Wiring for Control circuits shall be carried out with 2.5 sq. mm conductor. All wiring shall be run on the sides of the panels and shall be neatly bunched and cleated with access to equipment mounted on the panel. All wiring shall be taken to terminal blocks without joints or tees in their runs. Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted to each wire and each core of multi core cables terminated on the panels. Ferrules shall fit tightly on the wires, without falling off when the wire is removed. Ferrules shall be of yellow colour with black lettering.
- Terminal blocks shall be of the 650 V grade, Clip on type. Terminals shall be numbered for identification and grouped according to function. Terminals blocks shall be arranged with at least 100 mm clearance between any two sets. Separate terminals stems shall be provided for internal and external wiring respectively. All wiring shall be terminated on terminal blocks, using crimping type of lugs or claw type of terminations.
- Contractor will submit drawing of equipment for approval of the Employer before fabrication of the starter panel.
• One 2’ long 20 watt tube light for illuminating the panel will be provided with a toggle switch.

2.8.7 Cables

• The cable supplying power shall be PVC insulated, PVC sheathed, aluminum conductor 3.5 core armoured of the size included in BOQ. Cable for power supply from changeover switch fuse to AVR and starter panel shall be PVC insulated and PVC Sheathed copper conductor armoured of the size included in the BOQ. Cable for power supply to the motor from starter panel shall be 2 x 3 core copper wire flat type flexible submersible cable. It will be of the same size as is provided by the manufacturer of motor with the motor.

• Epoxy straight through joints shall be made in the LT cable laid between starter panel and motor in case the length of the cable supplied along with the motor is insufficient in length.

• Cables shall conform to IS 1554. Cables shall be capable of satisfactory performance when laid on trays, conduits and ducts or buried underground. Cables shall be capable of operating satisfactorily under a power supply system voltage variation of +/- 15%, a frequency variation +/- 5% and a combined voltage and frequency variation of +/- 15%.

• The contractor shall install, test and commission the cables in accordance with approved drawings and instructions issued by the client. Cables shall be laid as per approved drawing. Inspection on receipt, unloading, storage and handling of cables shall be in accordance with IS: 1255 and other Indian Standard Codes of Practice.

• Where cables cross roads and water, oil, gas or sewage pipes, the cables shall be laid in reinforced spun concrete or steel pipes. For road crossings the pipe for the cable shall be buried at not less than one meter depth.

• In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made should the cable develop a fault at a later date.

• Suitable double compression type cable glands shall be provided. Provision shall be made for earthing of each cable glands. Equipment terminal blocks for power connections shall be complete with adequate phase segregating insulating barriers and suitable crimping type of lugs (copper or aluminum as required) for connecting the insulated cable tails. All switchboards shall, unless otherwise specified, facilitate bottom cable entry. Removable gland plates shall be mounted at least 300 mm above the base of the panel. The individual cores of the cables shall be neatly dressed and supported at regular intervals before connecting them to the relevant terminals.

2.8.8 Earthing System

• The complete scope of work for earthing system shall be as per IS 3043. Earthing system shall be provided to ensure equipment and personnel safety and shall comply with all currently applicable standards regulations and safety codes. Earthing conductors shall be of hot dip galvanized iron flats / strips.

• Earth pits shall be constructed according to the stipulations of IS. 3043. Earth electrodes shall be fabricated in accordance with IS.3043. The minimum spacing between two adjacent earth electrodes shall not be less than 6 meters. Earth electrodes shall be located in inspection chambers with suitable lids and provided with facilities for the periodic testing of the earth resistivity. Electrodes shall as far as practicable be embedded below the permanent moisture level.

• The Contractor shall supply and install GI steel wires / strips required for system and individual equipment grounding. All work such as cutting, bending, supporting, coating, drilling, brazing, clamping, bolting and connecting onto structures, pipes, equipments frames, terminals, rails or other devices shall be in the Contractor's scope of work. The excavation, trenching and back filing shall be carried out by the Contractor as required, together with the supply of all material.
• Earthing shall conform to the Indian Standard Code of Practice IS. 3043 and Indian Electricity Rules, 1956. All materials and fittings used in the earthing installation shall conform to the relevant Indian Standards. Installation work shall be in accordance with approved earthing drawings.

• All earthing conductors to be buried in the ground shall be laid 600 mm below grade level and 1500 mm away from buildings. Backfill shall be placed in layers of 150 mm, uniformly spread along the trench and consolidated.

• Cable armour shall be bonded to the earthing system. Metal pipes and conduits through which cables run shall be efficiently bonded and earthed. Electrical conduits, pipes and cable tray sections shall be bonded to ensure electrical continuity and connected to earthing conductor at regular interval.

• All underground connections for the earthing system shall be welded, connection to equipment and devices shall be normally of the bolted type.

• Earth pits shall be treated with salt and charcoal.

2.9 Mild Steel Pipes

2.9.1 Seamless / Electrical welded steel pipes conforming to IS: 1239 Pt.1 (heavy) shall be used as a riser pipe for lowering of submersible pump motor set. The riser pipe shall have MS flange welded on both ends. The flanged pipe shall be jointed with nut and bolts by placing a rubber joint between the flanges.

2.10 Valves

2.10.1 The sluice valves and Non return valve of different sizes shall be require and conform to relevant Indian standards.

2.10.2 All necessary fittings including bolts, nuts, gaskets, counter flanges, jointing material, etc. as required shall be supplied.

2.11 Sluice Valves

2.11.1 Scope

This section covers the requirements for non rising stem type sluice valve of 100 mm size. The valves will be used for water supply on line installations in upright positions, up to 45°C working temperature, with double flange and cap or hand wheel, for manual operation.

2.11.2 Nominal pressure and dimensions

The working pressure of the valves shall be 10 / cm2 (1.0 Mpa)

The dimension and mass of the sluice valves shall be in accordance with IS: 14846 for sizes from 100 to 150 mm.

The flanges and their dimensions of drilling shall be in accordance with IS: 1538 (part-I to XXII).

2.11.3 Material

The material for different components parts of sluice valve shall conform to requirements given below:

<table>
<thead>
<tr>
<th>S No.</th>
<th>Component</th>
<th>Material</th>
<th>Ref. to IS</th>
<th>Grade / designation</th>
</tr>
</thead>
</table>
1. **Body, bonnet, wedge, stuffing box, gland, thrust plate, cap. etc.**
   - Grey cast iron
   - 210
   - FG 200

2. **Hand wheel**
   - Grey cast iron
   - 210
   - FG 200

3. **Stem**
   - Stainless steel
   - 6603
   - AISI 431, AISI 410

4. **Wedge nut**
   - Leaded tin bronze
   - 318
   - LTB 2

5. **Body seat ring, wedge facing ring**
   - Leaded tin bronze
   - 318
   - LTB 2

6. **Bushes**
   - Leaded tin bronze
   - 318
   - LTB 2

7. **Bolt**
   - Carbon steel
   - 1363
   - Class 4.6

8. **Nut**
   - Carbon steel
   - 1363
   - Class 4

9. **Bonnet gasket**
   - Compressed fibre board
   - 2712
   - C

10. **Gland packing**
    - Jute and hemp/graphite
     - 4687
     - nil

2.11.4 **Coating**

All sluice valves shall be coated by dipping in a bath of tar base composition as given in IS: 14846 for size of 100mm to 150mm.

All components susceptible to corrosion attack shall be coated internally and externally. Protective coating shall always be applied to the individual components before they are assembled, following shot blasting to give good adhesion.

2.11.5 **Marking, testing and inspection**

The standard marking and packing of the valves shall be done as per IS: 14846. The direction of rotation for OPEN, CLOSE position shall be marked on the hand wheel and on the bonnet of the valve.

Testing of sluice valve shall be done for close end in accordance with IS: 14846 for sizes from 100 mm to 150 mm. Hydro test for seat leakage shall be carried out at 10 kg/cm² (5 min) and for body leakage at 15 kg/cm² (5min). TCS for major materials shall be furnished.

All the valves shall be inspected for flaw detection test in accordance with IS: 14846 for sizes from 100 mm to 250 mm.

The design, construction material, manufacture, inspection, performance and testing shall comply with all applicable Indian Standards and Codes. Nothing in the specification will be construed to relieve the supplier of this responsibility.

2.12 **Non-return Valves PN 10 / 16 Class**

2.12.1 **Specification of Non-return Valves for water application**

1. The valves shall generally conform to IS: 5312 Part 1 (Single Door Type) for size 150mm.
2. The valve shall be suitable for mounting on a horizontal pipe line and flow direction shall be clearly embossed on the valve body.
3. Valves shall have in built quick closing non-slam characteristics achieved by suitable dispositions of weight on door and the hydraulic passage. No spring loaded / spring return action or external dampening arrangement is acceptable.

2.12.2 **Data**

1. **Size** : 150 NB
2. Rating : PN 10
3. Drilling : IS: 1538 Table 4 & 6

2.12.3 Material of Construction

1. Body / Door : CI IS: 210 Gr. FG 200 for PN 10 / 16
2. Hinge pin (single door) : St. St. AISI 410 / 431
3. Seat & Face rings : IS: 318 Gr. LTB II
4. Rivets : Soft annealed brass
5. Fasteners : Carbon Steel

2.12.4 Shop Testing

A) Hydro test:
1. Seat leakage : 10Kg/cm² (5 min) – for PN 10
2. Body : 15Kg/cm² (5 min) – for PN 10
3. Material Compliance : TC’s for major material to be furnished.

2.12.5 Other

G.A drawing to be furnished.

2.12.6 Inspection

2.12.7 During testing there shall be no visible evidence of structural damage to any of the valve components. Inspection shall be carried out in accordance to IS 5321 Pt.I

2.13 Inspection & testing of mechanical equipments at works

2.13.1 Following equipment will be subject to routine tests at the manufacturer’s premises in presence of SIPMIU’s representative. The acceptance test as per latest relevant IS shall be carried out.

(i) Submersible pump motor set.
(ii) Motor Control Panels
(iii) ERW pipes and Strainer pipes for tube well Assembly,
(iv) Delivery column pipe of Submersible pump set.

2.13.2 For each type of submersible motor, type test certificates will be provided. For type tests, test certificates from recognized test house will be accepted. All inspection and testing shall be carried out in accordance with the Specifications laid above and in absence of Specifications relevant Indian Standard will be followed.

2.13.3 SIPMIU’s authorized representative shall have access to the manufacturer’s premises at all times to inspect and examine the material and workmanship of the mechanical and electrical plant and equipment during its manufacture there.

2.13.4 All the items of electrical mechanical required shall be stored in closed room or shed with original packing.

2.14 Technical Details to Be Filled By Bidder

- Bidder’s data sheet for offered submersible Pump set
  (To be filled in by the Bidder separately for each type of Pump set offered)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars</th>
<th>Data to be Furnished by the bidder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Make</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Model</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Motor rating in KW</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Number of stages</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Discharge at duty head (LPM) [at 380 Volts]</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Duty head (M) [at 380 Volts]</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Pump efficiency at duty point (%)</td>
<td></td>
</tr>
<tr>
<td>S. No.</td>
<td>Item and Particulars</td>
<td>Data to be Furnished by the bidder</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Make and pressure rating of Sluice valves</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Make and pressure rating of Reflux valves</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Make of Liner assembly pipe of Mild steel</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Make of MS pipe for riser/column purpose</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Source/ quarry for the Gravel</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Make of submersible Cable</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Make of PVC Aluminum Cable</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Make of pressure gauge</td>
<td></td>
</tr>
</tbody>
</table>
2.15 **Electrical Scheme:**

The required electric power line of 415 volts, 3 phases, 50 HZ, shall be drawn by the contractor by laying cable and carrying out jointing works at the metered supply point within the pump house premises to be provided by the electricity authority and terminating other end of the cable at the 415 Volt switch Board (motor starter panel) to be installed within the pump house to cater to the total electrical demand i.e. tube well motor, the lighting and ventilation loads of the pump house etc.

The metered supply point of required capacity shall be provided by the supply authority and the demand note against the charges for the same shall be borne by the contractor and the contractor shall raise bill of the amount to receive reimbursement from the client.

The Client shall render full assistance in getting power connection from the concerned department.

The contractor shall carry out all digging works while laying cable for the job wherever necessary and shall restore the disturbed surfaces to normalcy after completion of the job.

The tube well motor shall be connected to the starter panel by flexible cable to be supplied along with the pump – motor assembly,

All safety measures shall have to be adopted and followed by the contractor while carrying out the above said networking.

2.16 **Supply, Installation, Testing, Commissioning Of Electrical Equipment / Items**

- Indoor mounted 415 Volt switch board (motor starter panel), local push button stations with all required electrical components, hardware, accessories to supply the electrical demand of the pump house at a suitable location in the room.

- All cabling works to complete the job.

- Capacitor bank to maintain the power factor of 0.98.

- Earthing stations with earth pits and wires, flats to form earth grid and shall connect to the starter panel, motors, and all other electrical equipment.

- All wirings including MCB DB, switch socket, raw power points, ceiling fans, exhaust fans, all external and internal lighting works with all accessories, hardware etc complete in all respect.

- The items which are needed to effectively complete the job.

2.17 **System design parameters:**

The electrical equipment / items selected for this project shall be suitable for operation of technical parameters specified below:

- **i)** Incoming Power Supply : AC, 415 V, 3Ph, 4 wires, 50 Hz
- **j)** Lighting : AC, 230 V, 1Ph, 2 wires
- **k)** Control system : AC, 230 V, 1Ph, 2 wires
- **l)** Ambient temperature : 50 degrees Centigrade
- **m)** System earthing : Solidly earthed
- **n)** Voltage Variation : ± 15% of rated voltage
- **o)** Frequency Variation : ± 5% of rated frequency
- **p)** Combined voltage and Frequency variation : ± 15%
2.18 **Technical specifications:**

- The 415 V switch board shall be in compliance to the codes and standards as follows:

  The installation shall meet the requirements of Indian Electricity rules. Materials, equipment and methods used in the manufacture shall conform to the latest edition of IS and IEC standards and the standards referred to in those standards, including the following.

<table>
<thead>
<tr>
<th>Standard/Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS: 60947, IEC 60947</td>
<td>Switchgear and control gear</td>
</tr>
<tr>
<td>IS: 60947, IEC 61641, IEC 60439</td>
<td></td>
</tr>
<tr>
<td>IS: 2705, IEC: 60185, IEC: 60044</td>
<td>Current transformers</td>
</tr>
<tr>
<td>IS: 3156, IEC: 60186</td>
<td>Voltage transformer</td>
</tr>
<tr>
<td>IS: 1248</td>
<td>Indicating Instruments</td>
</tr>
<tr>
<td>IS: 13010</td>
<td>Energy meters</td>
</tr>
<tr>
<td>IS: 8686, IS: 3231, IS: 3842</td>
<td>Relays</td>
</tr>
<tr>
<td>IS: 5082, IS: 2678, IEC 105</td>
<td>Bus bar (Aluminium)</td>
</tr>
<tr>
<td>IS: 282</td>
<td>Bus bar (Copper)</td>
</tr>
<tr>
<td>IS: 2544</td>
<td>Bus bar support insulators</td>
</tr>
<tr>
<td>IS: 8828</td>
<td>MCB</td>
</tr>
<tr>
<td>IS: 9224, IS: 13703</td>
<td>HRC Fuses</td>
</tr>
<tr>
<td>IS: 13947, IEC 60292</td>
<td>Starter</td>
</tr>
<tr>
<td>IEC 60071</td>
<td>Co-ordination of Insulation</td>
</tr>
<tr>
<td>IEC 60445</td>
<td>Identification of Equipment Terminals and of Terminations of Certain Designated Conductors, Including General Rules for an Alphanumeric System.</td>
</tr>
<tr>
<td>IS: 6875</td>
<td>Control switches and push buttons</td>
</tr>
<tr>
<td>IEC 60529</td>
<td>Degrees of protection provided by enclosures (IP Code)</td>
</tr>
<tr>
<td>IS 6005</td>
<td>Code of practice for phosphating iron &amp; steel</td>
</tr>
<tr>
<td>NEMA-TR-1</td>
<td>NEMA standard Publication for power Transformers.</td>
</tr>
<tr>
<td>IS 3347</td>
<td>Porcelain bushings</td>
</tr>
<tr>
<td>Indian Electricity Rules</td>
<td></td>
</tr>
<tr>
<td>Indian electricity act</td>
<td></td>
</tr>
<tr>
<td>CBIP manual/ Guidelines</td>
<td></td>
</tr>
</tbody>
</table>

This covers LT Panels, DB, Local push button station, and any other panel supplied by the contractor / vendor. The spare feeders shall be as per the SLD.

- All the equipment shall be suitable to be installed at hot, humid and dusty tropical atmosphere.
- The switch board shall be as follows:
Metal clad, fully compartmentalized, dust, vermin proof and floor mounted. Louvre openings suitably padded with felts shall be provided. Bus bar, power cable, PT, metering/protection enclosure shall have separate compartments.

Made from 2 mm CRCA sheet steel & 1.6 mm for non-load bearing members and partition walls with stiffeners and 3.15 mm for gland plates. For single core cable non magnetic gland plate with special care for magnetically screened nut-bolt joint of gland plate with panel body shall be taken.

Shall have provision for bottom entry for cable.

Full height vertical cable alley of minimum 250mm width for power and control cables with shrouds for outgoing terminals.

Minimum and maximum operating height shall be 300mm & 1950mm respectively from the top of panel and base frame. Panel height shall be restricted to 2400 mm.

Integral base frame shall be of ISMC 75.

Main Bus bar of uniform dimension throughout the panel length and of material of high conductive electrical grade aluminum/ aluminum alloy / copper / copper alloy.

Neutral Bus bar: Sized not less than half of phase bus bar.

Max. temperature shall be limited to 40 °C rise over 50°C amb for Bolted joints (plain or tinned) and 55 °C rise over 50 °C amb) for silver plated joints.

PVC insulating heat resistance sleeves for a bus bar and shrouds for joints shall be provided.

Bus insulator shall be non-hygroscopic, flame-retardant, track resistant type with high creepage surface.

All hardware shall be nickel chromium zinc passivated.

Incomers shall be microprocessor based MCCB/ACB (Fixed or Draw out type as per requirement of the project) controlled. Bus coupler and incomers are equally rated.

Automatic star-delta starter shall be provided for motor starter panel and selection of component for motor starters shall comply with type-II coordination as per IS-13947 / IEC-60947.

Push buttons, indicating lamps, selector switches, meters etc. all shall be flush mounted and shall be mounted within operating zone only.

All the components associated to a feeder shall be mounted in the same vertical panel.

Bimetallic connectors between dissimilar metals.

- All components mounted inside the panels shall be easily accessible for inspection & maintenance point of view.
  a) Shipping length shall be restricted to max.2400mm.
  b) Lifting lugs shall be provided on each shipping section.
  c) Insulation Level (1 Minute 50Hz withstand voltage) 2kV

- The MCCB with rotary operating mechanism and push to trip button shall be microprocessor based with O/L, S/C, E/F releases, draw out type with communication compatibility. Shall have trip free, shunt trip with manual ON/OFF facility. In case of requirement U/V release may also be opted for. The short circuit capacity shall not be
less than 70 KA. And lcs shall be equal to 100% Icu. The MCCB shall conform to IS 13947 (Part 2) and IEC 60947-2.

- The MCB shall have trip free, shunt trip, with manual close / open mechanism, automatic tripping for over load and short circuit. 1 NO + 1 NC auxiliary contacts shall be provided and provision shall be kept for multiplication of auxiliary contacts with inclusion of auxiliary contactor. Breaking capacity shall be as per IEC 60898/ IS 8828. Number of poles required shall be as per project requirement.

- The Motor Protection Circuit Breaker (MPCB) shall have built in protection release for overload, short-circuit. Shall have trip free mechanism and shunt trip, indication for ON, OFF & TRIP. The ambient compensated for in panel temperature considering outside ambient of 50°C. The contactor to be in line shall be AC23.

- The motor feeder shall have on / off / trip indicating lamps, on /off push buttons, ammeter, voltmeter with selector switches etc. The other feeders shall have on / off.

- The dust protected heavy-duty control & selector switches are to be provided. Contacts shall be silver surfaced, rated 10A (Continuous) and 2 A (Making/Breaking) at operating voltages. The ammeter & voltmeter selector switches shall be four position types. The Ammeter selector switches shall have make before break feature to prevent open circuiting of CT secondary. The inscriptions of nomenclatures shall be properly provided.

- The Push Button shall be of heavy duty, shrouded, push to actuate, spring return type. It shall have 2 NO + 2 NC contacts, rated 10A Continuous and 2 A (Making/Breaking) at their respective operating voltage. Start and stop push buttons shall be coloured green and red. Push buttons shall be of push to actuate the contact type and shall be lockable.

- The Fuses & Indicating Lamps shall be HRC, preferably link type with blade contact design as per DIN. All fuses shall be type-2 coordinated with upstream & downstream equipments. Indicating lamps shall be of LED type with low watt consumption. Indicating lamps shall be rated for operation on 230V AC.

- AC Starter/ Contactors shall have following features:
  a) 3-Pole, air break type, duty class III with non-bouncing silver/ silver alloy contacts.
  b) AC3 for uni-directional
  c) Contactors shall be capable of pull-in at 85 percent of rated voltage and shall not drop out at 70 percent of rated voltage or greater.

- The Indicating Meters shall have accuracy class 1%, 90° scale, and anti-glare type. The ammeter for motor with extended suppressed end-scale range to indicate starting current (6-8 times full load). The size of the ammeter & voltmeter shall be 96 x 96 sq. mm.

- All wiring for control, protective, alarm and indication circuits on all equipments shall be carried out with at least 650V grade, PVC insulated, stranded tinned copper, 2.5/1.5 sq. mm conductors. Wiring for Control circuits shall be carried out with 2.5 sq. mm conductor. All wiring shall be run on the sides of the panels and shall be neatly bunched and cleated with access to equipment mounted on the panel. All wiring shall be taken to terminal blocks without joints or tees in their runs. Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted to each wire and each core of multi core cables terminated on the panels. Ferrules shall fit tightly on the wires, without falling off when the wire is removed. Ferrules shall be of yellow colour with black lettering.

- The terminal block shall be of 1100V grade clip on type and 20% spare shall be provided. Isolation at terminal block to be provided for different voltage circuits. Terminals shall be numbered for identification and grouped according to function. Terminals blocks shall be arranged with at least 100 mm clearance between any two sets. Separate terminal stems shall be provided for internal and external wiring
respectively. All wiring shall be terminated on terminal blocks, using crimping type of lugs or claw type of terminations.

- The Cable Termination shall be done neatly. The cable entry shall be done from bottom or top with removable gland plate.

- In order to operate the motor under economic power factor of 0.98, power factor improvement capacitor of suitable rating is provided in parallel to the motor circuit and this capacitor is put on line when the motor is ON and disconnected from the line no sooner the motor stops.

- The Internal Ground Bus of 25 x 6 mm aluminum flat shall be extended the full length of the panel. Equivalent copper flat may also be used.

- Each vertical section shall be provided with thermostat controlled space heater, illuminating lamp and 5A, 3 pin plug socket.

- The Local Push Button Station (LPBS) shall be wall/bracket mounting with the following features:
  a) 2NO+2NC contacts for each PB.
  b) Each LPBS shall have start PB & Emergency stop PB. Start PB shall be spring return type & it shall be used for motor test purpose. Therefore a selector switch shall be mounted in motor starter for TEST selection, only when ‘Test’ is selected the start PB will work. STOP PB shall be mushroom-headed stay put type spring return to release.
  c) LPBS shall be provided for all motors in scope of vendor.
  d) LPBS, Starter panels shall be IP-54 for indoor duty. For extreme dusty area it shall be IP-65.

- The Lighting DB (LDB), Auxiliary DB, any other DB shall be designed for a maximum temperature of 85°C and minimum bus size shall be 25 x 6 mm with fault level of 9kA and the bus shall be electrolytic hard drawn aluminum. The panel shall be wall mounting and shall have provision of cable entry from top and bottom. Nameplate of anodized aluminum with inscriptions indelibly shall be etched on it.

- Contractor will submit drawing of equipment for approval of the Employer before fabrication of the panel.

2.19 Cables:

- Cables shall conform to IS 1554. Cables shall be capable of satisfactory performance when laid on trays, conduits and ducts or buried underground. Cables shall be capable of operating satisfactorily under a power supply system voltage variation of +/- 15%, a frequency variation +/- 5% and a combined voltage and frequency variation of +/- 15%.

- The contractor shall install, test and commission the cables in accordance with approved drawings and instructions issued by the client. Cables shall be laid as per approved drawing. Inspection on receipt, unloading, storage and handling of cables shall be in accordance with IS: 1255 and other Indian Standard Codes of Practice.

- Where cables cross roads and water, oil, gas or sewage pipes, the cables shall be laid in reinforced spun concrete or steel pipe or HDPE pipes or PVC pipe of sizes as per BOQ. For road crossings the pipe for the cable shall be buried at not less than one meter depth.

- In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made should the cable develop a fault at a later date.

- Suitable double compression type cable glands shall be provided. Provision shall be made for earthing of each cable glands. Equipment terminal blocks for power connections shall be complete with adequate phase segregating insulating barriers and suitable crimping type of lugs (copper or aluminum as required) for connecting the insulated cable tails. All switchboards shall, unless otherwise specified, facilitate bottom cable entry. Removable gland plates shall be mounted at least 300 mm above
the base of the panel. The individual cores of the cables shall be neatly dressed and supported at regular intervals before connecting them to the relevant terminals.

2.20 **Earthing System:**

- The complete scope of work for earthing system shall be as per IS 3043. Earthing system shall be provided to ensure equipment and personnel safety and shall comply with all currently applicable standards regulations and safety codes. Earthing conductors shall be of hot dip galvanized iron flats / strips.

- Earth pits shall be constructed according to the stipulations of IS. 3043. Earth electrodes shall be fabricated in accordance with IS.3043. The minimum spacing between two adjacent earth electrodes shall not be less than 6 meters. Earth electrodes shall be located in inspection chambers with suitable lids and provided with facilities for the periodic testing of the earth resistivity. Electrodes shall as far as practicable be embedded below the permanent moisture level.

- The Contractor shall supply and install GI steel wires / strips required for system and individual equipment grounding. All work such as cutting, bending, supporting, coating, drilling, brazing, clamping, bolting and connecting onto structures, pipes, equipments frames, terminals, rails or other devices shall be in the Contractor's scope of work. The excavation, trenching and back filing shall be carried out by the Contractor as required, together with the supply of all material.

- Earthing shall conform to the Indian Standard Code of Practice IS. 3043 and Indian Electricity Rules, 1956. All materials and fittings used in the earthing installation shall conform to the relevant Indian Standards. Installation work shall be in accordance with approved earthing drawings.

- All earthing conductors to be buried in the ground shall be laid 600 mm below grade level and 1500 mm away from buildings. Backfill shall be placed in layers of 150 mm, uniformly spread along the trench and consolidated.

- Cable armour shall be bonded to the earthing system. Metal pipes and conduits through which cables run shall be efficiently bonded and earthed. Electrical conduits, pipes and cable tray sections shall be bonded to ensure electrical continuity and connected to earthing conductor at regular interval.

- All underground connections for the earthing system shall be welded, connection to equipment and devices shall be normally of the bolted type.

- Earth pits shall be treated with salt and charcoal.

2.21 **Painting:**

All sheet steel work intended for painting shall be phosphated in accordance with the following procedure and in accordance with relevant standards for phosphating iron and steel.

a) Oil, grease, dirt and scarf shall be thoroughly removed by emulsion cleaning.  
b) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

All sheet steel work intended for painting shall be phosphated in accordance with the following procedure and in accordance with relevant standards for phosphating iron and steel.
a) Oil, grease, dirt and scarf shall be thoroughly removed by emulsion cleaning.

b) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

c) After phosphating, thorough rinsing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and oven drying.

d) The phosphate coating shall be sealed by the application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be flash dried while the second coat shall be stoved.

After application of the primer, two coats of finishing synthetic enamel paint shall be applied, with each coat followed by stoving. The second finishing coat shall be applied after completion of tests. The color for the finishing paint shall be as per clients requirement.

2.22 Testing and Commissioning:

General:

In general, the following checks shall be carried out on all the equipment/systems, as applicable.

a) Any physical damage or defect and cleanliness
b) Tightness of all bolts, clamps and connections
c) Condition of accessories and their completeness
d) Clearances
e) Earthing connections
f) Correctness of installation with respect to approved drawings/specifications
g) Correctness and condition of connections

Commissioning Tests:

The following commissioning tests are to be carried out on all the equipment/systems, as applicable.

a) Insulation resistance measurement of equipment, accessories, cabling/wiring etc.
b) Continuity tests
c) Operational and functional tests.
d) Safety Procedure and Practice

Safety procedure and practice should be provided by electrical Contractor as per I.S. 5216:

2.23 Contractor’s License:

The Contractor shall obtain the necessary License/Authorization from the Licensing Board of the locality/State for carrying out the installation work. The persons deputed by the Contractor’s firm should also hold valid permits issued/recognized by the Licensing Board of the locality/State in which the work is to be done.

The electrical installation work shall be carried out by licensed electricians only and approved by appropriate authorities. It is the responsibility of Contractor to get approval of complete system from the appropriate authority.

2.24 INSPECTION AND TESTING:

a) Purchaser shall approve make of components.
b) Purchaser shall approve Q&A.
c) All routine test as per relevant IS/IEC
2.25 SPECIAL TOOLS AND TACKLES:

A set of special tools & tackle which are necessary for erection, commissioning, operation, maintenance and overhauling of the equipment shall be supplied after approval from purchaser.

2.26 DRAWING/DATA/MANUALS TO BE SUBMITTED:

2.27 WITH THE BID:

a) Deviations if any. In case no deviations are mentioned it will be presumed that the specification is complied in Toto.
b) List of make.
c) Catalogue & technical write-up.
d) Typical control schematics.

2.28 FOR APPROVAL:

Following (in addition to above) documents for approval:

a) Guaranteed technical particular.
b) QAP.
c) Single line diagram.
d) Test certificate.
e) As-built drgs.
g) GA and dimensional drawings with weight.
h) Control schematic.

The bidder may note that the scope shall not be limited to the specification, details mentioned herein, for effective and successful commissioning of the equipment. also the drawings, data, documents mentioned here in the specification are basic and minimum requirement only.

3. QUALITY ASSURANCE AND QUALITY CONTROL

The contractor to execute all the works and perform tests as per QA & QC Manual.

3.1 GENERAL RESPONSIBILITIES

Contractors are responsible for providing:

- all necessary plant, labor, equipment and construction materials to be used in the works;
- all plant, equipment, materials and labor for temporary and auxiliary works;
- all equipment and components to be installed or incorporated in the works;
- transportation and storage facilities for all materials and equipment.
- office and accommodation for staff and labor; and for consultants and client’s staff
- sanitation facilities at the site; and
- all necessary staff and equipment for testing and quality control including site office laboratories.

Contractors are responsible for executing and completing the works in accordance with the specified standards and specifications, within the contractual time allowed, and within the contract price for these works.

QUALITY ASSURANCE/QUALITY CONTROL DUTIES

The contractor’s QA/QC duties are summarized in Table 16.2 Other duties shall be performed as stipulated in the contract documents or directed by the Engineer/PIU.

Table
<table>
<thead>
<tr>
<th>Activity / Item</th>
<th>Contractor’s QA/QC Duties</th>
</tr>
</thead>
</table>
| Designs for turnkey contracts| • Prepare designs using appropriate QA/QC procedures  
• Submit designs and drawings to the SIPMIU/DSMC for review and approval  
• Maintain design register at site  
• Use only approved drawings for construction                                                                                                                                 |
| Designs for item-rate contracts| • Maintain design register at site  
• Use only approved drawings for construction                                                                                                                                                                          |
| Test laboratory and equipment| • Intimate SIPMIU/DSMC the details, date of completion with requisite manufacturers’ and calibration certificates  
• Maintain the equipment in good condition and calibrate as necessary                                                                                                                                               |
| Material receipts            | • Enter receipts in material register  
• Intimate SIPMIU/DSMC in writing                                                                                                                                                                                                 |
| Materials testing            | • Prepare mix designs as required by contract and submit test results to SIPMIU/DSMC  
• Take test samples in presence of SIPMIU/DSMC when requested  
• Perform materials tests  
• Submit test reports to SIPMIU and DSMC with monthly reports  
• Maintain test log                                                                                                                                                                                                 |
| Rejected materials           | • Enter in material register at site  
• Intimate SIPMIU and DSMC in writing the proposed date of removal from site and confirm after removal                                                                                                                                 |
| Material consumption         | • Enter daily consumption of materials in material register and indicate balance quantity                                                                                                                                 |
| Construction equipment       | • Intimate SIPMIU and DSMC the details, date of mobilization along with requisite insurance certificate  
• Maintain equipment in good working condition                                                                                                                                                                          |
| Construction                 | • Intimate SIPMIU and DSMC in writing when construction is going to commence and what activities are proposed to be undertaken.  
• Intimate SIPMIU and DSMC in advance when critical works, such as concreting, embankment, paving, pipeline laying and jointing, testing, etc., would be undertaken, along with the test certificates of the materials proposed to be used in these works. No critical activity shall start unless the material test certificates are verified and approved by the Engineer.  
• Provide necessary QA/QC                                                                                                                                                                                             |
| Daily work progress          | • Maintain in daily log                                                                                                                                                                                                     |
## Activity / Item

### Contractor’s QA/QC Duties

<table>
<thead>
<tr>
<th>Activity / Item</th>
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</tr>
</thead>
</table>
| Testing of works in progress     | • Perform tests as per contract requirements  
                                    • Submit test reports to SIPMIU and DSMC  
                                    • Maintain test log |
| Rejected work items              | • Intimate SIPMIU and DSMC in writing the proposed date of removal from site and confirm after removal, or (if so agreed by SIPMIU and DSMC)  
                                    • Rectify defective work and invite SIPMIU and DSMC for re-inspection. |
| Instructions from Engineer       | • Enter change orders, site instructions, letters and minutes of meetings issued by the Engineer and Consultants in the Instruction Log |
| Inspection of Engineer           | • Take instructions in Site Order Book.  
                                    • Advise SIPMIU and DSMC of compliance |
| Progress scheduling and control  | • Prepare and maintain project schedules and undertake work in accordance with approved schedule |
| Reporting                        | • Prepare and submit Monthly Progress Reports |
| Records                          | Maintain the following records on site:  
                                    • Material Register  
                                    • Site Order Book  
                                    • Hindrance Register  
                                    • Daily Log  
                                    • Design Register  
                                    • Test Log  
                                    • Instruction Log  
                                    • Equipment Register  
                                    • Labor Register  
                                    • Approved Construction Drawings  
                                    • Test Reports  
                                    • Site Laboratory Record  
                                    • Permissions Issued by Departments  
                                    • Correspondence Record  
                                    • Copies of Monthly Progress Reports  
                                    • Any other records as specified in the Contract and/or as instructed by the Engineer |

### 3.2 STATUTORY REQUIREMENTS

Bidder shall comply with all the applicable statutory rules pertaining to Factories Act (as applicable for the state of Tripura), Fire Safety Rules of Tariff Advisory Committee, Water Act for Pollution control, Explosives Act., etc.

Provisions of safety, health and welfare according to Factories Act shall be complied with.

Statutory clearances and norms of State Pollution Control Board shall be followed.

Bidder shall obtain approval of Civil / Architectural drawings from concerned authorities before taking up the construction work.
3.3 CONTRACTOR'S SITE OFFICE AND LABORATORY

- The contractor shall establish suitable size site office cum laboratory in the locality of work area only having minimum 500 sqft space (100 sqft for laboratory, 200 sqft for his staff and 200 sqft for SIPMIU’s engineer or his representative. Along with required sufficient furniture for his staff, he will also arrange to provide two tables, 5 chairs, one steel almirah, sufficient number of display board for SIPMIU’s engineer and his staff.

- The office cum laboratory accommodation will be established within 30 days from the date of commencement of work.

- The calibration of the laboratory equipment and instrument shall at the initial stages be certified by agencies approved by the engineer. Laboratory equipment shall be properly maintained and calibrated throughout the period of the contract by the contractor at his own expense. Contractor will not be eligible for getting any payment for establishing site office.

------- x -------
## DRAWINGS FOR SEPTAGE MANAGEMENT

### LIST OF DRAWINGS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Drawing no</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>STP – Plan Layout</td>
<td>9296/DPR/STP/011</td>
</tr>
<tr>
<td>2.</td>
<td>Rest Room for O&amp;M Workers</td>
<td>9292/DPR/STP/009</td>
</tr>
<tr>
<td>3.</td>
<td>Toilet Block STP site</td>
<td>9296/DPR/STP/012</td>
</tr>
<tr>
<td>4.</td>
<td>Septage collection chamber</td>
<td>9296/DPR/STP/020</td>
</tr>
</tbody>
</table>
TOTAL AREA = 43000 SQM

8MLD STP = 11000 SQM

APPROACH ROAD = 2000 SQM

BALANCE AREA = 30000 SQM

LEFT FOR FUTURE

Indicate treated Effluent recirculation line to septage collection sump

Tube Well, Toilet Block, Rest Room
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS MENTIONED OTHERWISE
2. D - Door (1000X2100)
3. D1 - Door (900X2100)
4. W - Window (1200X1500)
5. DO NOT SCALE THE DRAWING FOLLOW WRITTEN DIMENSION ONLY
6. ALL RCC WORKS ARE IN M20 GRADE UNLESS OTHERWISE MENTIONED
NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS MENTIONED OTHERWISE.
2. D - Door (800X2100)
3. D2 - Door (750X2100)
4. V - Ventilator (600X900)
5. WB - Wash basin
6. DO NOT SCALE THE DRAWING FOLLOW WRITTEN DIMENSION ONLY.
7. ALL RCC WORKS ARE IN M20 GRADE UNLESS OTHERWISE MENTIONED.
8. STEEL SHALL CONFORM TO HYSD BARS OF GRADE Fe 500 (IS 1786)
1. All dimensions are in millimetres unless mentioned otherwise.
**DRAWINGS FOR SEPTAGE MANAGEMENT**

**LIST OF DRAWINGS**

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<td>4</td>
<td>Septage collection chamber</td>
<td>9296/DPR/STP/020</td>
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Initial Environmental Examination

Project Number: 35290

April 2015

India: North-Eastern Region Capital Cities Development Investment Program – Septage Management for Central and South part of Agartala city (Tranche-3)

Prepared by State Investment Program Management and Implementation Unit (SIPMIU)
Urban Development Department, Govt. of Tripura

For the Government of Tripura
North-eastern Region Capital Cities Development Investment Program (NERCCDIP)

The initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB’s Board of Directors, Management, or staff, and may be preliminary in nature.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>AMC</td>
<td>Agartala Municipal Council</td>
</tr>
<tr>
<td>BOQ</td>
<td>Bill of quantity</td>
</tr>
<tr>
<td>CBO</td>
<td>Community-based organization</td>
</tr>
<tr>
<td>CDP</td>
<td>City Development Plan</td>
</tr>
<tr>
<td>CFE</td>
<td>Consent for Establishment</td>
</tr>
<tr>
<td>CFO</td>
<td>Consent for Operation</td>
</tr>
<tr>
<td>CGWB</td>
<td>Central Ground Water Board</td>
</tr>
<tr>
<td>CLC</td>
<td>City Level Committee</td>
</tr>
<tr>
<td>CPHEEO</td>
<td>Central Public Health and Environmental Engineering Organization</td>
</tr>
<tr>
<td>DSMC</td>
<td>Design Supervision and Management Consultant</td>
</tr>
<tr>
<td>DTW</td>
<td>Deep Tube Well</td>
</tr>
<tr>
<td>DWS</td>
<td>Drinking Water and Sanitation</td>
</tr>
<tr>
<td>EAC</td>
<td>Expert Appraisal Committee</td>
</tr>
<tr>
<td>EARP</td>
<td>Environment Assessment Review Procedure</td>
</tr>
<tr>
<td>EARF</td>
<td>Environmental Assessment Resettlement Framework</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>EMS</td>
<td>Environmental Monitoring Specialist</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>FFA</td>
<td>Framework Financing Agreement</td>
</tr>
<tr>
<td>GAPA</td>
<td>Greater Agartala Planning Area</td>
</tr>
<tr>
<td>GLSR</td>
<td>Ground level Storage Reservoir</td>
</tr>
<tr>
<td>GRC</td>
<td>Grievance Redress Committee</td>
</tr>
<tr>
<td>GWTP</td>
<td>Ground Water Treatment Plant</td>
</tr>
<tr>
<td>H and S</td>
<td>Health and safety</td>
</tr>
<tr>
<td>IEE</td>
<td>Initial Environmental Examination</td>
</tr>
<tr>
<td>INR</td>
<td>Indian Rupee</td>
</tr>
<tr>
<td>IRP</td>
<td>Iron Removal Plant</td>
</tr>
<tr>
<td>JNNURM</td>
<td>Jawaharlal Nehru National Urban Renewal Mission</td>
</tr>
<tr>
<td>KL</td>
<td>Kilo liters</td>
</tr>
<tr>
<td>LPCD</td>
<td>Liters per capita per day</td>
</tr>
<tr>
<td>MFF</td>
<td>Multitranche financing facility</td>
</tr>
<tr>
<td>MLD</td>
<td>Million liters per day</td>
</tr>
<tr>
<td>MOEF</td>
<td>Ministry of Environment and Forests</td>
</tr>
<tr>
<td>NAAQS</td>
<td>National Ambient Air Quality Standards</td>
</tr>
<tr>
<td>NER</td>
<td>North Eastern Region</td>
</tr>
<tr>
<td>NERCCDIP</td>
<td>North Eastern Region Capital Cities Development Investment Program</td>
</tr>
<tr>
<td>NGO</td>
<td>Nongovernmental organization</td>
</tr>
<tr>
<td>NRW</td>
<td>Non-revenue water</td>
</tr>
<tr>
<td>O and M</td>
<td>Operation and maintenance</td>
</tr>
<tr>
<td>OHSA</td>
<td>Occupational Health and Safety Administration</td>
</tr>
<tr>
<td>OHSR</td>
<td>Overhead storage reservoirs</td>
</tr>
<tr>
<td>OMC</td>
<td>Operations and Maintenance Contractors</td>
</tr>
<tr>
<td>PFR</td>
<td>Periodic Financing Request</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
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</tr>
<tr>
<td>PHED</td>
<td>Public Health Engineering Department</td>
</tr>
<tr>
<td>PWD</td>
<td>Public Works Department</td>
</tr>
<tr>
<td>ROW</td>
<td>Right of way</td>
</tr>
<tr>
<td>SEIAA</td>
<td>State Environment Impact Assessment Authority</td>
</tr>
<tr>
<td>SIPMIU</td>
<td>State-level Investment Program Management and Implementation Units</td>
</tr>
<tr>
<td>SPS</td>
<td>Safeguard Policy Statement</td>
</tr>
<tr>
<td>SR</td>
<td>Service Reservoir</td>
</tr>
<tr>
<td>TA</td>
<td>Technical Assistance</td>
</tr>
<tr>
<td>TDS</td>
<td>Total dissolved solids</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of reference</td>
</tr>
<tr>
<td>UDD</td>
<td>Urban Development Department</td>
</tr>
<tr>
<td>UFW</td>
<td>Un-accounted For Water</td>
</tr>
<tr>
<td>ULB</td>
<td>Urban local body</td>
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**WEIGHTS AND MEASURES**

<table>
<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>dbA</td>
<td>decibels</td>
</tr>
<tr>
<td>ha</td>
<td>Hectare</td>
</tr>
<tr>
<td>KL</td>
<td>Kilo liter</td>
</tr>
<tr>
<td>km</td>
<td>kilometer</td>
</tr>
<tr>
<td>km²</td>
<td>square kilometer</td>
</tr>
<tr>
<td>l</td>
<td>liter</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>m²</td>
<td>square meter</td>
</tr>
<tr>
<td>m³</td>
<td>cubic meter</td>
</tr>
<tr>
<td>MT</td>
<td>metric tons</td>
</tr>
<tr>
<td>MTD</td>
<td>metric tons per day</td>
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**NOTES**

(i) In this report, "$" refers to US dollars.
(ii) "INR" and "Rs" refer to Indian rupees.
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EXECUTIVE SUMMARY

1. The North Eastern Region Capital Cities Development Investment Program (NERCCDIP) envisages achieving sustainable urban development in the Project Cities of Agartala, Aizal, Kohima, Gangtok and Shillong through investments in urban infrastructure sectors. NERCCDIP is being implemented over a six year period beginning in 2010, and will be funded by a loan via the Multitranche Financing Facility (MFF) of the Asian Development Bank (ADB).

2. The Executing Agency (EA) is the Urban Development Department (UDD) of the Government of Tripura (GoT); and the Implementing Agency (IA) is the Investment Program Coordination cell. The Project Management and Implementation Unit of the NERCCDIP is the State-level Investment Program Management and Implementation Units (SIPMIU).

3. ADB requires the consideration of environmental issues in all aspects of the Bank’s operations, and the requirements for Environmental Assessment are described in ADB’s SPS (2009). This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.

4. This draft Initial Environmental Examination (IEE) has been prepared for the Agartala City (south & central parts) Septage Management project for funding under Tranche 3, specifically for the (i) Procurement of conventional and split type cess pool machines, and (ii) Construction of conventional Septage Treatment Plant at Debendranagar Agartala. An Environmental Management Plan (EMP) is proposed as part of this report which includes (i) mitigation measures for significant environmental impacts during implementation, (ii) environmental monitoring program, and the responsible entities for mitigation, monitoring, and reporting; and (iii) public consultation and information disclosure; and grievance redress mechanism.

5. Detailed design will be begun on April 2015 and to be completed in June 2015. After award of contract concerned contractor will finalize the field design and accordingly IEE will be revised. Construction will begin end of 2015, and will take around eighteen months. All civil works will be completed by the mid of 2017.

6. The subproject location (treatment plant) is located outside of main city at Debendranagar. The subproject location is undulating but not located in areas prone to water-logging, salinasation, and flash flood. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. Trees, vegetation (mostly shrubs and grasses), and animals are those commonly found in urban areas. The subproject location are not located in or near any historically-, culturally-, archaeologically- or architecturally-significant or tourists area.

7. Potential negative impacts were identified in relation to design, construction, and operation of the infrastructure. A number of impacts and their significance have already been reduced by amending the designs thus no impacts were identified as being due to the project design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels.

8. During the construction phase, impacts mainly arise from the need to dispose/ utilization of moderate quantities of cut soil; and from the disturbance of residents, businesses, and traffic...
during transportation of materials. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation.

9. Once the system is operating, most facilities (equipment and treatment plant) will operate with routine maintenance, which should not affect the environment. The area is isolated and hence direct impact to nearby environment is the minimum. The main impacts of the operating septage treatment system will be beneficial to the citizens of Agartala. They will be provided with septage treatment and improve the quality of life of people as well as benefit individual and public health with improvements in hygiene. This will reduce the incidence of disease associated with poor sanitation. This will also lead to economic gains as people will be less away from work and indirectly increase their income.

10. There are limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the project will employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities.

11. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures in the EMP are implemented and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the SIPMIU. There will also be longer-term surveys to monitor the expected improvements in the quality of domestic water and the health of the population.

12. The stakeholders were involved in developing the IEE through face-to-face discussions on site and public meeting held in the city, after which views expressed were incorporated into the IEE and the planning and development of the project. The IEE and EMP after translate into local language will be made available at public locations in the city and will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation, when a nationally-recognised NGO will be appointed to handle this key element to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

13. Therefore the subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures. Based on the findings of the IEE, the classification of the Project as Category "B" is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009) or GoI EIA Notification (2006).
I. INTRODUCTION

A. Purpose of the Report

1. The North Eastern Region Capital Cities Development Investment Program (NERCCDIP) envisages achieving sustainable urban development in the Project Cities of Agartala, Aizal, Kohima, Gangtok and Shillong through investments in urban infrastructure sectors. The urban infrastructure and services improvement is proposed in the following sectors (i) water supply, (ii) sewerage and sanitation, and (iii) solid waste management. The expected impact of NERCCDIP is increased economic growth potential, reduced poverty, and reduced imbalances between the NER and the rest of the country. The expected outcomes of the Investment Program will be an improved urban environment and better living conditions for the 1.65 million people expected to be living in the NERCCDIP cities by 2018. To this end, NERCCDIP will (i) improve and expand urban infrastructure and services in the cities including in slums and (iii) strengthen urban institutional, management, and the financing capacity of the institutions, including the urban local bodies. Based on considerations of economic justification, absorptive capacity and sustainability of the implementing agencies, sub-projects have been identified in each city in the priority infrastructure sectors.

2. Though NERCCDIP aims to improve the environmental condition of urban areas, the proposed improvements of infrastructure facilities may exert certain adverse impacts on the natural environment. While developing urban infrastructure facilities, impacts during the construction stage are expected to be more severe than impacts during the operation phase, though for a short duration. Exceptions being some facilities such as solid waste landfills and sewage treatment plants, septage treatment plant which may also exert adverse impacts during the operation phase, if due care is not taken.

3. NERCCDIP is being implemented over a six year period beginning in 2010, and will be funded by a loan via the Multitranche Financing Facility (MFF) of the ADB. The Executing Agency (EA) is the Urban Development Department (UDD) of the Government of Tripura (GoT); and the Implementing Agency (IA) is the Investment Program Coordination cell. State-level Investment Program Management and Implementation Units (SIPMIU) is the Project Management and Implementation Unit (PMIU).

4. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in ADB’s SPS (2009). This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans. At Agartala city project implementation is running for Tranche 1 & 2.

5. This draft Initial Environmental Examination (IEE) has been prepared for the Agartala City (covering south & central parts) Septage Management project for funding under Tranche 3, specifically for the (i) Procurement of conventional and split type cess pool machines, and (ii) Construction of conventional Septage Treatment Plant at Debendranagar Agartala.

6. This is draft IEE report. Report will be updated after finalization of the design.

7. This IEE report covers the general environmental profile of Agartala city and includes an overview of the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the subproject's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) is also proposed as part of this report which includes mitigation measures for significant environmental impacts during implementation of the Project, environmental monitoring program, and the responsible entities for mitigation and monitoring.
B. Extent of the IEE Study

8. This IEE report was prepared on the basis of detailed screening and analysis of all environmental parameters, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation per ADB’s Safeguard Policy Statement (SPS, 2009) and Government of India Environmental Impact Assessment (EIA) Notification of 2006.

1. ADB Policy

9. ADB requires the consideration of environmental issues in all aspects of ADB’s operations, and the requirements for Environmental Assessment are described in ADB SPS 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.

10. Screening and Categorization. The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impact are assigned to one of the following four categories:

(i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.

(ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

(iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

(iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all Projects will result in insignificant impacts.

11. Environmental Management Plan. An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project’s impact and risks.

12. Public Disclosure. ADB will post the following safeguard documents on its website so affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

(i) For environmental category A projects, draft EIA report at least 120 days before Board consideration;

(ii) Final or updated EIA and/or IEE upon receipt; and

(iii) Environmental Monitoring Reports submitted by SIPMIU during project implementation upon receipt.

13. The above is to meet the requirements of ADB’s Public Communication Policy 2011.

2. National Law
14. The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for environmental assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorised as A or B depending on the scale of the project and the nature of its impacts.

15. Categories A projects require Environmental Clearance from the National Ministry of Environment and Forests (MOEF). The proponent is required to provide preliminary details of the project in the form of a Notification, after which an Expert Appraisal Committee (EAC) of the MOEF prepares comprehensive Terms of Reference (TOR) for the EIA study, which are finalized within 60 days. On completion of the study and review of the report by the EAC, MOEF considers the recommendation of the EAC and provides the Environmental Clearance if appropriate.

16. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorises the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the Environmental Clearance based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

17. The only type of infrastructure provided by the NERCCDIP that is specified in the EIA Notification is solid waste management. Environment Clearance is not required for the said subproject.

3. Others

18. As per Tripura State Pollution Control Board (TSPCB) before construction of Septage Treatment Plant Consent for Establishment (CFE) will be required. Also Consent for Operation (CFO) will be necessary prior to operation of the treatment plant.

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

19. **Type.** This is an urban sanitation project intended to improve the current sanitation situation of Agartala in terms of improved septage management for central and south part of Agartala. This is one of a series of subprojects designed by NERCCDP that are intended to raise the standards of the municipal infrastructure and services of Agartala and the other urban centres to those expected of modern Asian towns.

20. **Category.** Environmental examination indicates the proposed subproject falls within ADB’s environmental Category B projects. The subproject components will only have small-scale, localized impacts on the environment, and can be mitigated. Under ADB procedures such projects require an IEE to identify and mitigate the impacts.

21. **Need.** Benefits of scientific septage management includes,

   - Clean and green environment
   - Significant reduction in the pollution level of water bodies and rivers
   - Prevention of various water born diseases such as diarrhea, dysentery, cholera,
jaundice, typhoid, etc. saving huge amount of money which would have been spent for treatment of these diseases

✓ Overall improvement of living standard

22. ‘Septage’ is both solid and liquid waste that accumulates in onsite sanitation systems (OSS) e.g. septic tanks. This has three main components – scum, effluent and sludge. It has an offensive odour, appearance and contains significant levels of grease, grit, hair, debris and pathogenic micro organisms. The construction and management of OSS are left largely to ineffective local practices and there is lack of holistic septage management practices.

23. Projections of urbanization trends points towards more numbers of households that are going to install septic tanks. This would magnify the existing problems in the Indian town and cities. The limited capacities and resources of urban local bodies (ULBs) have resulted in minimal regulation and maintenance of these systems. Due to lack of awareness of its impacts on environmental degradation and ill-effects on health it has not been a priority area.


25. A survey undertaken by the Ministry of Urban Development in 2009 of 423 cities of different categories highlighted the need for an urgent action and improvement in terms of improving sanitation to make town /cities healthy and clean (Results of National Rating for cities). Further in order to address the issue in a time bound manner the ministry also issued an advisory to all ULBs based on a policy paper on Septage Management prepared by Center for Science & Environment (CSE).

Present status of Septage Management in India

26. A rapid Assessment of Septage Management in Asia – Policies and Practices in India, Indonesia, Malaysia, The Philippines, Sri Lanka, Thiland and Vietnam was carried out by USAID Regional Development Mission for Asia (RDMA) in 2010. Key challenges and strengths are shown below.

<table>
<thead>
<tr>
<th>Key Challenges</th>
<th>Key Strengths</th>
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<tbody>
<tr>
<td>• No physical infrastructure to treat septage in the country, and very limited use of mechanized desludging</td>
<td>• 2008 national policy requires states and local governments to develop integrated sanitation policies, including septage management</td>
</tr>
<tr>
<td>• Manual scavenging still widespread, although prohibited by law; onsite sanitation not viewed as a problem or priority</td>
<td>• Availability of national funding support for cities to develop septage management infrastructure</td>
</tr>
<tr>
<td>• Emphasis on centralized, advanced engineering solutions for sanitation; septage management not perceived as a solution</td>
<td>• Presence of international, NGO, and research organizations supports the development of septage management</td>
</tr>
<tr>
<td>• Most cities and states do not have policies on septage management and lack data concerning onsite sanitation systems in their jurisdictions</td>
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27. Onsite Sanitation Prevalence. Among 350 million urban residents in India, an estimated 144 million people (40 percent of the urban population) are connected to sewerage systems, 102 million (29 percent) are connected to septic tanks, and 60 million (17 percent) use
pit or vault latrines. The prevalence of onsite sanitation varies dramatically from state to state, with as many as 80 percent of toilets connected to septic tanks in the states of Orissa and Rajasthan. The number of septic tanks has grown quickly over the last few decades as households invest in private sanitation. In the future, many households that currently have latrines will invest in septic tanks, and some septic tank users will connect to sewerage systems. By 2017, the World Bank estimates that 260 million urban residents will have sewer connections, 148 million will use septic tanks, and 78 million will use latrines. While these numbers differentiate between latrines and septic tanks, many septic tanks are in reality similar to latrines, and have leaking sides and open bottoms. Many septic tanks, even for public toilets and commercial entities, are inaccessible for desludging and maintenance.

28. **Septage Collection and Treatment Capacity.** Historically, the GOI has prioritized water supply far above sanitation; for instance, the 1997 to 2002 national budget for rural water supply and sanitation provided less than six percent of its total funding for sanitation. Within sanitation funding, the government focused on centralized sewerage systems and wastewater treatment plants (WWTPs). While India is beginning to address septage following the National Urban Sanitation Policy (NUSP), no local governments have yet provided public collection or treatment services. In this context, communities generally depend on private service providers – small companies or individuals – to clean septic tanks and latrines on an emergency basis. Municipal sanitation workers commonly double as cleaners as well. Though a few companies use gullysuckers or vacuum cleaning pumps in larger cities, most informal, individual service providers empty tanks manually, without taking safety precautions or having permits. Sanitation workers and companies dispose of the waste at remote locations, in landfills (if available), or sell it directly to farmers or fish farms as fertilizer. The NUSP estimates that the wastewater of 48 to 82 percent of urban households in India is not safely disposed. Anecdotally, private operators charge an average of $25 to $30 per tank, but costs can range from as low as $5 to as much as $100 per tank, depending on the city, distance to the disposal site, and tank size.

29. The NUSP notes that onsite sanitation management is closely related to principles of a caste system in India, which indicates that the lowest castes should remove human excreta. Although the Constitution of India has banned manual scavenging and requires cities to provide scavengers with alternative, dignified work, the task of cleaning latrines continues to be a job of members of the scheduled castes, whether they are government or private employees. This cultural practice has resulted in low levels of political and societal interest in sanitation and septage management. As cities develop sanitation plans and adopt septage management programs to meet NUSP requirements, they can help to eliminate manual scavenging and provide sanitation workers with improved working conditions or alternative employment.

30. **Legal Framework.** In 2008, the Ministry of Urban Development (MOUD) issued the national Urban Sanitation Policy. In surveying the state of sanitation in cities, the policy finds that “sanitation – the safe management of human excreta, including its safe confinement and treatment, and associated hygiene-related practices – has assumed crisis proportions in urban areas.” According to NUSP, the sector faces these key challenges:

- Low prioritization and awareness of the public and government agencies;
- Lack of explicit policies on sanitation, particularly safe disposal;
- Abundance of fragmented agencies that lack the direction and incentive to provide comprehensive sanitation;
- Focus on project- and technology-based investment decisions rather than citywide planning;
- Lack of attention on access by the poor and underserved to safe sanitation; and
• Supply-driven rather than demand-responsive solutions.

31. In responding to these challenges, this policy sets the following goals:
• Raising awareness and promoting behaviour change;
• Achieving open defecation free cities;
• Developing citywide sanitation plans;
• Providing 100 percent sanitary and safe confinement, transport, treatment, and disposal of human excreta and liquid wastes; and
• Providing proper operations and maintenance (O&M) of all sanitary installations

32. The NUSP mandates states to develop state urban sanitation strategies and work with cities to develop city sanitation plans. It also includes draft frameworks to guide states and cities in developing their sanitation strategies. The Government of India plans to support states in this effort by helping them prepare their plans by 2010, providing technical assistance, funding policy development, and rating city sanitation progress through a national Award program. In the year 2010-11, six out of 28 states have developed urban sanitation policies.

33. The 74th Constitutional Amendment of 1992 substantively recognized the powers of municipal governments, called Urban Local Bodies (ULBs), which are responsible for initiating preventive and reactive measures to tackle infectious diseases, and directing and managing sanitary facilities and infrastructure. While they have had the power to address onsite sanitation and septage since 1992, most ULBs have not done so. The NUSP, therefore, now makes it explicit that cities and states must issue policies and technical solutions that address onsite sanitation, including the safe confinement of septage.

34. EPA Guidelines for septage disposal system is enclosed below.

<table>
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<th>Table 4-1. Guidelines for Selecting a Septage Disposal System</th>
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<td><strong>Conditions</strong></td>
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<td>-------------------</td>
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<tr>
<td>Small, unserved rural community</td>
</tr>
<tr>
<td>Land available but relatively close to neighbor</td>
</tr>
<tr>
<td>Inadequate land area; soil conditions, WWTP with available capacity within 20 miles</td>
</tr>
<tr>
<td>Inadequate land area; soil conditions but relatively close to neighbor</td>
</tr>
<tr>
<td>Inadequate land area; no available WWTP capacity</td>
</tr>
<tr>
<td>Medium-size, partially served, suburban or urban community</td>
</tr>
<tr>
<td>Inadequate land area, available WWTP capacity</td>
</tr>
<tr>
<td>Inadequate land area; no available WWTP capacity</td>
</tr>
<tr>
<td>Treated, served municipality with suburban onsite systems</td>
</tr>
<tr>
<td>No available WWTP capacity</td>
</tr>
</tbody>
</table>
35. **Present scenario Septage Management at Agartala, Tripura.** Septage refers to all sludge collected and transported from septic tank systems by vacuum trucks for disposal or treatment. In the absence of sewage system, 54% of the population use households’ water closet (WC) linked to septic tanks but mostly without soak pits. Most of the existing septic tank systems do not meet technical standards and partially treated wastewater, in most cases flows to surface drains. Thus there is partial blending of partially treated wastewater and grey water emanating from households. The present level of municipal information system does not hold information on details of septic tanks such as location, design standards, year of construction, operating performance and frequency of septage clearance. On an average the volume of faecal sludge generated annually is 30,000 m\(^3\) which is collected by the AMC and disposed of in the SWM dumping yard. Field survey investigations revealed that about 60% households can’t be reached by Cess Poll vehicle because narrow lanes. Residents generally resort to engaging manual labour to empty the septic tanks. A well designed septic tank will remove up to 60% of BOD and 40-60% of suspended solids and in combination with soil absorption, soil will remove the remaining BOD, and suspended solids, bacteria and viruses from the effluent. As mentioned earlier most of the existing septic tank systems do not meet technical standards and partially treated wastewater, in most cases flows to surface drains and an estimated about 8520 kg/day of BOD entering the Haora River.

36. In case of pour flush latrine, the excreta flushed into the leach pit are biodegradable under both anaerobic and aerobic conditions. The water, together with the liquid and soluble products of biodegradation, passes through the leach pit wall into the surrounding soil and is thereby disposed of. The solid products of biodegradation accumulate in the leach pit, which in time fills up. In case of single leach pits they are to be-sludged when full. If there are twin pits, then when one pit is full, the excreta are diverted to the second laech pit and first pit is rested; after a period of one or two years the enormous load of excreted pathogens will, by natural biodegradation and the action of time and tempertaure, be rendered harmless, and the pit will contain a friable that is both safe to use and inoffensive.

37. Summary of Septage (Waste from Septic Tanks) Management presently at Agartala,
   - Household No. across Agartala City-90000(tentative)
   - Septic tank Number- 70000(tentative)
   - Dry Latrines/Un-Sanitary latrines- 20000

38. As per the report of the Tripura sate Pollution Control Board 1145 Kaccha latrines on the bank of Haora river have direct connection into the Haora river.

39. Municipal council is practicing mechanical septage collection by cess-pool since many years.

40. Two types of collection is noted,
   a. Manual
   b. Mechanical

41. **Manual:** As there are 70000 septic tanks and one septic tank gets full and requires cleaning within an average 8-10 years. This means each year about 7000 septic tanks are being cleaned in Agartala City out of which AMC got only 940 orders in 2012-13. This means remaining 6000 septic tanks have been cleared manually in the year 2012-13. Thus unofficially manual cleaning of septic tanks in vogue and septage thus cleared flown into storm water drainage, flowing to Bangladesh across borders raising international concern.
42. **Mechanical**: AMC has two no. of cess-pool machines. Daily about 4-5 septic tanks are cleaned. Disposal at present is unscientific. Septage is dumped in the landfill untreated. In 2012-13 AMC got around 940 orders for mechanical septage clearance and collected fees of Rs. 852766 @ rate of Rs. 900/trip. But the figure of 940 is very small.

43. **Difficulties and problems faced by AMC**:
   - Only two functioning cess-pools which can cater only 6-8 orders per day. Lack of ability of AMC to cater entire orders and pendency problem.
   - Lack of ability of AMC to cater entire orders and pendency problem
   - High expenditure per trip of cess pool and very subsidized rate
   - No access to too narrow lanes and gullies as the cess pool can not enter due to big size
   - High expenditure per trip of cess pool and very subsidized rate
   - No scientific disposal of septage at present
   - People do not follow practice of construction of soak pit along with septic tank though it is mandatory as per TBR-2004, overflow pipe of septic tank is put into storm water drainage leading to pollution of water bodies of city and international water.
   - Lack of awareness of cess-pool services due to less publicity by AMC
   - Relatively large number of kaccha latrines: As per ILCS survey there are about 18790 kaccha/un sanitary latrines. As per The Tripura Pollution Control Board Survey 1145 latrines along the Haora river have direct connection into the river

44. Central Pollution Control Board identified the river stretch along the City of Agartala for the Haora River to be one of the grossly polluted stretches in minor river basins in India and has recommended immediate conservation measures. The Tripura Pollution Control Board carried out assessments and recommended the implementation of a comprehensive sewerage collection and sewage treatment system for the City of Agartala. Extent of pollution of Haora river as per the Report of the Tripura State Pollution Control Board 2011 and results shown in **Table 3**.

45. **Main reasons of Pollution of Haora River and other Water bodies of Agartala City**:
   - Practice of manual cleaning of septic tanks and throwing of the septage thus collected into the storm water drainage which ultimately flows to Haora and other water bodies of the city.
   - In most of the households there is no soak pit attached to the septic tank for soaking the overflow of septic tank. The overflow is directly put into the storm water drainage which ultimately flows to Haora and other water bodies of the city. As per the Tripura Building Rule 2004 soak pit is mandatory for all the septic tanks.
   - Large number of kaccha latrines. There are about 20000 kaccha latrines in the city. Most of these latrines are directly connected with the storm water drainage or some water channels or river.

46. **Action taken by AMC**. As mentioned above the target of AMC is to clean 6000-7000 septic tanks mechanically per year using cess-pool machines. For this AMC is procured two number of split type cess-pools which can enter inside narrow lanes and gullies of the
city. Also two conventional cess pools are going to be procured shortly thus taking the total number of cess-pools to six from the two. If one cess-pool can clear 4-5 septic tanks per day then six cesspools can clear 20-25 septic tanks per day. Thus the target of 6000-7000 per year can be achieved.

47. Treatment of the septage thus collected shall be done in the 8 Million Liters per Day Capacity Sewage Treatment Plant (STP) which is going to be operational shortly under the JnNURM Scheme where pure water will be generated out of this septage which can be used for horticulture/ agricultural purpose..

48. Simultaneously AMC will be taking steps for massive public awareness through print, electronic media, small movies clips on SWM, various mass program, by pamphlets, leaflets etc especially during the coming Durgapuja period.

49. Proposal for legal action against those who put the septage and overflow of the septic tanks into the stormwater drains thus violating Tripura Building Rule-2004

B. Location and Implementation Schedule

50. The subproject is located in Agartala City of Tripura District, in the west part of Tripura in north-eastern India. The proposed infrastructures will be located in and around the city. The subproject will cover the central zone (area measuring 13.084 km²) and southern zone (area measuring 22,826 km²) under the Agartala Municipal Council (AMC). The total subproject area is 35.910 km². Proposed septage management project will cover population of 316306 of 63,300 households.

51. Detailed design will be started by April 2015 and to be completed by June 2015. Construction will begin within 2015 end, and will take around eighteen months. All civil works will be completed by the mid of 2017. Implementation schedule will be revised after finalization of design process.

C. Description of the Subproject

52. Proposed scope of sub project covers, (i) Procurement of 4 nos. conventional type and 4 nos. split type cess pool equipment and (ii) Construction of conventional septage treatment plant at Debendranagar. Location of Debendranagar and Septage Treatment plant site is shown in Appendix 1 and proposed location in layout plan and land marking is shown in Appendix 2.

53. During operation the tanks will be emptying to a collection tank from where the septage will flow to the grit channel and then to the thickeners. The supernatant from the thickeners will be treated subsequently in aeration tank and clarifiers while the thickened sludge will be further dewatered in the centrifuge or belt press. More detailing will be possible after preparation of detail design.

54. Process flow diagram and area requirement for Treatment Plant is shown in Appendix 3. Photo of the proposed location of treatment plant is shown in Appendix 4.

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Administrative Boundaries

55. Agartala is the capital of Tripura, the third smallest Indian state considered as the gateway to the North-Eastern India. The AMC was established in 1871 with an area of only 3 km². Presently the extended limit of AMC covers an area of 62 km² comprising of 35 wards.
The Greater Agartala Planning Area (GAPA) is spread over an area of 92.0 km². It comprises AMC and eight other villages with a population of more than 4 lakhs. Figure 1 shows the AMC wards and GAPA zonal map. Considering the natural geographical division created by the Haora and Katakhal Rivers, the GAPA has been demarcated to distinguish the three (3) zones: the north zone, central zone and south zone.

(i) North Zone: The area is located, north of Katakhal River. This zone comprises mainly the northern extension of the present AMC area (Wards 1 to 8) and peripheral villages, Narsingarh, Singarbil, and Gandhigram CT.

(ii) Central Zone: The area bounded by Haora River embankment on the south and Katakhal River on the north. This zone mainly comprises the erstwhile AMC area and the newly extended areas (Wards 9 to 16 and Wards 18 to 22).

(iii) South Zone: This area is located at the south of Haora River. This zone includes the southern part of the extended AMC (Wards 23 to 35) and the adjoining areas of Ananda nagar, Dukli, Madhupur, Madhuban and Charipara.

Considering similar geographical divisions, the subproject area has been defined to be the area comprising of the central zone (area measuring 13.084 km²) and south zone (area measuring 22.826 km²). The total subproject area is 35.910 km².

2. Topography, Drainage, and Natural Hazards

Topography. The major part of the City (Central Agartala) has a flat terrain. However, the North and South Zones have a rolling terrain with an average altitude varying from a high of 25 to 30 m to a low of 8 m. Greater Agartala is a combination of plain and undulated areas. The central zone is a flat land bounded by the rivers Haora in the south and Katakhal in the north. An important characteristic of the central part of the city is that it is located at a lower level than other areas giving it the appearance of a saucer. Due to its saucer shape, the low lying areas are vulnerable to inundation during monsoons.

Drainage. The drainage system of Greater Agartala is dominated by two major rivers (Haora and Katakhal), which drains the core area of the city. These two rivers flow westward into Bangladesh. In terms of catchment area, Haora River is the seventh largest in the Tripura and is the only source of surface water for Greater Agartala. In addition to these two rivers, there are other rivers like Bangeshwar Gang, Debeta Gang, Nagichara, Kalapani Charra and its tributaries within Greater Agartala. The Akhaura canal system running along the Akhaura road serves mainly the central area. All rivers are rain-fed and ephemeral in nature and their flow is directly related to rainfall.
60. **Natural Hazards.** North-eastern region of India extending to the Himalayan arc in the north and Burmese arc to the east is among the most seismically active regions of the world. The whole of Tripura State falls under seismic zone V, and is highly vulnerable to earthquakes. The sites covered by the subproject are not located in areas prone to water-logging, salinasation, and flash flood.

3. **Geology, Mineral Resources, and Soils**

61. **Geology.** The geology of GAPA is represented by the repetitive succession of sedimentary rock like sandstone, shale and clay from bottom to top, belonging to Surma group, Tipam group and Dupitila group. The valley is dominated by thick sandstones horizons with thin intervening shale/clay horizons. The sedimentary rocks are deformed and folded. The sandstones are highly porous underlain by impermeable shales or clay and are favourable for ground water retention.

62. **Mineral Resources.** The most important minerals in Tripura are glass sand, lignite, clay, and limestone. The most important of all the minerals that are associated with the state is natural gas and oil. There are good sources of white sand on the bank of the water body called Bijainadi close to the place called old Agartala. Some other reserves are found in the western and eastern parts of Champamura.
63. **Soils.** The plains of Haora River are alluvial in nature consisting of sand, silt and clay. The soil in Agartala is in general of poor to medium quality. It is characterized by a top soil underlain by a soft to medium/stiff, silty clay/clayey silt layer, which follows a moderately dense to very dense silty sand layer. Bearing capacity of soil is poor and usually is of the range of 4 – 6 tons per m\(^2\) Central Agartala and most parts of south Agartala.

4. **Climate**

64. The climate of Agartala is of tropical monsoon type. The average annual rainfall is around 2,200 mm. The ambient temperature varies from 4.2 °C to 37.6 °C on the average. The winter period is from November to early March, summer is from March to May, and monsoon is from June to September. Winds, which are of moderate velocity, are from the south-to-south – east direction for most of the time. Average velocity of wind varies from 4 km to 9 km per hour.

5. **Air Quality**

65. There is no fixed ambient air quality monitoring stations under the Tripura State Pollution Control Board. There are no major air-polluting industries in Agartala and traffic/vehicular emission is the only significant source of pollutant, so air quality is likely to be well within the National Ambient Air Quality Standards (NAAQS).

66. During the year 2013 ambient air quality monitoring has been carried out under North-Eastern Region Capital Cities Development Investment Program at different locations of Agartala. The results of the monitoring are shown in Table 1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Date of sampling</th>
<th>Parameters (in microgram/cum)</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PM 2.5</td>
<td>PM 10</td>
</tr>
<tr>
<td>Area near AMC zonal office (ward 35)</td>
<td>13.11.2013</td>
<td>12.51</td>
<td>52.60</td>
</tr>
<tr>
<td></td>
<td>19.11.2013</td>
<td>14.7</td>
<td>51.9</td>
</tr>
<tr>
<td>Camper Bazar- Deendayal Ashram</td>
<td>14.11.2013</td>
<td>9.10</td>
<td>42.73</td>
</tr>
<tr>
<td>Near Aralia-II Deep TW</td>
<td>15.11.2013</td>
<td>6.26</td>
<td>33.24</td>
</tr>
<tr>
<td>Pratapgarh - Sadhu Tilla</td>
<td>16.11.2013</td>
<td>14.20</td>
<td>47.32</td>
</tr>
<tr>
<td>Near Pragati School</td>
<td>18.11.2013</td>
<td>17.22</td>
<td>51.60</td>
</tr>
<tr>
<td>Near Kali bari Sadhu Tilla</td>
<td>20.11.2013</td>
<td>21.2</td>
<td>57.6</td>
</tr>
<tr>
<td>Near Sishu Vidya Mandir Nursery School (Aralia)</td>
<td>21.11.2013</td>
<td>27.8</td>
<td>73.6</td>
</tr>
<tr>
<td>Near West Champamura School (Champamura)</td>
<td>22.11.2013</td>
<td>24.5</td>
<td>68.2</td>
</tr>
<tr>
<td>Near Vidhyasagar School (Bankumari bazaar)</td>
<td>23.11.2013</td>
<td>20.6</td>
<td>63.4</td>
</tr>
<tr>
<td>Near Vivekananda School (Bardowali)</td>
<td>25.11.2013</td>
<td>17.2</td>
<td>68.3</td>
</tr>
<tr>
<td>Near SD Mission (Sarbadharma Ashram)</td>
<td>26.11.2013</td>
<td>19.1</td>
<td>72.6</td>
</tr>
<tr>
<td>Near Cold Store (Dasaratdegb Stadium)</td>
<td>27.11.2013</td>
<td>15.8</td>
<td>65.3</td>
</tr>
<tr>
<td>Near Badharghat School (Dukli)</td>
<td>28.11.2013</td>
<td>20.4</td>
<td>67.2</td>
</tr>
<tr>
<td>Near AMC Sector Office (Ward No. 27)</td>
<td>29.11.2013</td>
<td>14.5</td>
<td>60.6</td>
</tr>
</tbody>
</table>

(Sources: Monitoring data as a part of NERCCDIP, Agartala, 2013)
67. Monitoring results indicate that concentration of air quality parameters are within the standard.

6. Surface Water

68. The State of Tripura is well endowed with surface water resources. As many as ten major rivers are reported to generate an annual flow of 793 million m³ of water. All rivers are rain-fed and ephemeral in nature. All major rivers originate from hill ranges and show a typical drainage pattern called trelis, except a few instances of dendrite pattern.

69. Haora River. The Haora River originates from Baramura range and flows westerly via Agartala to Bangladesh. The total length of the river is 53 km. The quality of raw and treated water from Haora River is measured by the Drinking Water and Sanitation Department (DWS Dept.). Results of water quality analysis conducted in 18 June 2010 is shown in Table 2 below. The physico-chemical analysis of the water of Haora River shows that iron levels (raw water) are more than the prescribed standard. All other parameters are within the prescribed limits. After Agartala, Haora River flows to Bangladesh, where it is used mainly for irrigation purposes.

Table 2: Surface Water Quality of Haora River – Raw & Treated (Date of Sampling: 18 June 2010)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Raw Water</th>
<th>Treated water</th>
<th>Desired Limit (Drinking water BIS 2012)</th>
<th>Permissible Limit (Drinking water BIS 10500: 2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>31.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Colour in Hazen unit</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Turbidity in NTU</td>
<td>0.2</td>
<td>0.2</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td>Taste &amp; Odour</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>pH - value</td>
<td>7.2</td>
<td>7.0</td>
<td>6.5 – 8.5</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Total Alkalinity in mg/l as CaCO₃</td>
<td>72.0</td>
<td>56.0</td>
<td>200.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Total Hardness in mg/l as CaCO₃</td>
<td>56.0</td>
<td>50.0</td>
<td>300.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Total Iron in mg/l as Fe</td>
<td>2.986</td>
<td>0.034</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Chloride in mg/l as Cl</td>
<td>12.0</td>
<td>13.0</td>
<td>250.0</td>
<td>1000.0</td>
</tr>
<tr>
<td>Total Solid in mg/l</td>
<td>-</td>
<td>71.5</td>
<td>5000.0</td>
<td>No guideline</td>
</tr>
<tr>
<td>Total dissolved solid in mg/l</td>
<td>82.55</td>
<td>BDL</td>
<td>500.0</td>
<td>2000.0</td>
</tr>
<tr>
<td>Total suspended solid in mg/l</td>
<td>-</td>
<td>71.5</td>
<td>25.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Residual Chlorine as Cl in mg/l</td>
<td>-</td>
<td>0.2</td>
<td>0.2</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Nitrate in mg/l as NO₃</td>
<td>2.984</td>
<td>BDL</td>
<td>45.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Arsenic in mg/l as As</td>
<td>BDL</td>
<td>BDL</td>
<td>0.05</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Sulphate in mg/l as SO₃</td>
<td>36.48</td>
<td>34.16</td>
<td>200.0</td>
<td>400.0</td>
</tr>
<tr>
<td>Calcium in mg/l as Ca</td>
<td>18.2</td>
<td>11.2</td>
<td>75.0</td>
<td>200.0</td>
</tr>
<tr>
<td>Magnesium in mg/l as Mg</td>
<td>1.3</td>
<td>5.3</td>
<td>30.0</td>
<td>150.0</td>
</tr>
<tr>
<td>Electrical Conductivity in µs</td>
<td>127.0</td>
<td>110.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Fluoride in mg/l as F</td>
<td>0.256</td>
<td>0.056</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Total Acidity in mg/l</td>
<td>4.0</td>
<td>6.0</td>
<td>&lt;12</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Free Carbon dioxide in mg/l</td>
<td>5.0</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dissolved oxygen in mg/l</td>
<td>6.8</td>
<td>7.2</td>
<td>≥6.0</td>
<td>≥6.0</td>
</tr>
</tbody>
</table>

Note: BDL = below detection limit; mg/L = milligram per liter; U = unobjectionable; A = agreeable; Desired Limit = Bureau of Indian Standard (BIS) for Drinking Water (undesirable effects expected when exceeded); Permissible Limit = BIS for Drinking Water in absence of alternate source (beyond permissible limit is not allowed).

BIS: Bureau of Indian Standard
Source: Drinking Water and Sanitation Department, Government of Tripura.
70. Later in 2011 extent of pollution of Haora River was studied by the Tripura State Pollution Control Board. Results are shown in Table below. Results indicate that Haora River water is contaminated with discharge sewerage within city limit. Level of coliform count and BOD are high and above the standard.

Table 3: Haora River water quality at different locations

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Point of origin of Haora River</th>
<th>Near Chandrapur</th>
<th>Near Bangladesh Boarder</th>
<th>Standard Value (Surface River Water)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>28.5</td>
<td>30.0</td>
<td>30.5</td>
<td>-</td>
</tr>
<tr>
<td>Total dissolved solid in mg/l</td>
<td>156</td>
<td>174</td>
<td>220</td>
<td>500</td>
</tr>
<tr>
<td>Total suspended solid in mg/l</td>
<td>26</td>
<td>46</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>pH - value</td>
<td>7.65</td>
<td>7.34</td>
<td>8.10</td>
<td>6.5 – 8.5</td>
</tr>
<tr>
<td>Colour in Hazen unit</td>
<td>2.5</td>
<td>10.2</td>
<td>12.6</td>
<td>10</td>
</tr>
<tr>
<td>Turbidity in NTU</td>
<td>5</td>
<td>26</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Total Alkalinity in mg/l as CaCO₃</td>
<td>69.34</td>
<td>120.0</td>
<td>143.02</td>
<td>-</td>
</tr>
<tr>
<td>Dissolved oxygen mg/l</td>
<td>7.2</td>
<td>6.24</td>
<td>5.6</td>
<td>6.0</td>
</tr>
<tr>
<td>Biochemical Oxygen Demand mg/l</td>
<td>1.9</td>
<td>3.5</td>
<td>8.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Chemical Oxygen Demand mg/l</td>
<td>8.0</td>
<td>22.0</td>
<td>39.0</td>
<td>-</td>
</tr>
<tr>
<td>Total Coliform (MPN/100 ml)</td>
<td>110</td>
<td>540</td>
<td>1800</td>
<td>500</td>
</tr>
<tr>
<td>Phosphates mg/l</td>
<td>0.010</td>
<td>0.020</td>
<td>0.065</td>
<td>-</td>
</tr>
<tr>
<td>Total Hardness in mg/l as CaCO₃</td>
<td>59.55</td>
<td>84.36</td>
<td>178.65</td>
<td>300</td>
</tr>
<tr>
<td>Calcium in mg/l as Ca</td>
<td>15.91</td>
<td>23.86</td>
<td>35.79</td>
<td>80.10</td>
</tr>
<tr>
<td>Magnesium in mg/l as Mg</td>
<td>4.8</td>
<td>6.02</td>
<td>21.63</td>
<td>24.28</td>
</tr>
<tr>
<td>Chloride in mg/l as Cl</td>
<td>7.2</td>
<td>9.6</td>
<td>24</td>
<td>250</td>
</tr>
<tr>
<td>Nitrate in mg/l as NO₃</td>
<td>0.02</td>
<td>0.025</td>
<td>0.060</td>
<td>20</td>
</tr>
<tr>
<td>Nitrite in mg/l</td>
<td>0.01</td>
<td>0.035</td>
<td>0.040</td>
<td>-</td>
</tr>
<tr>
<td>Ammoniacal Nitrogen mg/l</td>
<td>Nil</td>
<td>0.016</td>
<td>0.025</td>
<td>1.2</td>
</tr>
</tbody>
</table>

(Source: Pollution Control Board) http://agartalacity.tripura.gov.in/PDF/Septage_Mangement.pdf

71. Recently DWS Dept. carried out monitoring for Haora River raw water and treated water. Results are depicted in Table below. Results indicate that treated water is suitable for drinking except high concentration of residual chlorine.

Table 4: Raw & Treated water quality of Haora River (2014)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Raw Water</th>
<th>Treated water from Present WTP</th>
<th>Desired Limit (Drinking water BIS 2012)</th>
<th>Permissible Limit (Drinking water BIS 2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical appearance</td>
<td>Turbid</td>
<td>Unobjectionable</td>
<td>Unobjectionable</td>
<td></td>
</tr>
<tr>
<td>Colour in Hazen unit</td>
<td>-</td>
<td>&lt;5</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Turbidity in NTU</td>
<td>261</td>
<td>1.02</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td>Taste &amp; Odour</td>
<td>Unobjectionable</td>
<td>Unobjectionable</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>pH - value</td>
<td>7.24</td>
<td>7.0</td>
<td>6.5 – 8.5</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Total Alkalinity in mg/l as CaCO₃</td>
<td>80.0</td>
<td>58.0</td>
<td>200.0</td>
<td>600.0</td>
</tr>
</tbody>
</table>
### Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Water</td>
</tr>
<tr>
<td>Treated water from Present WTP</td>
</tr>
<tr>
<td>Desired Limit (Drinking water BIS 2012)</td>
</tr>
<tr>
<td>Permissible Limit (Drinking water BIS 2012)</td>
</tr>
<tr>
<td>Total Hardness in mg/l as CaCO₃</td>
</tr>
<tr>
<td>62.0</td>
</tr>
<tr>
<td>56.0</td>
</tr>
<tr>
<td>300.0</td>
</tr>
<tr>
<td>600.0</td>
</tr>
<tr>
<td>Total Iron in mg/l as Fe</td>
</tr>
<tr>
<td>2.874</td>
</tr>
<tr>
<td>0.033</td>
</tr>
<tr>
<td>0.3</td>
</tr>
<tr>
<td>1.0</td>
</tr>
<tr>
<td>Chloride in mg/l as Cl</td>
</tr>
<tr>
<td>10.0</td>
</tr>
<tr>
<td>11.0</td>
</tr>
<tr>
<td>250.0</td>
</tr>
<tr>
<td>1000.0</td>
</tr>
<tr>
<td>Residual Chlorine as Cl in mg/l</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>0.5</td>
</tr>
<tr>
<td>0.2</td>
</tr>
<tr>
<td>No relaxation</td>
</tr>
<tr>
<td>Nitrate in mg/l as NO₃</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>0.392</td>
</tr>
<tr>
<td>45.0</td>
</tr>
<tr>
<td>100.0</td>
</tr>
<tr>
<td>Arsenic in mg/l as As</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>BDL</td>
</tr>
<tr>
<td>0.05</td>
</tr>
<tr>
<td>No relaxation</td>
</tr>
<tr>
<td>Sulphate in mg/l as SO₃</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>38.91</td>
</tr>
<tr>
<td>200.0</td>
</tr>
<tr>
<td>400.0</td>
</tr>
</tbody>
</table>

(Source: DWS Data on River Haora, date of sampling 27.05.2014)

### 7. Groundwater

72. Surveys carried out by the Central Ground Water Board (CGWB) reveal that the aquifer system in the Agartala possesses good potential. The depth of the water table in both pre-monsoon and post-monsoon seasons range between 2 to 6 m with net seasonal fluctuations ranging between 1 to 2 m. In Greater Agartala, the depth of water level for shallow aquifer was observed to be in the range of 1 to 5 meter below ground level (mbgl), while the depth to water level in the deeper aquifers was observed between 1 to 7 mbgl. The pattern of pre-monsoon water table contours in Agartala reveals that the master slope of the ground water is towards West.

73. Hydrological surveys revealed that the valleys of Tripura have three to four major aquifers within 259 m in depth. Data from the CGWB\(^1\) shows annual replenishable groundwater resource is 2.19 billion cubic meters (BCM) and the net annual groundwater availability is 1.97 BCM. It also shows that 0.17 BCM is drafted annually thus the groundwater is not over exploited and not critical.

74. Records of groundwater quality monitoring from DWSD (Table 5) show raw groundwater quality, which supply directly to households in Agartala. The quality does not conform to the set norms of the BIS. It has been noted that iron levels in all the deep tube wells are above the desired and permissible limits. In few locations, levels of turbidity, colour, fluoride, and dissolved oxygen are above the permissible limits.

### Table 5: Deep Tube Wells Ground Water Quality (Date of Sampling: 10\(^{th}\) February 2009)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>GW-1</th>
<th>GW-2</th>
<th>GW-3</th>
<th>GW-4</th>
<th>GW-5</th>
<th>GW-6</th>
<th>GW-7</th>
<th>GW-8</th>
<th>GW-9</th>
<th>Desired Limit</th>
<th>Permissible Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>O</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>O</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Colour in Hazen unit</td>
<td>&gt;25</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;5</td>
<td>&gt;50</td>
<td>&lt;5</td>
<td>&lt;10</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Turbidity in NTU</td>
<td>32.1</td>
<td>8.9</td>
<td>6.1</td>
<td>1.3</td>
<td>76.0</td>
<td>2.6</td>
<td>4.8</td>
<td>3.7</td>
<td>1.1</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td>Taste</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

\(^1\) Data accessed from CGWB website (http://cgwb.gov.in) on 23-February-2011.
<table>
<thead>
<tr>
<th>Parameters</th>
<th>GW-1</th>
<th>GW-2</th>
<th>GW-3</th>
<th>GW-4</th>
<th>GW-5</th>
<th>GW-6</th>
<th>GW-7</th>
<th>GW-8</th>
<th>GW-9</th>
<th>Desired Limit</th>
<th>Permissible Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH- value</td>
<td>6.49</td>
<td>6.35</td>
<td>6.74</td>
<td>6.31</td>
<td>7.05</td>
<td>6.34</td>
<td>6.28</td>
<td>6.47</td>
<td>6.15</td>
<td>6.5 – 8.5</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Total Alkalinity in mg/l as CaCO₃</td>
<td>92.0</td>
<td>84.0</td>
<td>86.0</td>
<td>88.0</td>
<td>72.0</td>
<td>90.0</td>
<td>76.0</td>
<td>84.0</td>
<td>72.0</td>
<td>200.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Total Hardness in mg/l as CaCO₃</td>
<td>62.0</td>
<td>56.0</td>
<td>58.0</td>
<td>50.0</td>
<td>44.0</td>
<td>42.0</td>
<td>58.0</td>
<td>20.0</td>
<td>44.0</td>
<td>300.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Total Iron in mg/l as Fe</td>
<td>4.24</td>
<td>5.12</td>
<td>4.88</td>
<td>4.46</td>
<td>5.86</td>
<td>4.32</td>
<td>4.87</td>
<td>4.15</td>
<td>0.3</td>
<td>1.0</td>
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<tr>
<td>Chloride in mg/l as Cl</td>
<td>13.0</td>
<td>13.0</td>
<td>13.5</td>
<td>8.5</td>
<td>9.0</td>
<td>8.5</td>
<td>9.2</td>
<td>9.5</td>
<td>18.0</td>
<td>250.0</td>
<td>1000.0</td>
</tr>
<tr>
<td>Total Solid in mg/l</td>
<td>89.9</td>
<td>81.4</td>
<td>80.1</td>
<td>86.0</td>
<td>64.6</td>
<td>78.7</td>
<td>63.8</td>
<td>78.1</td>
<td>81.4</td>
<td>5000.0</td>
<td>No guideline</td>
</tr>
<tr>
<td>Total dissolved solid in mg/l</td>
<td>89.7</td>
<td>81.3</td>
<td>79.9</td>
<td>85.8</td>
<td>64.3</td>
<td>78.6</td>
<td>63.7</td>
<td>78.0</td>
<td>81.3</td>
<td>500.0</td>
<td>2000.0</td>
</tr>
<tr>
<td>Total suspended solid in mg/l</td>
<td>0.16</td>
<td>0.15</td>
<td>0.16</td>
<td>0.25</td>
<td>0.28</td>
<td>0.10</td>
<td>0.15</td>
<td>0.10</td>
<td>0.15</td>
<td>25.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Residual Chlorine as Cl in mg/l</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Nitrate in mg/l as NO₃</td>
<td>3.06</td>
<td>0.77</td>
<td>0.66</td>
<td>0.15</td>
<td>3.12</td>
<td>0.58</td>
<td>0.78</td>
<td>1.34</td>
<td>0.65</td>
<td>45.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Arsenic in mg/l as As</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
<td>0.05</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Sulphate in mg/l as SO₃</td>
<td>12.2</td>
<td>0.74</td>
<td>1.11</td>
<td>BDL</td>
<td>25.55</td>
<td>2.96</td>
<td>2.96</td>
<td>0.56</td>
<td>200.0</td>
<td>400.0</td>
<td></td>
</tr>
<tr>
<td>Calcium in mg/l as Ca</td>
<td>12.0</td>
<td>4.0</td>
<td>11.2</td>
<td>8.0</td>
<td>8.8</td>
<td>6.4</td>
<td>6.4</td>
<td>6.4</td>
<td>7.5</td>
<td>200.0</td>
<td></td>
</tr>
<tr>
<td>Magnesium in mg/l as Mg</td>
<td>7.7</td>
<td>11.1</td>
<td>7.2</td>
<td>7.2</td>
<td>5.3</td>
<td>6.3</td>
<td>7.29</td>
<td>0.97</td>
<td>8.7</td>
<td>30.0</td>
<td>150.0</td>
</tr>
<tr>
<td>Electrical Conductivity in µs</td>
<td>138</td>
<td>125</td>
<td>123</td>
<td>132</td>
<td>99</td>
<td>121</td>
<td>98.0</td>
<td>120</td>
<td>106</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Fluoride in mg/l as F</td>
<td>0.04</td>
<td>BDL</td>
<td>0.08</td>
<td>0.28</td>
<td>BDL</td>
<td>0.16</td>
<td>BDL</td>
<td>0.08</td>
<td>BDL</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Total Acidity in mg/l</td>
<td>32.0</td>
<td>32.0</td>
<td>18.0</td>
<td>64.0</td>
<td>12.0</td>
<td>60.0</td>
<td>40.0</td>
<td>46.0</td>
<td>66.0</td>
<td>&lt;12</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Free Carbon dioxide in mg/l</td>
<td>58.0</td>
<td>82.0</td>
<td>20.9</td>
<td>180.0</td>
<td>22.0</td>
<td>86.0</td>
<td>48.0</td>
<td>124.0</td>
<td>90.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dissolved oxygen in mg/l</td>
<td>6.2</td>
<td>5.8</td>
<td>9.0</td>
<td>3.8</td>
<td>9.1</td>
<td>5.1</td>
<td>5.8</td>
<td>5.5</td>
<td>5.3</td>
<td>≥6.0</td>
<td>≥6.0</td>
</tr>
</tbody>
</table>

Note: BDL = below detection limit; mg/L = milligrams per liter; O = objectionable; U = unobjectionable; A = agreeable
Source: Drinking Water and Sanitation Department, Government of Tripura

75: New deep tube well water qualities have been tested by DWS Dept. at two locations. Results indicate that in both the samples concentration of iron is very high and much above the
desirable and permissible limits for drinking water. Hence treatment (removal of iron) is required before supply.

Table 6: Recent data ground water quality from new deep tube well

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of sampling</td>
<td>13.08.2013</td>
<td>26.09.2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>29</td>
<td>27.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>Unobjectionable</td>
<td>Unobjectionable</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Colour in Hazen unit</td>
<td>&gt;25</td>
<td>&gt;25</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Turbidity in NTU</td>
<td>124.0</td>
<td>26.0</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td>Taste &amp; Odour</td>
<td>Agreeable</td>
<td>Agreeable</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>pH value</td>
<td>6.54</td>
<td>6.67</td>
<td>6.5 – 8.5</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Total Alkalinity in mg/l as CaCO₃</td>
<td>64.0</td>
<td>90.0</td>
<td>200.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Total Hardness in mg/l as CaCO₃</td>
<td>46.0</td>
<td>52.0</td>
<td>300.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Total Iron in mg/l as Fe</td>
<td>6.092</td>
<td>4.166</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Chloride in mg/l as Cl</td>
<td>10.0</td>
<td>6.5</td>
<td>250.0</td>
<td>1000.0</td>
</tr>
<tr>
<td>Total Solid in mg/l</td>
<td>-</td>
<td>-</td>
<td>5000.0</td>
<td>No guideline</td>
</tr>
<tr>
<td>Total dissolved solid in mg/l</td>
<td>81.9</td>
<td>91.0</td>
<td>500.0</td>
<td>2000.0</td>
</tr>
<tr>
<td>Total suspended solid in mg/l</td>
<td>-</td>
<td>-</td>
<td>25.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Residual Chlorine as Cl in mg/l</td>
<td>Not Found</td>
<td>Not Found</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>Nitrate in mg/l as NO₃</td>
<td>1.326</td>
<td>1.096</td>
<td>45.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Arsenic in mg/l as As</td>
<td>BDL</td>
<td>BDL</td>
<td>0.05</td>
<td>No relaxation</td>
</tr>
<tr>
<td>Sulphate in mg/l as SO₃</td>
<td>24.0</td>
<td>30.08</td>
<td>200.0</td>
<td>400.0</td>
</tr>
<tr>
<td>Calcium in mg/l as Ca</td>
<td>8.0</td>
<td>11.2</td>
<td>75.0</td>
<td>200.0</td>
</tr>
<tr>
<td>Magnesium in mg/l as Mg</td>
<td>6.31</td>
<td>5.83</td>
<td>30.0</td>
<td>150.0</td>
</tr>
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<td>Electrical Conductivity in µs</td>
<td>126</td>
<td>140</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Fluoride in mg/l as F</td>
<td>1.342</td>
<td>0.198</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Total Acidity in mg/l</td>
<td>-</td>
<td>-</td>
<td>&lt;12</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Free Carbon dioxide in mg/l</td>
<td>Escaped</td>
<td>Escaped</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dissolved oxygen in mg/l</td>
<td>7.8</td>
<td>7.6</td>
<td>≥6.0</td>
<td>≥6.0</td>
</tr>
</tbody>
</table>

(Source: DWS (PWD), Agartala, Tripura, 2013)

B. Biological Resources

76. There are no protected areas, wetlands, mangroves, or estuarines in or within the subproject location.

77. The “Shipahijala Wild Life Sanctuary” situated in Bishalgarh Development Block, is located at a distance of 28 km from Agartala city. The sanctuary covers an area of 18.53 sq km,
and possesses rich diversity of wild life particularly birds (migratory birds during winter seasons) and primates. The subproject components are not expected to have any effect on the Sanctuary.

78. Forest map of Tripura shown in **Figure 2**. It shows that there is no forest area nearby the project site of Treatment Plant. Only few open scrub land and few trees are located within the proposed Septage Treatment Plant site.

79. **Flora.** There are no designated forest areas or sanctuaries within the GAPA boundaries. The Tripura State Biodiversity Action Plan has identified pockets of rich biodiversity as conservation hotspots. None of the identified hotspots are located within the GAPA boundaries. While a number of endangered primate species are found within Tripura state, none of them are reported within the GAPA.

80. A phyto diversity survey and analysis was carried out at the subproject locations in GAPA using the Shannon-Wiener Diversity Index, and evenness with the Evenness index. The indices show that the diversity in terms of flora is not significant, and the indices reveal that all locations fall short of that a primary forest. The trees are mostly timber yielding. While there exist some species in locations away from the inhabited areas, that are important, they are not unique. In none of the project locations, rare/endangered tree/plant species have been identified that need to be taken up for conservation or special protection in the project. However, it is included in the mitigation measures to minimize loss and clearance of vegetation shall be complied with to ensure loss of vegetation.

81. **Fauna.** The subproject location is open scrub undulated land nearby the city. Therefore existence of wild fauna is not reported. Only domestic animals such as pigs, dogs, cows, buffalos, cats and goats are present in the subproject areas.
C. Economic Development

1. Land Use

82. Total area of GAPPA is 9,200 hectares (ha), out of which 3,125 ha are classified as developed area (residential, commercial, industrial, government and semi-government, recreation-park, public facilities, and circulation). The remaining 6,075 ha are water bodies, plantations, defence area, vacant land and agricultural area. Majority of the subproject locations are in the developed area of the city.

2. Commerce, Industry and Agriculture

83. Tripura's gross state domestic product for 2004 is estimated at $2.1 billion in current prices. The economy of Tripura is agrarian. More than 50 per cent of its population depends on agriculture for livelihood and contribution of agriculture and allied activities.

84. Tripura is characterised by low income, overwhelming percentage of population below the poverty line, income leakage, and unemployment. The state is predominantly rural in character (85.29%). Average land holding size is 0.97 hectare. 90% of the cultivators are either small or marginal.

85. Trade and Commerce. There are two small industrial estates, with a total number of 36 industrial units and with a total capital investment of INR 56.575 million. Other than the 2
industrial estates, there are 17 other significant industries in Agartala. These industries, as per records, are not in the category of large and medium industries.

86. Wholesale trade in the city is functioning mostly in the Gole Market area and spreads haphazardly mixing with the retail trade. There are 9 markets maintained by AMC within erstwhile Municipal limits, of which, Battala and Maharaj Ganja Bazaar are the main service and distribution centres of Greater Agartala.

87. Agriculture. Agriculture and allied activities is the mainstay of the people of Tripura and provides employment to about 64% of the population. There is a preponderance of food crop cultivation over cash crop cultivation in Tripura. At present about 62% of the net sown area is under food crop cultivation. Paddy is the principal crop, followed by oilseed, pulses, potato and sugarcane. Tea and rubber are the important cash crops of the State. Handicraft, particularly hand-woven cotton fabric, wood carvings and bamboo products, are also important. The subproject areas are not located in agricultural lands.

3. Infrastructure

88. Water Supply. The people of Agartala get their water from piped water supply systems operated by the Public Health Engineering Department (PHED), private and community wells and the two rivers that run through the city. Although about 70% of the population of the area is served by central water supplies, water is available for only a few hours a day in most parts of the city. PHED’s water supply systems have two main sources, comprising the Haora River and groundwater. Distribution of water is partly through distribution reservoirs and partly through direct pumping. Major parts of the distribution system pipelines are obstructed by iron deposits. The water supply system is unmetered. The major problems with the water supply system are under utilization of the capacity of the two treatment plants, under production from the ground water sources, ineffective treatment for iron removal, absence of proper disinfection and a substantial amount of unaccounted for water (UFW), presently about 35% of production.

89. Sewerage and Sanitation. Agartala city is not covered by an underground sewerage system at present. Although about 90% of households have cistern or pour flush latrines, about 10% use pit latrines. Open defecation is widespread among lower income group people especially those living along rivers and drains and in rural areas. The ground water table being very high there is a high risk of contamination of wells.

90. Drainage. Although GAPA has numerous storm water drains and two major rivers flowing through it, the city suffers from recurrent flood problems. During normal rainfall of about 3 to 4 hours, the central part of Agartala gets flooded. Although there is adequate fall in most parts of the city to support a gravity drainage system, some parts of the city are on low-lying land and drainage problem is more evident. The most severe problems arise when a combination of tidal conditions in the Brahmaputra basin and high rainfall cause the waters in the Haora and Katakhal Rivers to be higher than the city. Several pumps have been provided to lift the water out of the city during these seasons. Most of the main drains are masonry-lined, but the feeder drains are earth-lined and in a poor condition with silt and vegetation choking them.

91. Industrial Effluents. Industries within the city area have no separate treatment facility. The industries are required to treat their own effluents before disposal and are not allowed by the Agartala Municipal Council (AMC) to connect to the local drainage network.
92. Solid Waste. An estimated 200 tons/day of solid waste is generated within the city. Only 50% of the waste generated is collected and transported. The waste dumped haphazardly along roads, drains and open areas leading to unhygienic conditions. The collected waste is dumped at Hapania, situated in village Madhupur about a kilometer away from the Dr. Ambedkar hospital.

93. Transportation. The Assam – Agartala – Sabroom Road (NH-44) connects Agartala with Silchar, Guwahati and other towns of Assam. The total length of roads in the city is approximately 390 km with a road density of about 4.2 km per km². The road system is planned, well defined and geometrical in the central core area, following a gridiron pattern. In the outer areas, it is more haphazard and ill planned. The mixed traffic and encroachments along roads like the Motor Stand to Subhash Market road, Hariganga Basak Road upto the Post Office Chowmansi etc, leads to high levels of congestion in the city especially in the central business district area. The presence of cycle rickshaws adds to the congestion.

D. Social and Cultural Resources

94. Demography. The total estimated population of AMC limits as per 2011 census is 399,668. Population density of GAPA increased to 41% person per hectare in the year 2001 in compared to 38% in 1991. There are two major racial groups, namely the Indo-Aryans represented by the Bengalis and the Indo-mongoloid represented by communities like the Tripuris, the Reangs, the Noatis, the Kukis, the Halams, the Chakma, the Mogh and the Lushai. The percentage of Scheduled Tribe population to the total city population is estimated to be around 4%. The scheduled tribe populations living in the city is well integrated with the mainstream and is gainfully employed. The literacy rate in Agartala is the highest among the localities of Tripura.

95. Health and Educational Facilities. There are good educational facilities in Tripura state, which serve both Agartala urban people and inhabitants of surrounding villages and towns in the hinterland. There are about 21 colleges in Agartala comprising Medical college, Degree college, Nursing college, Polytechnic college and Open university. Percentage of literacy according to 2011 census is 93.88, higher than the national literacy rate.

96. There are also 9 nos. nursing home and hospital at Agartala. One Government Medical College is also located at Agartala.

97. History, Culture, and Tourism. The city has a historical back ground. The ancient capital of the princely State ‘Swadhin Tripura’ was at Rangamati (Udaipur, South Tripura) by the bank of the river Gomti and in 1760 A.D., It was shifted by the Maharaja Krishna Manikya to the site of old Agartala by the bank of river Haora and was named ‘Haveli’. The Capital city of Agartala was founded in1838 AD by Maharaja Krishna Kishore Manikya (1830-49 A.D.).

98. Agartala is a city of many tourist attractions. These include palaces, temples, wildlife sanctuaries and many others. The most popular tourist place in Agartala is the Tripura Sundari Temple, popularly known as Matabari that is located at a distance of 55 Km from the city. Other places of interest are, the Ujjayanta Palace, located within the city, Neer Mahal located 53 km from the city, Unnakoti- a pilgrimage center with rock carvings and murals. The tourism industry in Agartala city is growing at a fast pace. The specific subproject locations are not located within any historically-, culturally-, archaeologically- or architecturally-significant or tourists area.

IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES
99. This section of the IEE reviews possible subproject-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the subproject’s area of influence. As defined previously, the primary impact areas are (i) site for septage treatment plant and approach road; (ii) main routes/intersections which will be traversed by construction vehicles and operation equipment/vehicle; and (iii) quarries and borrow pits as sources of construction materials. The secondary impact areas are: (i) entire Agartala area outside of the delineated primary impact area; and (ii) entire West Tripura district in terms of over-all environmental improvement.

100. The ADB Rapid Environmental Assessment Checklist for Waste Water was used to screen the subproject for environmental impacts and to determine the scope of the IEE investigation. The completed Checklist is found in Appendix 5. All the proposed subproject components will interact physically with the environment.

101. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation during land development for treatment plant and earth movements; and (iii) being located in the Agartala city, will not cause direct impact on biodiversity values. The subproject will be in properties held by the local government and access to the subproject locations is thru public rights-of-way. Only due to presence of defence land nearby the proposed site

A. Pre-construction – Location and Design

102. Design of the Proposed Components.

103. No concept plan and design prepared for the sub project till submission of this draft IEE. Assessment is carried out from common understanding.

104. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation for construction of different units of treatment plant will be done by backhoe and supplemented by manual digging. Excess spoils generated will be utilized as site, since topography of the site is undulating and which required cutting & filling.

105. During operation of treatment plant effluent will be discharged after attending the Indian standard. Nearby farmers will be utilized treated effluent Appendix 6 shows the effluent standard. Sludge will be utilized (after drying) as manure for production of vegetables. Frequency of collection will be assessed after development of design.

106. With increase in additional production of water under the said program and its use more sewage water will be generated. There is no sewage treatment system within the project area. Hence treatment of raw sewage water and septage management is very much necessary along with development of the city.

107. As per DWS Dept. the excess sewage to be generated due to increase in the level of water supply will be taken care of by the existing household level on-site sanitation system. The excess sullage will be going to the existing wastewater and drainage disposal system which is being augmented under 13th. Finance commission of Govt. of India. This proposed augmentation is expected to be completed by 2016. At present the individual houses is provided with individual septic tanks and public toilets are constructed and maintained by city Municipal Corporation. For septage management a proposal under Govt.’s consideration for implementation under ADB’s financial assistance. Accordingly IEE is prepared for septage
management of central and south part of Agartala city.

108. Impacts arise from the design of the project including the technology used and scale of operation.

109. Impacts associated with the planning mainly depend on the site selection. Location impacts include on-site biophysical array and encroachment / impact either directly or indirectly on adjacent environments. It also includes the impacts on the people who might lose their livelihoods due to the development of the proposed site.

110. Structure in seismic zone V- Design impact & mitigation: While a structure is designed all possible load combination are considered those may come into structure. This includes seismic load also. In zone V like Agartala the ground vibration is maximum. Corresponding to this the Peak Ground Acceleration (PGA) is provided in the relevant code for seismic design (Indian Standard, IS 1893: 2002). As per this PGA and the seismic acceleration response curve is given in the code and other factors like Response Reduction Factor and Importance Factor as per the same code the seismic analysis is done and structures are designed accordingly. As the ground acceleration is maximum in zone V, the cost of the structure also becomes high for provision of higher reinforcement etc. As per the seismic design philosophy laid in IS: 1893, 2002, the structure are designed such a way that it can withstand all Design Basis Earthquake (DBE) which are basically minor and medium ground slaking and it should not collapse but have cracks which are reparable during Maximum Considered Earthquake (MCE) which are basically major slaking. Thus as per the provision of the seismic code the structure are designed in such a way that in no case it will collapse. The present structures are also designed in line with the above provision of the IS 1893.

111. **Encroachment into private properties, forestland and cutting of trees and damage to vegetation.** No private land acquisition is required for construction of treatment plant. Sufficient land is available for construction of landfill facility and septage treatment plant. Only there is existence of defence land nearby the proposed project site. Proper dialogue is required with defence authority. At the same time sufficient buffer area is needed to minimize impact on aesthetic environment.

112. No forest area is involved in the project. Forest Clearance from the Tripura Environment and Forest Department will be not required. In case of tree felling in future permission will be taken up from forest dept.

113. **Utilities.** No utilities existing within proposed plant site.

114. **Social and Cultural Resources.** Tripura is an area of large numbers of temples (some of them are historic) and other religious sites, so there is a risk that any work involving ground disturbance can uncover and damage archaeological and historical remains. For this subproject, excavation will occur in open area, so it could be that there is a medium risk of such impacts. Nevertheless, DSMC/SIPMIU will:

- Consult Agartala Municipal Corporation (AMC) to obtain an expert assessment of the archaeological potential of the site;
- Consider alternatives if the site is found to be of high risk;
- Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available; and
- Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved.
115. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the subproject location. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals on water bodies, swamps, or in areas which will inconvenience the community. All locations would be included in the design specifications and on plan drawings.

116. **Site selection of sources of materials.** Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) would be included in the design specifications and on plan drawings. Priority would be sites already permitted by Mining Department. If other sites are necessary, these would to be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities. It will be the construction contractor’s responsibility to verify the suitability of all material sources and to obtain the approval of Urban Local Body. If additional quarries will be required after construction is started, then the construction contractor shall use the mentioned criteria to select new quarry sites, with written approval of AMC.

**B. Construction**

1. **Screening of No Significant Impacts**

117. The construction work is expected not to cause major negative impacts, mainly because:

   (i) Most of the activities will be within the scrub land of Debendranagar. No as such significant impact on biodiversity is expected. Only few tree felling may be required;

   (ii) Project site located on an government-owned land which is not occupied or used for any other purpose;

   (iii) Overall construction program will be relatively short and is expected to be completed in 18 months with activities to conducted by small teams and specified location so most impacts will be localized and short in duration; and

   (iv) Most of the predicted impacts associated with the construction process are produced because the process is invasive, such as involving excavation. However the routine nature of the impacts means that most can be easily mitigated and the impacts are clearly a result of the construction process rather than the design or location, as impacts will not occur if excavation or other ground disturbance is not involved.

118. As a result, there are several aspects of the environment which are not expected to be affected by the construction process and these can be screened out of the assessment at this stage as required by ADB procedure. These are shown in **Table 7**. These environmental factors are screened out presently but will be assessed again after development of design.

| Table 7: Fields in which construction is not expected to have significant impacts |
|--------------------------|--------------------------|
| **Field**                | **Rationale**            |

<table>
<thead>
<tr>
<th>Field</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topography, Drainage, and Natural Hazards</td>
<td>Activities are not large enough to affect these features.</td>
</tr>
<tr>
<td>Geology, Geomorphology, Mineral Resources, and Soils</td>
<td>Activities are not large enough to affect these features. No mineral resources in the subproject location.</td>
</tr>
<tr>
<td>Climate</td>
<td>Activities are not large enough to affect this feature.</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Short-term production of dust is the only effect on atmosphere, but no as such locality nearby the proposed area</td>
</tr>
<tr>
<td>Geohydrology and Groundwater</td>
<td>Activities will not be large enough to affect these features</td>
</tr>
<tr>
<td>Protected Areas</td>
<td>No protected areas nearby the project location</td>
</tr>
<tr>
<td>Flora and Fauna</td>
<td>No rare or endangered species.</td>
</tr>
<tr>
<td>Land Use</td>
<td>No change in major land use, only treatment plant will be constructed within scrub land</td>
</tr>
<tr>
<td>Socio-economic</td>
<td>Subproject site is located within AMC land</td>
</tr>
<tr>
<td>Commerce, Industry, and Agriculture</td>
<td>Activities are not large enough to affect these features</td>
</tr>
<tr>
<td>Population</td>
<td>Activities are not large enough to affect this feature. Only after construction people of south and central Agartala will be benefited</td>
</tr>
<tr>
<td>Health and education facilities</td>
<td>Activities are not large enough to affect this feature. There is positive health impact</td>
</tr>
<tr>
<td>Historical, Archaeological, Paleontological, or Architectural sites</td>
<td>No scheduled or unscheduled historical, archaeological, paleontological, or architectural sites</td>
</tr>
</tbody>
</table>

2. Construction method

119. No concept plan and design is prepared for the project. Detail construction methodology can be included after development of design. Work mostly involved; cleaning of vegetation, land preparation through cutting & filling, excavation and development of settling tank & different chambers and administrative & operation buildings.

3. Anticipated Impacts and Mitigation Measures

120. Construction work is not complicated. Only excavation and development of settling tank, ponds, and chambers will be required as a part of Treatment Plant. During construction standard safety norms\(^2\) needs to be maintained.

121. Sources of Materials. Significant amount of gravel, sand, and cement will be required for this subproject. The construction contractor will be required to:

(i) The material sources permitted by government;
(ii) Verify suitability of all material sources and obtain approval of State Investment Program Management & Implementation Unit (SIPMIU); and
(iii) Submit to DSMC on a monthly basis documentation of sources of materials.

122. Air Quality. Emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality in the construction sites. Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons)

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\(^2\) Occupational Health and Safety of employees working only in factories and mines have been specifically covered in GOI laws. However, the Constitution of India has provisions to ensure that the health and well-being of all employees are protected and the State has the duty to ensure protection. For this subproject, the mitigation measures were based on the World Bank Environmental, Health, and Safety (EHS) Guidelines.
but temporary and during construction activities only. To mitigate the impacts, construction contractors will be required to:

(i) Consult with SIPMIU/DSMC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
(ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
(iii) Avoiding the need to stockpile on site;
(iv) Use tarpaulins to cover sand and other loose material when transported by trucks; and
(v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.

123. **Surface Water Quality.** Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby stream. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
(ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with SIPMIU/DSMC on designated disposal areas;
(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
(iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
(v) Dispose any wastes generated by construction activities in designated sites; and
(vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).

124. **Noise Levels.** There are no health facilities, scheduled or unscheduled historical, archaeological, paleontological, or architectural sites near the construction sites. Construction of treatment plant is planned outside the locality but increase in noise level may be caused by excavation equipment, and the transportation of equipment, materials, and people. Impact is negative, short-term, and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan activities in consultation with SIPMIU/DSMC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
(ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle’s approach;
(iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and
(iv) Maintain maximum sound levels not exceeding 80 decibels (dBa) when measured at a distance of 10 m or more from the vehicle/s.

125. **Generation of Spoil and disposal.** Excess earth will be generated after excavation but for land development that earth will be utilized within the project site.
126. **Landscape and Aesthetics.** The construction works will produce excess excavated, excess construction materials, and solid waste such as wood, trees and plants, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. These impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Prepare and implement Waste Management Plan;
(ii) Avoid stockpiling of excess excavated soils and specifically use of the same;
(iii) Recover used oil and lubricants and reuse or remove from the sites;
(iv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
(v) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
(vi) Request SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

127. **Surface and Groundwater Quality.** Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. To ensure that water will not pond in pits and voids near subproject location, the construction contractor will be required to conduct excavation works on non-monsoon season.

128. **Accessibility.** Hauling of construction materials and operation of equipment on-site can cause traffic problems. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
(ii) Schedule transport and hauling activities during non-peak hours;
(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
(iv) Keep the site free from all unnecessary obstructions;
(v) Drive vehicles in a considerate manner;
(vi) Coordinate with Govt. Traffic Department for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; and
(vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

129. **Socio-Economic – Income.** The subproject components will be located in Government land. Construction works will impede the access of residents to specific site in limited cases. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

(i) Leave spaces for access between mounds of soil;
(ii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

130. **Socio-Economic – Employment.** Manpower will be required during the 18-months construction stage. This can result to generation of contractual employment and increase in
local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to:

(iii) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and

(i) Secure construction materials from local market.

131. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

(i) Designate a safeguard focal person and undertake safeguards orientation by SIPMIU/ DSMC

(ii) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training\(^3\) for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;

(iii) Strict compliance of H&S plan and requirements of wearing personal protective equipment (PPE) during work hours;

(iv) Provide specific guidance for suitable PPE for every on-site work assignment.

(v) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;

(vi) Provide medical insurance coverage for workers;

(vii) Secure all installations from unauthorized intrusion and accident risks;

(viii) Provide supplies of potable drinking water;

(ix) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;

(x) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;

(xi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;

(xii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;

(xiii) Ensure moving equipment is outfitted with audible back-up alarms;

(xiv) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international

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\(^3\) Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.
standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and

(xv) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

132. **Maintaining Core Labour Standard.** The Contractor and SIPMIU are responsible for ensuring that international CLS\(^4\) –as reflected in national labour laws and regulations are adhered to. SIPMIU is ultimately responsible for monitoring compliance with national labour laws and regulations, provided that these national laws are consistent with CLS. ADB will carry out due diligence – during loan review missions - to ensure that executing and implementing agencies and contractors comply with applicable (national) core labour standards and labour laws. SIPMIU will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labour laws and core labour standards on: (a) prohibition of child labour as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste; and (c) elimination of forced labour; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites. These will be monitored as part of the project’s safeguards reporting requirements.

133. **Community Health and Safety.** Project site is located at isolated area, hence health and safety risk to community is minimum. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan routes to avoid times of peak-pedestrian activities.
(ii) Liaise with SIPMIU/DSMC in identifying risk areas on route cards/maps.
(iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
(iv) Provide road signs and flag persons to warn of dangerous conditions, at the entry point of site from the road.

134. **Work Camps.** Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Consult with SIPMIU/DSMC before locating project offices, sheds, and construction plants;
(ii) Minimize removal of vegetation and disallow cutting of trees;
(iii) Provide water and sanitation facilities for employees;
(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;
(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;
(vi) Recover used oil and lubricants and reuse or remove from the site;

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\(^4\) Core Labor Standards (CLSs) are a set of four internationally recognized basic rights and principles at work: (i) freedom of association and the right to collective bargaining; (ii) elimination of all forms of forced or compulsory labor; (iii) effective abolition of child labor; and (iv) elimination of discrimination in respect of employment and occupation.
(vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
(viii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
(ix) Request SIPMIU/DSMC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

135. **Social and Cultural Resources.** For this subproject, excavation will occur at specific isolated location, so it could be that there is a moderate risk of such impacts. Nevertheless, the construction contractor will be required to:

(i) Strictly follow the protocol for chance finds in any excavation work;
(ii) Request SIPMIU/DSMC or any authorized person with archaeological/historical field training to observe excavation;
(iii) Stop work immediately to allow further investigation if any finds are suspected; and
(iv) Inform SIPMIU/DSMC if a find is suspected, and take any action they require ensuring its removal or protection in situ.

C. **Operation and Maintenance**

1. **Screening out areas of no significant impact**

136. Because a septage management system should operate without the need for major repair and maintenance, there are several environmental sectors which should be unaffected once the system begins to function. These are identified in Table 8 below, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

<table>
<thead>
<tr>
<th>Field</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td>No impact expected</td>
</tr>
<tr>
<td>Wildlife, forests, rare species, protected areas</td>
<td>There are no wildlife, forests, rare species, and protected areas.</td>
</tr>
<tr>
<td>Coastal resources</td>
<td>Agartala is not located in a coastal area.</td>
</tr>
<tr>
<td>Industries</td>
<td>Septage system is not linked to industry</td>
</tr>
</tbody>
</table>

2. **Operation and Maintenance of Septage Management System**

137. O and M of the septage management system will be the responsibility of DWS. A small number of people will be employed to operate and maintain the mechanized treatment plant. DWS will employ local contractors to conduct repairs, and contractors should be required to operate the same kinds of Health and Safety procedures as used in the construction phase to protect workers and the public.

138. The system have a design life of 30 years, during which shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the pumps and other equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any
repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

3. Anticipated Environmental Impacts and Mitigation Measures

139. General. The work will follow the same procedures during the construction stage. DWS needs to require its O and M contractor to:

(i) Maintenance of Treatment Plant should be done as per supplier repairing guideline,
(ii) Prior to discharge, ensure compliance of Indian (Central Pollution Control Board) Effluent Discharge standard.
(iii) Conduct work during non-monsoon period; and
(iv) Cover construction material like cement to prevent dusts.

140. O & M Manual of Treatment plant will be prepared at advance stage of construction before commissioning of system.

141. Sludge Handling. During operation of Septage Treatment Plant sludge will be generated. After drying of sludge which can be utilized by farmers as manure. Detailing of sludge management is possible after development of detail project report.

142. Wastewater. Wastewater from septage management plant will be discharge into channel, which flows to farmers land nearby. DWS needs to require its O and M contractor to:

(i) Land application of wastes with high dissolved solids concentrations is generally preferred over discharge to surface water subject to an evaluation of potential impact on soil, groundwater, and surface water resulting from such application; and
(ii) Treat and dispose of reject streams, consistent with CPHEEO requirements.

143. Appendix 6 shows the Indian standard for discharge of effluent in environment.

144. Hazardous Chemicals. Septage treatment may involve the use of chemicals for neutralization. DWS needs to require its O and M contractor to:

(i) Minimum storage of chemicals;
(ii) Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; and
(iii) Develop and implement a plan for responding to accidental releases.

145. Air Emissions. Air emissions from septage treatment plant involve odour. Odour will be controlled by spraying of chemicals used for landfill site.

146. Ecological Resources. There are no significant ecological resources in or around the city as well as project location, so any repairs or maintenance work can be conducted without ecological impacts.

147. After construction of septage treatment plant green belt will be developed in and around the plant by the contractor. No extra land will be required.

148. Economic Development. There are no major anticipated economic development impacts during O and M of the facilities.
149. The provision of an improved sanitation system is not expected to have direct economic benefits for business or industry, as service will only be provided to domestic users. However businesses will almost certainly benefit from the expected improvement in the health and well-being of their workforce as this should result in fewer days lost through illness, and overall increased productivity.

150. **Social and Cultural Resources.** Although there is a medium risk of excavation in the project location discovering material of historical or archaeological importance, there will be no need to take precautions to protect such material when areas are excavated to repair.

151. The citizens of the Agartala city will be the major beneficiaries of the improved sanitation system, as they will be provided with a constant supply of better quality water, piped into their homes and as well as scientific septage management facility. In addition to improved environmental conditions, the subproject will improve the over-all health condition of the town as diseases of poor sanitation (such as diarrhoea and dysentery) will be reduced.

### V. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

#### A. Project Stakeholders

152. The primary stakeholders are:

(i) Residents, farmers (who can utilize treatment plant sludge);
(ii) State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts; and
(iii) State and local tourism authorities.

153. The secondary stakeholders are:

(i) Urban Development Department (UDD) as the Executing Agency;
(ii) Other government institutions whose remit includes areas or issues affected by the subproject (state and local planning authorities such as PWD, AMC);
(iii) Non-government organizations (NGOs) and community-based organizations (CBOs) working in the affected communities;
(iv) Other community representatives (prominent citizens, religious leaders, elders, women’s groups);
(v) The beneficiary community in general; and
(vi) ADB, GoI, and Ministry of Finance.

#### B. Consultations and Disclosures Conducted

154. Discussion will be held with the local people during project design. Issues to be discussed are:

(i) Awareness and extent of the project and development components;
(ii) Benefits of the subproject for the economic and social upliftment of community;
(iii) Labour availability in the subproject locations or requirement of outside labour involvement;
(iv) Local disturbances due to construction works;
(v) Necessity of tree felling etc. at subproject location;
(vi) Water logging and drainage problem if any;
(vii) Forest and sensitive area nearby the subproject locations and  
(viii) Movement of wild animals nearby the subproject sites.

155. A Training and awareness programme on Septage Management for Urban Local Body (ULB) Engineers, of the Government of Tripura was conducted in collaboration with the Government, Water and Sanitation Programme (WSP) of the World Bank, Consortium for DEWATS Dissemination (CDD) Society, International Water Management Institute (IWMI) and Asian Development Bank. The programme was conducted at Pragna Bhavan in Agartala during September 5th-6th, 2013. Appendix 7 shows the training note.

156. English version of the Environmental Assessment and Review Framework (EARF) has been placed in the offices of AMC, DWS and SIPMIU. Begalee (local language) versions of the EARF and this IEE will be provided during workshops to ensure stakeholders understood the objectives, policy, principles, and procedures.

C. Future Consultation and Disclosure

157. UDD extended and expanded the consultation and disclosure process significantly during implementation of NERCCDIP. They temporarily appointed NGO to handle this key aspect of the programme. The NGO continuously (i) conducts a wide range of community development activities in relation to all subprojects in the city; and (ii) ensures the needs and concerns of stakeholders are registered and are addressed in subproject design.

- **Consultation during detailed design:**
  - Focus-group discussions with affected persons and other stakeholders (including women's groups, NGOs and CBOs) to hear their views and concerns, so that these can be addressed in subproject design where necessary; and
  - Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.

- **Consultation during construction:**
  - Public meetings with affected communities to discuss and plan work programmers and allow issues to be raised and addressed once construction has started
  - Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation.

- **Project disclosure:**
  - Public information campaigns (via newspaper, TV and radio) to explain the project to the wider city population and prepare them for disruption they may experience once the construction program is underway;
  - Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in local language;
  - Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and
  - Providing a mechanism through which comments can be made.
158. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon receipt; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during design or implementation; (iii) corrective action plan prepared during Project implementation to address unanticipated environmental impacts and to rectify non-compliance to EMP provisions; and (iv) environmental monitoring reports, upon receipt.

VI. GRIEVANCE REDRESS MECHANISM

159. Grievances of affected persons will first be brought to the attention of the SIPMIU. Grievances not redressed by the SIPMIU will be brought to the Independent Grievance Redress Committee (IGRC) set up to monitor project implementation in Agartala. The IGRC, is chaired by the Secretary, Urban Development Department\(^5\) with representatives from the ULB, state government agencies, community-based organizations (CBOs) and NGOs. The GRC will determine the merit of each grievance, and resolve grievances within 10 days of receiving the complaint. Grievance not redressed by the IGRC will be referred to the appropriate courts of law. The DSMC will keep records of all grievances received including: contact details of complainant, date that the complaint was received, nature of grievance, agreed corrective actions and the date these were effected, and final outcome. The grievance redress process is shown in Figure 3.

160. All costs involved in resolving the complaints will be borne by the SIPMIU. The GRCs will continue to function throughout the project duration.

161. **Appendix 8** shows Grievance Redress notification at Website and process shown in local language.

162. **Appendix 9** shows The Grievance Registration/Suggestion Form in English and local language.

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\(^5\) The Secretary, Urban Development Department with Chief Engineer Public Works Department, PWD (Road and Bridge, R & B), Chief Engineer PWD (DWS, Drinking water & Sanitation) and Chairman cum Managing Director, will chair the Independent Grievance Redress Committee (IGRC). The Project Director would be the Secretary of the Committee. The IGRC will be fully empowered to take decisions in all matters related to the Project, which will include financial and administrative approvals.
VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Arrangements

163. The main agencies involved in managing and implementing the subproject are:

(i) The national-level Executing Agency (NEA) for the Investment Program is MOUD;

(ii) Investment Program Coordination Cell (IPCC) as Program Management Monitoring Consultant (PMMC) is established in MOUD. PMMC is responsible for overall management of the Investment Program in the city and they include social/environmental safeguard specialists whose tasks include monitoring Program implementation and reviewing and screening the subprojects submitted by State in accordance with subproject selection criteria, including the environmental provisions;

(iii) National level Steering Committee (NSC) set up by GOI to monitor the use of funds under MFF and overall implementation performance of the Investment Program;

(iv) State-level Executing Agency (SEA) is responsible for executing the part of the loan falling under the State Government;

(v) State Investment Program Management and Implementation Unit (SIPMIU) established in SEA and headed by a Program Director (PD). SIPMIU will oversee the Program’s environment and resettlement planning. This includes the preparation of all documentation needed for decision-making, contracting, and supervision of work and providing progress-monitoring information to the PD;
(vi) The SIPMIU have one Environment & Social Safeguard Specialist. The Environment and social Safeguard Specialist of SIPMIU shall be responsible for implementing the environmental safeguard provisions in the project including (i) ensuring environmental criteria for subproject selection in the EARP are followed, (ii) ensuring mitigation requirements are in contractor bidding documents, and (iii) liaising with various Central and State government agencies on compliance matters. The SIPMIU will appoint and manage Construction Contractors (CC) to build elements of the infrastructure who are required to submit Environmental Implementation Plans (EIPs) for SIPMIU approval;

(vii) The SIPMIU is assisted by the DSMC, who is responsible for design the infrastructure, manage tendering of contracts, and supervise the construction process;

(viii) An Environmental Specialist (ES) in the DSMC is responsible for addressing the environmental issues in the project components during design and implementation. The ES will ensure all mitigation requirements are in contractor bidding documents and EIPs, and will supervise the effective implementation of environmental provisions during construction. In addition, the ES will assist the SIPMIU on the procurement needs and other project implementation aspects and shall play a central role in ensuring capacity building on environmental management of the SIPMIU, Contractor and Line Departments through capacity development support and training;

164. **Figure 4** shows institutional responsibility for implementation of environmental safeguard at different level.
1. **Responsible for carrying out mitigation measures**

165. During construction stage, implementation of mitigation measures is the construction contractor’s responsibility while during operation stage, DWS will be responsible for the conduct of maintenance or repair works.

2. **Responsible for carrying out monitoring measures**

166. During construction, Environmental Specialist (ES) of DSMC and Environment & Social Safeguard Specialist of SIPMIU will monitor the construction contractor’s environmental performance.

167. During the operation stage, monitoring will be the responsibility of DWS.
3. **Responsible for reporting**

168. Construction contractor will submit monthly environment compliance report to DSMC. DSMC will submit quarterly monitoring and implementation reports to SIPMIU, who will take follow-up actions, SIPMIU will submit monitoring reports to the PD who will then submit to ADB. DSMC along with SIPMIU will prepare semi annual environment monitoring report for ADB. The semi annual report is to focus on the progress of implementation of the EMP and EARP and issues encountered and measures adopted, follow-up actions required, if any, as well as the status of Program compliance with subproject selection criteria, and relevant loan covenants. PMMC will seek clearance for submission and disclosure of the annual environmental monitoring report to ADB.

169. Environment monitoring report format checklist for Tranche 1 and Tranche 2 is attached as Appendix 10. Sample semi annual report format of Tranche 3 is attached as Appendix 11.

**B. Environmental Mitigation Plan**

170. **Table 9 to 11** shows the potential adverse environmental impacts, proposed mitigation measures, responsible parties. EMP will be revised after finalization of design. Revised EMP will be included in the bid documents and will be further reviewed and updated during implementation.

**C. Environmental Monitoring Program**

171. **Table 12 to 14** shows the proposed environmental monitoring program for this subproject. It includes all relevant environmental parameters, location, responsibility of mitigation and monitoring, method of monitoring and frequency of monitoring. Monitoring activities during the detailed engineering design stage will form part of the baseline conditions of the subproject location and will be used as the reference for acceptance of restoration works by the construction contractors. Environment monitoring program will be revised after finalization of design of the project.
<table>
<thead>
<tr>
<th>Field/Issues</th>
<th>Anticipated Impact</th>
<th>Mitigation Measures</th>
<th>Responsible for Mitigation</th>
<th>Monitoring of Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social and Cultural</td>
<td>Ground disturbance can uncover and damage archaeological and historical remains</td>
<td>(i) Consult Archaeological Survey of India (ASI) or concerned dept. of Tripura Govt. to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved.</td>
<td>SIPMIU &amp; DSMC</td>
<td>Chance Finds Protocol</td>
</tr>
<tr>
<td>Resources</td>
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<tr>
<td>Construction work camps,</td>
<td>Disruption to traffic flow and sensitive receptors along distribution pipeline laying area</td>
<td>(i) Prioritize areas within or nearest possible vacant space in the subproject location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, and drinking water supply systems; (iii) Do not consider core residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will</td>
<td>SIPMIU and DSMC to determine locations prior to award of construction contracts.</td>
<td>List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.</td>
</tr>
<tr>
<td>hot mix plants, stockpile</td>
<td></td>
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<td>areas, and disposal areas.</td>
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<tr>
<td>Field/Issues</td>
<td>Anticipated Impact</td>
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<td>Monitoring of Mitigation</td>
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<tr>
<td>Sources of Materials</td>
<td>Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.</td>
<td>(i) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of SIPMIU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from SIPMIU.</td>
<td>SIPMIU and DSMC to prepare list of approved quarry sites and sources of materials</td>
<td>(i) List of approved quarry sites and sources of materials; (ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.</td>
</tr>
</tbody>
</table>


**Table 10: Anticipated Impacts and Mitigation Measures – Construction Environmental Mitigation Plan**

<table>
<thead>
<tr>
<th>Field/Issues</th>
<th>Anticipated Impact</th>
<th>Mitigation Measures</th>
<th>Responsible for Mitigation</th>
<th>Monitoring of Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of Materials</td>
<td>Extraction of rocks and material may cause ground instability</td>
<td>(i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of Investment SIPMIU; (iii) If additional quarries will be required after construction has started, obtain written approval from SIPMIU; and;</td>
<td>Construction Contractor</td>
<td>Construction Contractor documentation</td>
</tr>
<tr>
<td>Field/ Issues</td>
<td>Anticipated Impact</td>
<td>Mitigation Measures</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
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<tr>
<td>Air Quality</td>
<td>Emissions from construction vehicles, equipment, and machinery used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons</td>
<td>(iv) Submit to DSMC on a monthly basis documentation of sources of materials. (i) Consult with SIPMIU/DSMC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; (iii) Use tarpaulins to cover sand and other loose material when transported by trucks; and (iv) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.</td>
<td>Construction Contractor</td>
<td>(i) Location of stockpiles; (ii) Complaints from sensitive receptors; (iii) Heavy equipment and machinery with air pollution control devices; (iv) Ambient air for respirable particulate matter (RPM- PM10 &amp; PM2.5) and suspended particulate matter (SPM); (v) Vehicular emissions such as sulphur dioxide (SO₂), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons</td>
</tr>
<tr>
<td>Surface water quality</td>
<td>Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby surface water (River water) quality.</td>
<td>(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with SIPMIU/DSMC on designated disposal areas;</td>
<td>Construction Contractor</td>
<td>(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) Number of silt traps installed along drainages leading to water bodies; (iii) Records of surface water quality inspection; (iv) Effectiveness of water management measures; (v) For inland water: suspended solids, oil and grease, biological oxygen</td>
</tr>
<tr>
<td>Field/ Issues</td>
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<tr>
<td>Noise Levels</td>
<td>Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people</td>
<td>(i) Plan activities in consultation with SIPMIU/DSMC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle’s approach; (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers,</td>
<td>Construction Contractor</td>
<td>(i) Complaints from sensitive receptors; (ii) Use of silencers in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels</td>
</tr>
</tbody>
</table>

(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (v) Dispose any wastes generated by construction activities in designated sites; and (vi) Conduct surface quality inspection particularly for River water according to the Environmental Management Plan (EMP). Demand (BOD), and coliforms.
<table>
<thead>
<tr>
<th>Field/ Issues</th>
<th>Anticipated Impact</th>
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<tr>
<td></td>
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<td>and portable street barriers the sound impact to surrounding sensitive receptor; and (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.</td>
<td>Construction Contractor</td>
<td>(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species</td>
</tr>
<tr>
<td>Ecological resources – Terrestrial</td>
<td>Felling of the trees (if any) – affect terrestrial ecological balance</td>
<td>(i) Minimize removal of vegetation and disallow cutting of trees; (ii) If tree-removal will be required, obtain tree-cutting permit from Municipal Corporation, (iii) Require to plant three (3) native trees for every one (1) that is removed; and (iv) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood.</td>
<td>Construction Contractor</td>
<td></td>
</tr>
<tr>
<td>Landscape and Aesthetics</td>
<td>Solid wastes as well as excess construction materials</td>
<td>(i) Prepare and implement Waste Management Plan; (ii) Avoid stockpiling of excess excavated soils; (iii) Coordinate with AMC/PWD for beneficial uses of excess excavated soils or immediately dispose to designated areas; (iv) Recover used oil and lubricants and reuse or remove from the sites;</td>
<td>Construction Contractor</td>
<td>(i) Waste Management Plan; (ii) Complaints from sensitive receptors; (iii) SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</td>
</tr>
<tr>
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<tr>
<td>Accessibility</td>
<td>Traffic problems and conflicts near project locations and haul road</td>
<td>(v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish; and (vii) Request SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</td>
<td>Construction Contractor</td>
<td>(i) Traffic Management Plan; (ii) Complaints from sensitive receptors; (iii) Number of signages placed at subproject location.</td>
</tr>
<tr>
<td>Field/ Issues</td>
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<td>transportation activities cannot be avoided during peak hours; and (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.</td>
<td>Construction Contractor</td>
<td>(i) Complaints from sensitive receptors;</td>
</tr>
<tr>
<td>Socio-Economic – Income.</td>
<td>In significant impact</td>
<td>(i) Leave spaces for access between mounds of soil; and (ii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</td>
<td>Construction Contractor</td>
<td>(i) Employment records; (ii) records of sources of materials</td>
</tr>
<tr>
<td>Socio-Economic - Employment</td>
<td>Generation of contractual employment and increase in local revenue</td>
<td>(i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and (ii) Secure construction materials from local market.</td>
<td>Construction Contractor</td>
<td>(i) Site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable.</td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>Occupational hazards which can arise during work</td>
<td>(i) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with occupational hazards and safety equipment.</td>
<td>Construction Contractor</td>
<td>(i) Site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable.</td>
</tr>
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<td>and use Personal Protective Equipment like helmet, gumboot, safety belt, gloves, nose musk and ear plugs; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Provide medical insurance coverage for workers; (iv) Secure all installations from unauthorized intrusion and accident risks; (v) Provide supplies of potable drinking water; (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.</td>
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<tr>
<td>Field/ Issues</td>
<td>Anticipated Impact</td>
<td>Mitigation Measures</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
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<tr>
<td>(viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; (x) Ensure moving equipment is outfitted with audible back-up alarms; (xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (xii) Disallow worker exposure to noise level greater than 85 dBA for a</td>
<td>fellow workers;</td>
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<tr>
<td>Field/ Issues</td>
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<tr>
<td>Core Labour Standard (CLS)- safety and compliance</td>
<td>Impact on health of contractor’s labour</td>
<td>Monitoring compliance with national labor laws and regulations, provided that these national laws are consistent with CLS. (SIPMIU will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labor laws and core labor standards on: (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste; and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites.</td>
<td>Construction Contractor</td>
<td>All records, documents related to health &amp; safety of labours</td>
</tr>
<tr>
<td>Community Health and Safety.</td>
<td>Traffic accidents and vehicle collision with pedestrians during material and waste transportation</td>
<td>(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with Construction Contractor</td>
<td>Construction Contractor</td>
<td>(i) Traffic Management Plan;</td>
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<td></td>
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<td>(ii) Complaints from</td>
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<td>Field/ Issues</td>
<td>Anticipated Impact</td>
<td>Mitigation Measures</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
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</table>
| Office, Work Camps & storage          | Temporary air, land and noise pollution from operation of camp & machine, water pollution from storage and use of fuels, oils, solvents, and lubricants | (i) Consult with SIPMIU/DSMC before locating project offices, sheds, and construction plants;  
(ii) Minimize removal of vegetation and disallow cutting of trees;  
(iii) Provide water and sanitation facilities for employees/labours;  
(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;  
(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;  
(vi) Recover used oil and lubricants and reuse or remove from the site;  
(vii) Manage solid waste according to the following | Construction Contractor                                                               | sensitive receptors                         |

(iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.  
(iv) Provide road signs and flag persons to warn.
<table>
<thead>
<tr>
<th>Field/ Issues</th>
<th>Anticipated Impact</th>
<th>Mitigation Measures</th>
<th>Responsible for Mitigation</th>
<th>Monitoring of Mitigation</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>preference hierarchy: reuse, recycling and disposal to designated areas; (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request SIPMIU/DSMC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</td>
<td>Construction Contractor</td>
<td>Records of chance finds</td>
</tr>
<tr>
<td>Social and Cultural Resources</td>
<td>Risk of archaeological chance finds</td>
<td>(i) Strictly follow the protocol for chance finds in any excavation work; (ii) Request SIPMIU/DSMC or any authorized person with archaeological field training to observe excavation; (iii) Stop work immediately to allow further investigation if any finds are suspected; and (iv) Inform SIPMIU/DSMC if a find is suspected, and take any action they require ensuring its removal or protection in situ.</td>
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</tbody>
</table>

DSMC = Design Supervision Management Consultant, H&S = health and safety, RPM = respirable particulate matter, SIPMIU = State-level Investment Program Management and Implementation Units, SPM = suspended particulate matter, AMC = Agartala Municipal Council, PWD = Public Works Department, DWS = Drinking Water and Sanitation
<table>
<thead>
<tr>
<th><strong>Field/ Issues</strong></th>
<th><strong>Anticipated Impact</strong></th>
<th><strong>Mitigation Measures</strong></th>
<th><strong>Responsible for Mitigation</strong></th>
<th><strong>Monitoring of Mitigation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational Health and Safety</td>
<td>Adverse impacts on the appearance of surrounding environment and exposure of workers to hazardous debris</td>
<td>(i) Ensure persons employed will be provided with suitable equipment; and (ii) Ensure all removed material will be deposited in the municipal waste storage bins.</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>(i) Records of training; (ii) H and S Plan approved by UDD</td>
</tr>
<tr>
<td>General</td>
<td>General impact</td>
<td>(i) Conduct work during non-monsoon period; and (ii) Cover or wet excavated material to prevent dusts.</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
</tr>
<tr>
<td>Treatment plant sludge</td>
<td>Environmental pollution - Potential impact on soil, groundwater, and surface water nearby the disposal site</td>
<td>Use of sludge by nearby farmers as manure</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>(i) Complaints from sensitive receptors (ii) Field checking (iii) Testing of soil, surface and ground water nearby</td>
</tr>
<tr>
<td>Wastewater</td>
<td>Discharge into water causing water pollution</td>
<td>(i) Land application (utilization by farmers) of wastes with high dissolved solids concentrations (ii) Treat and dispose of reject streams as per CPHEEO norm and O &amp; M Manual</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>(i) Complaints from sensitive receptors (ii) Field checking (iii) Testing of soil, surface and ground water</td>
</tr>
<tr>
<td>Hazardous Chemicals</td>
<td>Release to nature causing air, water and soil pollution</td>
<td>(i) Minimum storage of chemicals; (ii) Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>(i) Complaints from sensitive receptors (ii) Site checking (iii) Checking of awareness and emergency training document</td>
</tr>
<tr>
<td>Field/ Issues</td>
<td>Anticipated Impact</td>
<td>Mitigation Measures</td>
<td>Responsible for Mitigation</td>
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<tr>
<td>Air Emissions</td>
<td>Air pollution from odour generated from treatment plant</td>
<td>Proper storage and scientific utilization of chemicals utilized in treatment process; Collection of air samples; Use of spray for minimization of odour</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
</tr>
<tr>
<td>Health and Safety</td>
<td>x Development of septage treatment system is expected to significantly enhance hygienic condition of the city; x Reduction in health risks to the citizens.</td>
<td>x Undertake regular monitoring and maintenance of treatment process; x Carry out waste water quality monitoring</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
</tr>
</tbody>
</table>

**Table 12: Pre-construction Environmental Monitoring Program**

<table>
<thead>
<tr>
<th>Field of Mitigation Measures</th>
<th>Location</th>
<th>Responsible for Mitigation</th>
<th>Monitoring of Mitigation</th>
<th>Method of Monitoring</th>
<th>Indicators/ Standards</th>
<th>Frequency</th>
<th>Responsible for Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Environmental Condition – Ambient Air and noise Quality</td>
<td>Subproject location</td>
<td>Contractor</td>
<td>Establish baseline values of (i) respirable particulate matter (RPM) and (ii) CO, SO₂ &amp; NOX</td>
<td>Air sample collection and analyses by in-house laboratory or accredited 3rd party laboratory</td>
<td>GOI Ambient Air Quality Standards</td>
<td>Once prior to start of construction</td>
<td>SIPMIU</td>
</tr>
<tr>
<td>Social and As per site</td>
<td>SIPMIU and Chance Finds</td>
<td>Checking of Chance Finds</td>
<td>Once</td>
<td>SIPMIU</td>
<td></td>
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</tr>
<tr>
<td>Field of Mitigation Measures</td>
<td>Location</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
<td>Method of Monitoring</td>
<td>Indicators/Standards</td>
<td>Frequency</td>
<td>Responsible for Monitoring</td>
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<tr>
<td>Cultural Heritage requirement</td>
<td>DSMC</td>
<td>Protocol</td>
<td>records</td>
<td>Protocol provided to construction contractors prior to commencement of activities</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Construction work camps, stockpile areas, storage areas, and disposal areas. As per site requirement</td>
<td>SIPMIU and DSMC to determine locations prior to award of construction contracts.</td>
<td>List of selected location for construction work camps, stockpile areas, storage areas, and disposal areas.</td>
<td>Checking of records</td>
<td>List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas provided to construction contractors prior to commencement of works.</td>
<td>Once</td>
<td>SIPMIU</td>
<td></td>
</tr>
<tr>
<td>Sources of Materials As per site requirement</td>
<td>SIPMIU and DSMC to prepare list of approved quarry sites and sources of materials</td>
<td>(i) List of approved quarry sites and sources of materials; (ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.</td>
<td>Checking of records</td>
<td>(i) List of approved quarry sites and sources of materials provided to construction contractors (ii) Bid document included requirement for verification of suitability of sources and permit for additional quarry sites if necessary.</td>
<td>Once</td>
<td>SIPMIU</td>
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</tr>
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</table>
### Table 13: Construction Environmental Monitoring Program

<table>
<thead>
<tr>
<th>Field of Mitigation Measures</th>
<th>Location</th>
<th>Responsible for Mitigation</th>
<th>Monitoring of Mitigation</th>
<th>Method of Monitoring</th>
<th>Indicators/ Standards</th>
<th>Frequency</th>
<th>Responsible for Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of Materials</td>
<td>Quarries and sources of materials</td>
<td>Construction Contractor</td>
<td>Construction Contractor documentation</td>
<td>(i) Checking of records; (ii) visual inspection of sites</td>
<td>(i) Sites are permitted; (ii) Report submitted by construction contractor monthly (until such time there is excavation work)</td>
<td>Monthly submission for construction contractor</td>
<td>DSMC</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Construction sites and areas designated for stockpiling of materials</td>
<td>Construction Contractor</td>
<td>(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices; (iv) ambient air for respirable particulate matter (RPM- PM2.5 &amp; PM10) and suspended particulate matter (SPM); (v) vehicular emissions such as sulphur dioxide (SO₂), nitrous</td>
<td>(i) Checking of records; (ii) visual inspection of sites</td>
<td>(i) Stockpiles on designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) air pollution control devices working properly; (iv) GOI Ambient Quality Standards for ambient air quality; (v) GOI Vehicular Emission Standards for SO₂, NOx, CO and HC.</td>
<td>Monthly for checking records</td>
<td>DSMC in coordination with Pollution Control Board</td>
</tr>
<tr>
<td>Field of Mitigation Measures</td>
<td>Location</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
<td>Method of Monitoring</td>
<td>Indicators/Standards</td>
<td>Frequency</td>
<td>Responsible for Monitoring</td>
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<tr>
<td>Noise Levels</td>
<td>(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps</td>
<td>Construction Contractor</td>
<td>(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels</td>
<td>(i) Checking of records; (ii) visual inspection</td>
<td>(i) Complaints from sensitive receptors satisfactorily addressed; (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary</td>
<td>Monthly</td>
<td>DSMC in coordination with Pollution Control Board</td>
</tr>
<tr>
<td>Ecological resources – Terrestrial</td>
<td>Construction sites</td>
<td>Construction Contractor</td>
<td>Record related of tree felling and aquatic floral and faunal impact if any</td>
<td>(i) Checking of records; (ii) visual inspection</td>
<td>(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species</td>
<td>Quarterly</td>
<td>DSMC</td>
</tr>
<tr>
<td>Landscape and Aesthetics</td>
<td>(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps</td>
<td>Construction Contractor</td>
<td>(i) Waste Management Plan; (ii) complaints from sensitive receptors; (iii) SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</td>
<td>(i) Checking of records; (ii) visual inspection</td>
<td>(i) No accumulation of solid wastes on-site; (ii) implementation of Waste Management Plan; (iii) complaints from sensitive receptors satisfactorily addressed.</td>
<td>Monthly</td>
<td>DSMC</td>
</tr>
<tr>
<td>Accessibility</td>
<td>(i)</td>
<td>Construction</td>
<td>(i) Traffic</td>
<td>Visual</td>
<td>(i) Implementation</td>
<td>Monthly</td>
<td>DSMC</td>
</tr>
<tr>
<td>Field of Mitigation Measures</td>
<td>Location</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
<td>Method of Monitoring</td>
<td>Indicators/ Standards</td>
<td>Frequency</td>
<td>Responsible for Monitoring</td>
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<tr>
<td>Construction sites; (ii) traffic haul road</td>
<td>Contractor</td>
<td>Management Plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject location.</td>
<td>inspection</td>
<td>Traffic Management Plan, if required; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas</td>
<td>quarterly</td>
<td>DSMC</td>
<td></td>
</tr>
<tr>
<td>Socio-Economic - Income</td>
<td>Construction sites</td>
<td>Construction Contractor</td>
<td>(i) Complaints from sensitive receptors; (ii) number of signages, at subproject location.</td>
<td>Visual inspection</td>
<td>(i) Complaints from sensitive receptors satisfactorily addressed; (ii) signages visible and located in designated areas</td>
<td>Quarterly</td>
<td>DSMC</td>
</tr>
<tr>
<td>Socio-Economic - Employment</td>
<td>construction sites</td>
<td>Construction Contractor</td>
<td>(i) Employment records; (ii) records of sources of materials</td>
<td>Checking of records</td>
<td>Number of employees from Agartala equal or greater than 50% of total workforce</td>
<td>Quarterly</td>
<td>DSMC</td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>construction sites</td>
<td>Construction Contractor</td>
<td>(i) Site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where</td>
<td>(i) Checking of records; (ii) visual inspection</td>
<td>(i) Implementation of H and S plan; (ii) number of work-related accidents; (iii) % usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are</td>
<td>Quarterly</td>
<td>DSMC</td>
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<tr>
<td>Field of Mitigation Measures</td>
<td>Location</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
<td>Method of Monitoring</td>
<td>Indicators/ Standards</td>
<td>Frequency</td>
<td>Responsible for Monitoring</td>
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<tr>
<td>Core Labour Standard</td>
<td>Construction sites</td>
<td>Construction Contractor</td>
<td>Monitoring compliance with national labor laws and regulations, provided that these national laws are consistent with CLS. (SIPMIU will ensure that bidding and contract documents include</td>
<td>(i) Checking of records; (ii) visual inspection</td>
<td>Implementation of Core Labour Standard</td>
<td>Quarterly</td>
<td>DSMC, SIPMIU</td>
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<td>workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (x) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.</td>
<td>according to approved plan; (v) % of moving equipment outfitted with audible back-up alarms</td>
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<tr>
<td>Field of Mitigation Measures</td>
<td>Location</td>
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<td>Monitoring of Mitigation</td>
<td>Method of Monitoring</td>
<td>Indicators/Standards</td>
<td>Frequency</td>
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<tr>
<td>Office, Work Camps and storage areas</td>
<td>Work camps, Office And storage areas</td>
<td>Construction Contractor</td>
<td>specific provisions requiring contractors to comply with all: (i) applicable labor laws and core labor standards on: (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste; and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites.</td>
<td>Visual inspection</td>
<td>(i) Designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed</td>
<td>Quarterly</td>
<td>DSMC</td>
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</tbody>
</table>
### Field of Mitigation Measures

<table>
<thead>
<tr>
<th>Field of Mitigation Measures</th>
<th>Location</th>
<th>Responsible for Mitigation</th>
<th>Monitoring of Mitigation</th>
<th>Method of Monitoring</th>
<th>Indicators/ Standards</th>
<th>Frequency</th>
<th>Responsible for Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chance Finds Construction sites</td>
<td>Construction Contractor</td>
<td>Records of chance finds</td>
<td>Checking of records</td>
<td>Implementation of Chance Finds Protocol</td>
<td>As needed</td>
<td>DSMC</td>
<td></td>
</tr>
</tbody>
</table>

*BOD = biological oxygen demand, DSMC = Design Supervision Management Consultant, H&S = health and safety, RPM = respirable particulate matter, GOI= Government of India, SIPMIU = State-level Investment Program Management and Implementation Units SPM = suspended particulate matter.

### Table 14: Operation and Maintenance Environmental Monitoring Program

<table>
<thead>
<tr>
<th>Field of Mitigation Measures</th>
<th>Location</th>
<th>Responsible for Mitigation</th>
<th>Monitoring of Mitigation</th>
<th>Method of Monitoring</th>
<th>Indicators/ Standards</th>
<th>Frequency</th>
<th>Responsible for Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational Health and Safety subproject location</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>(i) Records of training; (ii) H and S Plan approved by PWD (DWS)</td>
<td>Complaints from sensitive receptors satisfactorily addressed</td>
<td>As needed</td>
<td>SIPMIU</td>
<td></td>
</tr>
<tr>
<td>General Maintenance work subproject location</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>Checking of records</td>
<td>Complaints from sensitive receptors satisfactorily addressed</td>
<td>As needed</td>
<td>SIPMIU</td>
<td></td>
</tr>
<tr>
<td>Community Health and Safety subproject location</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>Checking of records</td>
<td>Complaints from sensitive receptors satisfactorily addressed</td>
<td>As needed</td>
<td>SIPMIU</td>
<td></td>
</tr>
<tr>
<td>Accessibility subproject location</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>Checking of records</td>
<td>Complaints from sensitive receptors satisfactorily addressed</td>
<td>As needed</td>
<td>SIPMIU</td>
<td></td>
</tr>
<tr>
<td>Waste Water Quality All treatment plant location</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Drinking water and surface water quality as per BIS specification</td>
<td>Sample collection and laboratory analyses</td>
<td>GOI Drinking Water Standards</td>
<td>As needed</td>
<td>SIPMIU</td>
<td></td>
</tr>
<tr>
<td>Solid Wastes/ Sludge Near treatment plant Disposal</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>Sample collection and laboratory analyses</td>
<td>Complaints from sensitive receptors satisfactorily addressed</td>
<td>Quarterly</td>
<td>SIPMIU</td>
<td></td>
</tr>
<tr>
<td>Field of Mitigation Measures</td>
<td>Location</td>
<td>Responsible for Mitigation</td>
<td>Monitoring of Mitigation</td>
<td>Method of Monitoring</td>
<td>Indicators/Standards</td>
<td>Frequency</td>
<td>Responsible for Monitoring</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------</td>
<td>---------------------------</td>
<td>-------------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>----------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Hazardous Wastes</td>
<td>Treatment plant</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>(i) Site checking (ii) Checking of document</td>
<td>Complaints from sensitive receptors satisfactorily addressed. Awareness and emergency training document</td>
<td>Quarterly</td>
<td>SIPMIU</td>
</tr>
<tr>
<td>Air Emissions</td>
<td>Treatment plant location</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>Air sample collection and laboratory testing</td>
<td>GOI air quality standard</td>
<td>Quarterly</td>
<td>SIPMIU</td>
</tr>
<tr>
<td>Health and Safety</td>
<td>subproject location</td>
<td>PWD (DWS) and O and M Contractors</td>
<td>Complaints from sensitive receptors</td>
<td>Checking of records</td>
<td>Complaints from sensitive receptors satisfactorily addressed</td>
<td>As needed</td>
<td>PMU/PIU</td>
</tr>
</tbody>
</table>

CPCB = Central Pollution Control Board; DWS = Drinking Water and Sanitation Department; O&M = Operation and Maintenance; PWD = Public Works Department, SIPMIU = State-level Investment Program Management and Implementation Units
D. Environmental Management Costs

172. Most of the mitigation measures require the Construction Contractors to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. Regardless of this, any costs of mitigation by the construction contractors or DSMC are included in the budgets for the civil works and do not need to be estimated separately here. Mitigation that is the responsibility of UDD will be provided as part of their management of the project, so this also does not need to be duplicated here.

173. The remaining actions in the EMP are the various environmental monitoring activities to be conducted by the Environmental Monitoring Specialist. These have not been budgeted elsewhere, and their costs are shown in Table 15. The figures show that the total cost of environmental management and monitoring for the subproject as a whole (covering operation & design phase) is INR 0.335 million.

Table 15: Environmental Management and Monitoring Costs (INR)

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Number</th>
<th>Cost per Unit (INR)</th>
<th>Cost (INR)</th>
<th>Source of Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislation, Permits and Agreements</td>
<td>Consent to Establish and Consent to Operate for plants and machinery of the contractor.</td>
<td>As required</td>
<td>Applicable</td>
<td>Applicable</td>
<td>-</td>
</tr>
<tr>
<td>Public consultations and information disclosure</td>
<td>Information disclosure and consultations during preconstruction and construction phase.</td>
<td>As required</td>
<td>Lump sum</td>
<td>25,000</td>
<td>Concerned Contractor during project implementation will do public consultation Information disclosure in website by SIPMIU – project budget</td>
</tr>
<tr>
<td>Baseline Monitoring</td>
<td>Site preparation and preliminary activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>Once before start of construction works Covering working site</td>
<td>5 samples</td>
<td>8,000 per sample</td>
<td>40,000</td>
<td>Covered under engineering design and cost - Concerned Contractor</td>
</tr>
<tr>
<td>Noise</td>
<td>Once before start of construction works Covering working site</td>
<td>5 samples</td>
<td>2,000 per sample</td>
<td>10,000</td>
<td>Covered under engineering design and cost - Concerned Contractor</td>
</tr>
<tr>
<td>Construction Monitoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>Quarterly at 5 locations near project sites for</td>
<td>15 samples</td>
<td>8,000 per sample</td>
<td>1,20,000</td>
<td>Covered under engineering design and cost -</td>
</tr>
<tr>
<td>Component</td>
<td>Description</td>
<td>Number</td>
<td>Cost per Unit (INR)</td>
<td>Cost (INR)</td>
<td>Source of Funds</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>---------------------</td>
<td>------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Noise</td>
<td>Quarterly at 5 locations near project sites for atleast 1 year</td>
<td>15 samples</td>
<td>2,000 per sample</td>
<td>30,000</td>
<td>Covered under engineering design and cost – Concerned Contractor</td>
</tr>
<tr>
<td>Defect Liability Period</td>
<td>(No. of sites will be finalized as per Consent to Operate condition)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>Twice at 3 locations near project sites for 1 year</td>
<td>6 samples</td>
<td>8,000 per sample</td>
<td>48,000</td>
<td>Covered under engineering design and cost – Concerned Contractor</td>
</tr>
<tr>
<td>Noise</td>
<td>Twice at 3 locations near project sites for 1 year</td>
<td>6 samples</td>
<td>2,000 per sample</td>
<td>12,000</td>
<td>Covered under engineering design and cost – Concerned Contractor</td>
</tr>
<tr>
<td>Any unanticipated impact</td>
<td>Mitigation of any unanticipated impact arising during construction phase and defect liability period.</td>
<td>Lump sum</td>
<td>Lump sum</td>
<td>50,000</td>
<td>As per requirement - SIPMIU</td>
</tr>
</tbody>
</table>

**TOTAL (INR) Rupees fourteen lakh twenty thousand only** 3,35,000.00

**TOTAL (US$)** 5583.00

**VIII. FINDINGS AND RECOMMENDATIONS**

174. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Agartala Septage Management sub project. Potential negative impacts were identified in relation to both construction and operation of the improved infrastructure, but no impacts were identified as being due to either the project design or location. Mitigation measures have been developed in generic way to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the outline designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

175. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of the invasive nature of excavation; so there is a medium risk that ground disturbance may uncover important remains. Because of these factors the most significant impacts are on the physical environment, the human environment, tourism, and the cultural heritage.
176. During the construction phase, impacts mainly arise from the need of utilization of waste soil; and from the disturbance of residents by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation.

177. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the project will employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities.

178. Once the system is operating, most facilities will operate with routine maintenance, which should not affect the environment. Generation and disposal of sludge from treatment plant is also an issue. Utilization of waste water and sludge for agriculture is the best option.

179. The main impacts of the operating septage management system will be beneficial as the citizens of Agartala city will be provided along with a constant supply of water, which will serve a greater proportion of the population, including slum-dwellers. This will improve the quality of life of people as well as benefitting both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

180. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the SIPMIU. There will also be longer-term surveys to monitor the expected improvements in the quality of domestic water and the health of the population.

181. Finally, stakeholders were involved in developing the IEE through face-to-face discussions and on site meeting held in the city, after which views expressed were incorporated into the IEE and the planning and development of the project. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation, when a nationally-recognised NGO will be appointed to handle this key element to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

IX. CONCLUSIONS

182. The subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

183. Based on the findings of the IEE, the classification of the Project as Category “B” is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009) or GoI EIA Notification (2006).
Location of Debendranagar Septage Treatment Plant
APPENDIX 2

LOCATION OF SEPTAGE TREATMENT PLANT BESIDE SOLID WASTE MANAGEMENT AREA
LAND RECORD MARKING OF DEBENDRANAGAR LAND – AMC LAND
FLOW DIAGRAM – SEPTAGE TREATMENT

[Diagram showing the flow process involving Grit Channel, Equalisation Tank, Thickeners, Aeration Tank, Clarifier, and Dewatering System.]
APPENDIX 4

SITE PHOTOGRAPHS – DEBENDRANAGAR
APPENDIX 5

ADB RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST (SEPTAGE MANAGEMENT-AGARTALA, TRIPURA)

**Instructions:**
- This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

<table>
<thead>
<tr>
<th>Screening Questions</th>
<th>Yes</th>
<th>No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Project Siting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is The Project Area…</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x Densely populated?</td>
<td>✓</td>
<td></td>
<td>Agartala is not densely populated</td>
</tr>
<tr>
<td>x Heavy with development activities?</td>
<td>✓</td>
<td></td>
<td>No as such heavy development activity is noted at Agartala</td>
</tr>
<tr>
<td><strong>Adjacent to or within any environmentally sensitive areas?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x Cultural heritage site</td>
<td>✓</td>
<td></td>
<td>Few temples/other religious places are located within Agartala. No as cultural heritage site is located nearby the project area</td>
</tr>
<tr>
<td>x Protected area</td>
<td>✓</td>
<td></td>
<td>No as such</td>
</tr>
<tr>
<td>x Wetland</td>
<td>✓</td>
<td></td>
<td>Number of ponds are exist within Agartala but no designated wetland nearby the project location</td>
</tr>
<tr>
<td>x Mangrove</td>
<td>✓</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>x Estuarine</td>
<td>✓</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>x Buffer zone of protected area</td>
<td>✓</td>
<td></td>
<td>No protected area nearby the project site</td>
</tr>
<tr>
<td>x Special area for protecting biodiversity</td>
<td>✓</td>
<td></td>
<td>No as such</td>
</tr>
<tr>
<td>x Bay</td>
<td>✓</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td><strong>B. Potential Environmental Impacts</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will the project cause…</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x Impairment of historical/cultural monuments/areas and loss/damage to these sites?</td>
<td>✓</td>
<td></td>
<td>Not anticipated. The subproject will improve/prevent degradation of</td>
</tr>
<tr>
<td>Screening Questions</td>
<td>Yes</td>
<td>No</td>
<td>Remarks</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----</td>
<td>----</td>
<td>---------</td>
</tr>
<tr>
<td>x Interference with other utilities and blocking of access to buildings?</td>
<td></td>
<td>✓</td>
<td>Not expected. Project location at isolated area</td>
</tr>
<tr>
<td>x Nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?</td>
<td>✓</td>
<td></td>
<td>Not anticipated, mitigation measures will be applied at treatment plant</td>
</tr>
<tr>
<td>x Dislocation or involuntary resettlement of people?</td>
<td>✓</td>
<td></td>
<td>No displacement of communities is required in this subproject.</td>
</tr>
<tr>
<td>x Disproportionate impacts on the poor, women and children, indigenous peoples or other vulnerable groups?</td>
<td>✓</td>
<td></td>
<td>Not applicable.</td>
</tr>
<tr>
<td>x Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?</td>
<td>✓</td>
<td></td>
<td>Collected septage will be treated at the septage treatment plant</td>
</tr>
<tr>
<td>x Overflows and flooding of neighboring properties with raw sewage?</td>
<td>✓</td>
<td></td>
<td>The subproject will improve current situation of discharging raw sewage and sludge from kachha latrine to open drains.</td>
</tr>
<tr>
<td>x Environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?</td>
<td>✓</td>
<td></td>
<td>The EMP ensures measures are included to manage sludge. DWS to ensure only domestic septage will be treated before disposal</td>
</tr>
<tr>
<td>x Noise and vibration due to blasting and other civil works?</td>
<td>✓</td>
<td></td>
<td>Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.</td>
</tr>
<tr>
<td>x Risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?</td>
<td>✓</td>
<td></td>
<td>Not anticipated. The EMP ensures occupational health and safety measures are included. Chemicals will not be used during construction and operation activities.</td>
</tr>
<tr>
<td>x Discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?</td>
<td>✓</td>
<td></td>
<td>Not applicable as per nature of work</td>
</tr>
<tr>
<td>x Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?</td>
<td>✓</td>
<td></td>
<td>Buffer zone will be developed within the said package</td>
</tr>
<tr>
<td>x Road blocking and temporary flooding due to land excavation during the rainy</td>
<td>✓</td>
<td></td>
<td>Not anticipated. Construction activities will be conducted during</td>
</tr>
<tr>
<td>Screening Questions</td>
<td>Yes</td>
<td>No</td>
<td>Remarks</td>
</tr>
<tr>
<td>---------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>season?</td>
<td></td>
<td>71</td>
<td>non-monsoon season.</td>
</tr>
<tr>
<td>x Noise and dust from construction activities?</td>
<td>✓</td>
<td>71</td>
<td>Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.</td>
</tr>
<tr>
<td>x Traffic disturbances due to construction material transport and wastes?</td>
<td>✓</td>
<td>71</td>
<td>Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Since the treatment plant location at isolated place impact is not much</td>
</tr>
<tr>
<td>x Temporary silt runoff due to construction?</td>
<td>✓</td>
<td>71</td>
<td>The EMP ensures measures are included to mitigate the impacts. Construction contractors will be prohibited from stockpiling loose materials along drain channels and will be required to immediately dispose any waste materials.</td>
</tr>
<tr>
<td>x Hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?</td>
<td>✓</td>
<td>71</td>
<td>Not anticipated. Design life of the subproject is 30 years.</td>
</tr>
<tr>
<td>x Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?</td>
<td>✓</td>
<td>71</td>
<td>Not anticipated. The EMP ensures measures are included to manage sludge. The Treatment plant will includes an Operation and Maintenance (O&amp;M) Manual to ensure effluent complies with government standards.</td>
</tr>
<tr>
<td>x Contamination of surface and ground waters due to sludge disposal on land?</td>
<td>✓</td>
<td>71</td>
<td>Not anticipated. The EMP ensures measures are included to manage sludge.</td>
</tr>
<tr>
<td>x Health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?</td>
<td>✓</td>
<td>71</td>
<td>Not anticipated. The EMP ensures measures are included to mitigate the impacts.</td>
</tr>
<tr>
<td>x Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?</td>
<td>✓</td>
<td>71</td>
<td>Priority in employment will be given to local residents. Construction contractors will be required to provide workers camp with water</td>
</tr>
</tbody>
</table>
## A Checklist for Preliminary Climate Risk Screening

**Country/Project Title:** India/ North-Eastern Region Capital Cities Development Investment Program - Agartala Septage Management (Tr-3)

**Sector:** Urban Development

**Subsector:** Waste Water

**Division/Department:** Urban Development Department

<table>
<thead>
<tr>
<th>Screening Questions</th>
<th>Yes</th>
<th>No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?</td>
<td>✓</td>
<td></td>
<td>Priority in employment will be given to local residents.</td>
</tr>
<tr>
<td>Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?</td>
<td>✓</td>
<td></td>
<td>Not applicable. Construction will not involve use of explosives and chemicals. Trenching will be done manually.</td>
</tr>
<tr>
<td>Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. maintenance cost/scheduling of project outputs)?</td>
<td>✓</td>
<td></td>
<td>Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.</td>
</tr>
</tbody>
</table>

### Location and Design of project

- Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?
  - Score: 0

- Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?
  - Score: 0

### Materials and Maintenance

- Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g.
  - Score: 0

---

If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.
<table>
<thead>
<tr>
<th>Construction material?</th>
<th>Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance of project outputs</td>
<td>Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?</td>
</tr>
</tbody>
</table>

Options for answers and corresponding score are provided below:

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Likely</td>
<td>0</td>
</tr>
<tr>
<td>Likely</td>
<td>1</td>
</tr>
<tr>
<td>Very Likely</td>
<td>2</td>
</tr>
</tbody>
</table>

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Low Risk
## STANDARDS- EFFLUENT AND DRINKING WATER

### General Standards for Discharge of Environmental Pollutants: Effluents

<table>
<thead>
<tr>
<th>SL.no</th>
<th>Parameter</th>
<th>Inland surface water</th>
<th>Public sewers</th>
<th>Land of irrigation</th>
<th>Marine/coastal areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
</tr>
<tr>
<td>1.</td>
<td>Colour and odour</td>
<td>remove as far as practicable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 2.    | Suspended solids, mg/l. max.        | 100                  | 600           | 200                | (a) For process waste water 100  
(b) For cooling water effluent 10% above total suspended matter of influent. |
| 3.    | Particle size of suspended solids   | shall pass 850 micron IS Sieve |               | (a) Floatable solids, max. 3mm.  
(b) Settable solids (max 850 micron) |
<p>| 4.    | pH value                            | 5.5 to 9.0           | 5.5 to 9.0    | 5.5 to 9.0         | 5.5 to 9.0           |
| 5.    | Temperature                         | shall not exceed 5°C above the receiving water temperature |               | shall not exceed 5°C above the receiving water temperature |
| 6.    | Oil and grease, mg/l. max.          | 10                   | 20            | 10                 | 20                   |
| 7.    | Total residual chlorine, mg/l. max. | 1.0                  |               | 1.0                |                      |
| 8.    | Ammonical nitrogen (as N.) mg/l. max | 50                   | 50            | 50                 |                      |
| 9.    | Total Kjeldahl Nitrogen (as NH₃) mg/l. max | 100                  |               | 100                |                      |
| 10.   | Free ammonia (as NH₃), mg/l. max.  | 5.0                  |               | 5.0                |                      |
| 11.   | Biochemical oxygen demand (3 days at 27°C), mg/l. max. | 30                   | 350           | 100                | 100                 |
| 12.   | Chemical oxygen demand, mg/l. max. | 250                  |               | 250                |                      |</p>
<table>
<thead>
<tr>
<th>SL.no</th>
<th>Parameter</th>
<th>Inland surface water</th>
<th>Public sewers</th>
<th>Land of irrigation</th>
<th>Marine/coastal areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>Arsenic (as As) mg/l, max.</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>14.</td>
<td>Mercury (As Hg), mg/l, max.</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Lead (as Pb) mg/l, max</td>
<td>0.1</td>
<td>1.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Cadmium (as Cd) mg/l, max</td>
<td>2.0</td>
<td>1.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Hexavalent chromium (as Cr. +6) mg/l, max</td>
<td>0.1</td>
<td>2.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Total Chromium (as Cr) mg/l, max</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Copper (as Cu) mg/l, max</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Zinc (as Zn) mg/l, max</td>
<td>5.0</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Selenium (as Se) mg/l, max</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td></td>
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<tr>
<td>22.</td>
<td>Nickel (as Ni) mg/l, max</td>
<td>3.0</td>
<td>3.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Cyanide (as CN) mg/l, max</td>
<td>0.2</td>
<td>2.0</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>24.</td>
<td>Fluoride (as F) mg/l, max</td>
<td>2.0</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Dissolved phosphates (as P) mg/l, max</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>Sulfide (as S) mg/l, max</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>Phenolic compounds (as C₆H₅OH) mg/l, max</td>
<td>1.0</td>
<td>5.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Radioactive materials: (a) Alpha emitters microcurie/ml, max.</td>
<td>$10^{-7}$</td>
<td>$10^{-7}$</td>
<td>$10^{-6}$</td>
<td>$10^{-7}$</td>
</tr>
<tr>
<td></td>
<td>(b) Beta emitters microcurie/ml, max.</td>
<td>$10^{-8}$</td>
<td>$10^{-6}$</td>
<td>$10^{-7}$</td>
<td>$10^{-6}$</td>
</tr>
<tr>
<td>SL.no</td>
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<tr>
<td>-------</td>
<td>-------------------------</td>
<td>----------------------</td>
<td>---------------</td>
<td>-------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>29.</td>
<td>Bio-assay test</td>
<td>90% Survival of fish after 96 hours in 100% effluent</td>
<td>90% survival of fish after 96 hours in 100% effluent</td>
<td>90% survival of fish after 96 hours in 100% effluent</td>
<td>90% survival of fish after 96 hours in 100% effluent</td>
</tr>
<tr>
<td>30.</td>
<td>Manganese (as Mn)</td>
<td>2 mg/l</td>
<td>2 mg/l</td>
<td>2 mg/l</td>
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<tr>
<td>31.</td>
<td>Iron (as Fe)</td>
<td>3 mg/l</td>
<td>3 mg/l</td>
<td>3 mg/l</td>
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<tr>
<td>32.</td>
<td>Vanadium (as V)</td>
<td>0.2 mg/l</td>
<td>0.2 mg/l</td>
<td>0.2 mg/l</td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>Nitrate Nitrogen</td>
<td>10 mg/l</td>
<td></td>
<td>20 mg/l</td>
<td></td>
</tr>
</tbody>
</table>

These standards shall be applicable for industries, operations or process other than those industries operations or process for which standards have been specified in schedule of the Environment Protection Rules, 1989.
Training on Septage Management for ULB Engineers, Government of Tripura


The programme was conducted at Pragna Bhavan in Agartala during September 5th-6th, 2013. The organisation of the programme was coordinated by WSP and the Government of Tripura and technical inputs were provided by WSP, CDD Society, IWMI and ADB. 50 engineers from 8 districts of Tripura attended the programme.

The two-day programme aimed to bring together engineers from urban development departments of cities and towns in Tripura to enhance their understanding of septage management through knowledge sharing, practical exercises, project planning and field visits.

Day one was given to understanding septage generation and its characteristics as well as the involvement of the government, policy, institution, regulatory and legal framework in Tripura. This session was followed by detailed discussions on technology options for septage treatment and Decentralised Wastewater Treatment Systems (DEWATS™). DEWATS™ could be an option for septic tank effluent treatment as well as an on-site treatment option for institutions and residential colonies.

On Day two, participants were taken to a household where the septic tank was being desludged. Currently the practice is to dispose collected septage in the River Haora. Once the sewage treatment plant (STP) is in place, the collected septage will be disposed into the STP.

This was followed by a visit to the STP which is of 8 MLD capacity. It comprises of sequential batch reactors for sewage treatment and decanter for sludge compaction. The treated effluent will be chlorinated and disposed into the nearby river.

The participants evinced keen interest in further understanding treatment options especially DEWATS™. It was therefore recommended that the different towns identify problematic areas and develop appropriate solutions. This can be facilitated and supported by conducting design input sessions through practical training programmes. Pilot implementations can therefore be initiated for septage management as well as for septic tank effluent treatment – a step towards a cleaner Tripura.
APPENDIX 8

Grievance Redress Mechanism - shown in Website
চিত্র নং-১ কোনা নিরসনের পদ্ধতি।

Project Director
SIPMIU, NERCCDIP, ADB
APPENDIX 9
SAMPLE GRIEVANCE REGISTRATION FORM
(To be available in Hindi, English or local language, if any)

The NERCCDIP welcomes complaints, suggestions, queries and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

<table>
<thead>
<tr>
<th>Date</th>
<th>Place of registration</th>
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</thead>
</table>

**Contact Information/Personal Details**

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td></td>
</tr>
</tbody>
</table>

**Home Address**

**Village / Town**

**District**

**Phone no.**

**E-mail**

**Complaint/Suggestion/Comment/Question** Please provide the details (who, what, where and how) of your grievance below:

If included as attachment/note/letter, please tick here:

How do you want us to reach you for feedback or update on your comment/grievance?

---

**FOR OFFICIAL USE ONLY**

Registered by: (Name of official registering grievance)

If – then mode:
- Note/Letter
- E-mail
- Verbal/Telephonic

Reviewed by: (Names/Positions of Official(s) reviewing grievance)

**Action Taken:**

**Whether Action Taken Disclosed:**
- Yes
- No

**Means of Disclosure:**

**GRIEVENCES RECORD AND ACTION TAKEN**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Date</th>
<th>Name and Contact No. of Complainant</th>
<th>Type of Complain</th>
<th>Place</th>
<th>Status of Redress</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LOCAL LANGUAGE

এন, ই, আর, সি, টি, আই, পি প্রকল্প বাংলাদেশ সংক্রান্ত অভিযোগ, পরামর্শ, প্রশ্ন এবং সমস্যা সমাধান জানান। আমরা প্রশ্ন এবং প্রতিক্রিয়ার জন্য আপনার সাথে যোগাযোগ সেতু সকল তাদের নাম এবং যোগাযোগের তথ্য প্রদান অভিযোগ বাক্সের উপস্থাপন করি।

আপনি আপনার বাক্সের তথ্য প্রদান অতর্কিত করতে কিছু যে তথ্য গোপন থাকা চাই উচিত, আপনার নামের উপর / টাইপ *(গোপনীয়) * লিখে আমাদের অনুমতি করুন।

আপনাকে ধন্যবাদ।

<table>
<thead>
<tr>
<th>ভারিষ্ঠ</th>
<th>নিবন্ধন হৃদ</th>
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<tr>
<td>মালিকী</td>
<td>ভক্তিগত ভক্তি</td>
</tr>
<tr>
<td>নাম</td>
<td>লিখি</td>
</tr>
<tr>
<td>বাড়ির ঠিকানা</td>
<td></td>
</tr>
<tr>
<td>প্রাদ / শহর</td>
<td></td>
</tr>
<tr>
<td>জেলা</td>
<td></td>
</tr>
<tr>
<td>ফোন নম্বর</td>
<td></td>
</tr>
<tr>
<td>ইমেল</td>
<td></td>
</tr>
<tr>
<td>অভিযোগ / পরামর্শ / সম্পর্কি / প্রশ্ন (কি, কি, কেনা এবং কিরকমের আপনার অভিযোগের বিবরণ) প্রদান করুন:</td>
<td></td>
</tr>
<tr>
<td>সংযুক্তি / নেট / চিঠি হিসাবে অতর্কিত করা হয়, এখানে তিনি করোন:</td>
<td></td>
</tr>
<tr>
<td>কিভাবে আপনি আপনার মালিকী / অভিযোগ প্রতিক্রিয়া বা আপনাদের জন্য আপনি পৌঁছাতে চান?</td>
<td></td>
</tr>
</tbody>
</table>

ঔষধিত সরকারী ব্যবহারের জন্য

(অভিযোগ প্রকাশকের অভিযোগ নাম): দ্বারা নিবন্ধিত

- তারপর যেভাবে:
  - উপলব্ধ / পর
  - ইমেল
  - মৌলিক / টেলিফোন

পর্যালোচনা: (নাম / অভিযোগ পর্যালোচনা অভিযোগ পত্রিকা)

প্রথিত পদক্ষেপ:

যদি কম প্রকাশ নেওয়া:

- হাঁ
- না

প্রকাশ মাধ্যম:

| অভিযোগ তালিকা ও পৃষ্ঠি পদক্ষেপ |
|----------------|----------------|
| মূল সাব নাম | ভারিষ্ঠ | অভিযোগকারীর নাম এবং যোগাযোগের বিবরণ | অভিযোগের প্রকাশ | স্থান | প্রতিক্রিয়ার অবস্থান | মন্তব্য |
## Tranche 1 Monitoring checklist

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Mitigation Activities and Method</th>
<th>Location</th>
<th>Responsible for Mitigation</th>
<th>Monitoring Method</th>
<th>Responsible for Monitoring</th>
<th>Compliance Status/ Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre Construction Design phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Site preparation work completed including necessary clearance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Establishment of temporary camps with sanitary and solid waste management arrangement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Removal of overburden and excavated material from working site and use / preservation of the same – as per mitigation measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Water sprinkling at construction site for arresting dust (if any during dry period)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Materials carrying vehicle are covered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>All vehicles and equipments mobilized to construction site and producing emission, have Pollution Control Board certification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>At sensitive locations enclosures provided around generator set or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
### Project: Water Supply –

#### Package No:

#### Progress:

#### Physical progress:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Mitigation Activities and Method</th>
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<th>Responsible for Monitoring</th>
<th>Compliance Status/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Regular maintenance of noise producing equipment done</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Arrangement of drainage of waste water and arresting solid waste from waste water generated at construction site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Arrangement of pit for storage of muck</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Felling of trees done (if necessary) with mitigation measures i.e. planting of three trees for each tree fell.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Pollution of water bodies at construction site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Disposal of construction debris if any as per mitigation measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Ensure use of Personal Protective Equipment like helmet, gumboot, gloves, and earplugs at work place</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arrangement of First Aid Box at working site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Provide Health and Safety training to all</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### Project: Water Supply – Package No:
### Progress:
### Physical progress:

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>personnel and implement H&amp;S plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Plan truck routes (for carrying construction materials including pipes) to avoid narrow or congested roads and tourist sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Consideration of public safety - as per prescribed mitigation measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Employ at least 50% of workforce from communities near sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Continuous monitoring on implementation of mitigation measures</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Tranche 2- Monitoring checklist

#### Project: Water Supply- Package No:
#### Progress:
#### Physical progress:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Mitigation Activities and Method</th>
<th>Location</th>
<th>Responsible for Mitigation</th>
<th>Monitoring Method</th>
<th>Responsible for Monitoring</th>
<th>Compliance Status/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre Construction Design phase</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>Site preparation work completed including necessary clearance</td>
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**Construction**
<table>
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<tbody>
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</tr>
<tr>
<td>5</td>
<td>Materials carrying vehicle are covered - Reducing dust hazard</td>
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<td>6</td>
<td>All vehicles and equipment mobilized to construction site and producing emission, have Pollution Control Board certification</td>
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<td>7</td>
<td>At sensitive locations enclosures provided around generator set or other noise producing machinery</td>
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<td>8</td>
<td>Regular maintenance of noise producing equipment done</td>
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<tr>
<td>9</td>
<td>Arrangement of drainage of waste water and arresting solid waste from waste water generated at</td>
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</tbody>
</table>
### Project: Water Supply - Package No:

### Progress:

### Physical progress:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Mitigation Activities and Method</th>
<th>Location</th>
<th>Responsible for Mitigation</th>
<th>Monitoring Method</th>
<th>Responsible for Monitoring</th>
<th>Compliance Status/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Felling of trees done (if necessary) with mitigation measures i.e. planting of three trees for each tree fell.</td>
<td>construction site</td>
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<td>11</td>
<td>Pollution of water bodies at construction site</td>
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<td>12</td>
<td>Disposal of construction debris if any as per mitigation measures</td>
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<td>13</td>
<td>Ensure use of Personal Protective Equipment like helmet, gumboot, gloves, and earplugs at work place&lt;br&gt;Arrangement of First Aid Box at working site</td>
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<td>14</td>
<td>Provide Health and Safety training to all personnel and implement H&amp;S plan</td>
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<td>15</td>
<td>Plan truck routes (for carrying construction materials including pipes) to avoid narrow or congested roads and tourist sites</td>
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<td>16</td>
<td>Consideration of public safety - as per prescribed mitigation measures</td>
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<td>17</td>
<td>Employ at least 50% of workforce from communities near sites</td>
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</tbody>
</table>
Project: Water Supply - Package No:  
Progress:  
Physical progress:

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<th>Compliance Status/Explanation</th>
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</thead>
<tbody>
<tr>
<td>18</td>
<td>Continuous monitoring on implementation of mitigation measures</td>
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</tbody>
</table>
Semi-Annual Environmental Reporting Format

I. INTRODUCTION

- Overall project description and objectives
- Description of subprojects
- Environmental category of the sub-projects
- Details of site personnel and/or consultants responsible for environmental monitoring
- Overall project and sub-project progress and status

<table>
<thead>
<tr>
<th>No.</th>
<th>Sub-Project Name</th>
<th>Status of Sub-Project</th>
<th>List of Works</th>
<th>Progress of Works</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Design</td>
<td>Pre-Construction</td>
<td>Construction</td>
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</tbody>
</table>

Compliance status with National/ State/ Local statutory environmental requirements

<table>
<thead>
<tr>
<th>No.</th>
<th>Sub-Project Name</th>
<th>Statutory Environmental Requirements</th>
<th>Status of Compliance</th>
<th>Action Required</th>
</tr>
</thead>
</table>

Compliance status with environmental loan covenants

<table>
<thead>
<tr>
<th>No. (List schedule and paragraph number of Loan Agreement)</th>
<th>Covenant</th>
<th>Status of Compliance</th>
<th>Action Required</th>
</tr>
</thead>
</table>

II. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.

- There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send
to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:

(i) What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries?

(ii) If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;

(iii) Adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;

(iv) Are there designated areas for concrete works, and re-fuelling?

(v) Are there spill kits on site and if there are site procedures for handling emergencies;

(vi) Is there any chemical stored on site and what is the storage condition?

(vii) Is there any dewatering activities if yes, where is the water being discharged;

(viii) How are the stockpiles being managed?

(ix) How is solid and liquid waste being handled on site?

(x) Review of the complaint management system;

(xi) Checking if there are any activities being undertaken out of working hours and how that is being managed.
## Summary Monitoring Table – Water supply subproject

### A. Pre-construction Stage

<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
</tr>
</thead>
</table>
| **Utilities/Tree cutting** | (i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and  
  (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.  
  (iii) Collection of tree cutting permission with assistance SIPMIU/DSMC |
<p>| <strong>Traffic Management</strong>  | (i) Prepare a short traffic management schedule during preconstruction phase.                                                                                                                                             |</p>
<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
<th>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Social and Cultural Resources</td>
<td>(i) Consult Archaeological Survey of India (ASI) or concerned department in Agartala to obtain an expert assessment of the archaeological potential of the site; &lt;br&gt; (ii) Consider alternatives if the site is found to be of medium or high risk; &lt;br&gt; (iii) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.</td>
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<tr>
<td>Construction work camps, hot mix plants, stock pile areas, storage areas, and disposal areas.</td>
<td>(i) Prioritize areas within or nearest possible vacant space in the subproject location; &lt;br&gt; (ii) If it is deemed necessary to</td>
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<tr>
<td>Field</td>
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<td></td>
<td>locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community; and (v) Avoid setting up of labour camp near river</td>
<td>Sources of Materials (i) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all</td>
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</tbody>
</table>
### Field Mitigation Measures

<table>
<thead>
<tr>
<th>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</th>
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</thead>
<tbody>
<tr>
<td>Method of Monitoring</td>
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<td>Location of Monitoring</td>
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<tr>
<td>Date of Monitoring Conducted</td>
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<tr>
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</tbody>
</table>

- Material sources and to obtain the approval of SIPMIU and
- (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from SIPMIU

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**B. Construction Stage**

<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
<th>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of Materials</td>
<td>(i) Use quarry sites and sources permitted by government;</td>
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<tr>
<td></td>
<td>(ii) Verify suitability of all material sources and obtain approval of</td>
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</tbody>
</table>

DSC = Design Supervision Consultant, PMU = Project Management Unit; PIU = Project Implementation Unit
<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Investment SIPMIU;</td>
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<tr>
<td></td>
<td>(iii) If additional quarries will be required after construction has started, obtain written approval from SIPMIU; and</td>
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<td></td>
<td>(iv) Submit to DSMC on a monthly basis documentation of sources of materials.</td>
</tr>
<tr>
<td></td>
<td>Air Quality</td>
</tr>
<tr>
<td></td>
<td>(i) Consult with SIPMIU/DSMC on the designated areas for stockpiling of pipes, soils, gravel, and other construction materials;</td>
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<td></td>
<td>(ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;</td>
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<td></td>
<td>(iii) Use tarpaulins to cover</td>
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<table>
<thead>
<tr>
<th>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</th>
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<td>sand and other loose material when transported by trucks; and</td>
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<td>(iv) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.</td>
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<td></td>
<td>(v) Carry out air quality monitoring</td>
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<tr>
<td>Traffic Management</td>
<td>(i) Implement a traffic management schedule during preconstruction phase.</td>
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<tr>
<td>Noise Levels</td>
<td>(i) Plan activities in consultation with SIPMIU/DSMC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least</td>
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<tr>
<td>Field</td>
<td>Mitigation Measures</td>
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<td></td>
<td>disturbance;</td>
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<td>(ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</td>
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<td></td>
<td>(iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor, and</td>
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<td></td>
<td>(iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.</td>
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<td></td>
<td>Ecological resources –</td>
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<tr>
<td></td>
<td>(i) Minimize removal of vegetation (if any) and</td>
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<tr>
<td>Terrestrial</td>
<td>disallow cutting of trees;</td>
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<td>(ii) If tree-removal will be required, obtain tree-cutting permit from Municipal Corporation,</td>
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<td></td>
<td>(iii) Require to plant three (3) native trees for every one (1) that is removed; and</td>
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<td></td>
<td>(iv) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood.</td>
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<tr>
<td>Landscape and Aesthetics</td>
<td>(i) Storage areas will be properly fenced off.</td>
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<td>(ii) Prepare and implement Waste Management List;</td>
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<td>(iii) Avoid stockpiling of excess excavated soils;</td>
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<td>(iv) Coordinate with AMC</td>
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<td>for beneficial uses of excess excavated soils</td>
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<td>(v) Recover used oil and lubricants and reuse or remove from the sites;</td>
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<td>(vi) Manage solid waste according to the following preference hierarchy:</td>
<td>reuse, recycling and disposal to designated areas;</td>
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<td></td>
<td>(vii) Remove all wreckage, rubbish;</td>
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<td>(viii) Retain mature trees on and around the site where possible;</td>
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<td>(ix) Cluster construction activities on site on a specific area to avoid &quot;sprawl&quot;;</td>
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<td></td>
<td>(x) Unwanted material and litter will be removed on</td>
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<td>frequent basis; and</td>
<td>(xi) Request SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</td>
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<tr>
<td>Accessiblity</td>
<td>(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;</td>
<td>(ii) Schedule transport and hauling activities during non-peak hours;</td>
<td>(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;</td>
<td>(iv) Keep the site free from</td>
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<tr>
<td>Field</td>
<td>Mitigation Measures</td>
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<td>all unnecessary obstructions; (v) Drive vehicles in a considerate manner; (vi) Coordinate with Agartala Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints; and (viii) Provide planks across trenches in front of businesses, and ensure works are completed</td>
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</tbody>
</table>

<p>| Parameters Monitored (As a minimum those identified in the IEE should be monitored) | Method of Monitoring | Location of Monitoring | Date of Monitoring Conducted | Name and Designation of Person Who Conducted the Monitoring |</p>
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<td>quickly to avoid disruption</td>
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<tr>
<td>Socio-Economic–Income.</td>
<td>(i) Leave spaces for access between mounds of soil; and</td>
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<td></td>
<td>(ii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</td>
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<tr>
<td>Employment Generation</td>
<td>(i) The use of labor intensive construction measures will be used where appropriate;</td>
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<td>(ii) Employ local (unskilled) labor if possible;</td>
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<td>(iii) Training of labor to benefit individuals beyond completion of the subproject;</td>
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<td>(iv) The training of</td>
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<tr>
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<td>unskilled or previously unemployed persons will add to the skills base of the area; and (v) Recruitment of labors will take place offsite.</td>
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<tr>
<td>Occupational Health and Safety</td>
<td>(i) Develop and implement site-specific Health and Safety (H&amp;S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment like helmet, gumboot, gloves, nose mask and ear plugs; (c) H&amp;S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-</td>
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</tr>
<tr>
<td>Field</td>
<td>Mitigation Measures</td>
<td>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</td>
<td>Method of Monitoring</td>
<td>Location of Monitoring</td>
<td>Date of Monitoring Conducted</td>
<td>Name and Designation of Person Who Conducted the Monitoring</td>
</tr>
<tr>
<td>-------</td>
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<td>------------------------------------------------------------</td>
</tr>
</tbody>
</table>

related accidents;

(ii) Designate a safeguard focal person and undertake safeguards orientation by PMU/PIU;

(iii) Ensure H&S plan is easily understandable to workers and laborers. Keep in mind that this plan will be used on-site and workers/laborers may not always understand highly technical terms;

(iv) Strict compliance of H&S plan and requirements of wearing personal protective equipment (PPE) during work hours;

(v) Provide specific guidance for suitable PPE for every on-site work
<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(vi) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the project site;</td>
</tr>
<tr>
<td></td>
<td>(vii) Provide medical insurance coverage for workers;</td>
</tr>
<tr>
<td></td>
<td>(viii) Secure all installations from unauthorized intrusion and accident risks;</td>
</tr>
<tr>
<td></td>
<td>(ix) Provide supplies of potable drinking water at working sites;</td>
</tr>
<tr>
<td></td>
<td>(x) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; and</td>
</tr>
<tr>
<td></td>
<td>(xi) Provide H&amp;S orientation training to all assignments</td>
</tr>
</tbody>
</table>

<p>| Parameters Monitored (As a minimum those identified in the IEE should be monitored) | Method of Monitoring | Location of Monitoring | Date of Monitoring Conducted | Name and Designation of Person Who Conducted the Monitoring |</p>
<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</td>
</tr>
<tr>
<td></td>
<td>(xii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</td>
</tr>
<tr>
<td></td>
<td>(xiii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</td>
</tr>
<tr>
<td></td>
<td>(xiv) Ensure moving equipment is outfitted with</td>
</tr>
<tr>
<td>Field</td>
<td>Mitigation Measures</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>audible back-up alarms;</td>
</tr>
<tr>
<td>xv) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</td>
<td></td>
</tr>
<tr>
<td>xvi) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>Mitigation Measures</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Community Health and Safety | (i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with SIPMIU/DSMC in identifying high-risk areas on route cards/maps.  

(iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.  

(iv) Provide road signs and flag persons to warn.  

(v) Provide protective fencing around open trenches, and cover any open trench with metal planks during non-construction hours. potentially cause soil |
<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>contamination;</td>
</tr>
<tr>
<td></td>
<td>(vi) Recover used oil and lubricants and reuse or remove from the site;</td>
</tr>
<tr>
<td></td>
<td>(vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; and</td>
</tr>
<tr>
<td></td>
<td>(viii) Request SIPMIU/DSMC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</td>
</tr>
<tr>
<td>Camp sites</td>
<td>(i) Consult SIPMIU/DSMC before locating project offices, sheds, and construction plants;</td>
</tr>
<tr>
<td></td>
<td>(ii) Minimize removal of vegetation and disallow</td>
</tr>
<tr>
<td>Field</td>
<td>Mitigation Measures</td>
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<tr>
<td>-------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>cutting of trees;</td>
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</tr>
<tr>
<td>Field</td>
<td>Mitigation Measures</td>
</tr>
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<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request SIPMIU/DSMC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</td>
</tr>
</tbody>
</table>

| Social and Cultural Resources | (i) Strictly follow the protocol for chance finds in any excavation work; |
|                              | (ii) Request SIPMIU/DSMC or any authorized person with archaeological field training to observe excavation; |
|                              | (iii) Stop work immediately to allow further investigation if any finds are suspected; and |
DSC = Design Supervision Management Consultant, H&S = health and safety, RPM = respirable particulate matter, SPM = suspended particulate matter, PMU = Project Management Unit; PIU = Project Implementation Unit

C. Defects Liability Stage

<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>General maintenance</td>
<td>(ii) Conduct work during non-monsoon period; and</td>
</tr>
<tr>
<td></td>
<td>(ii) Cover or wet excavated material to prevent dusts.</td>
</tr>
</tbody>
</table>

(iv) Inform SIPMIU/DSMC if a find is suspected, and take any action they require ensuring its removal or protection in situ.
### Field Mitigation Measures Parameters Monitored (As a minimum those identified in the IEE should be monitored) Method of Monitoring Location of Monitoring Date of Monitoring Conducted Name and Designation of Person Who Conducted the Monitoring

<table>
<thead>
<tr>
<th>Field</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health &amp; safety</td>
<td>Undertake regular monitoring and maintenance of water supply infrastructure.</td>
</tr>
</tbody>
</table>

### Overall Compliance with CEMP/EMP

<table>
<thead>
<tr>
<th>No.</th>
<th>Sub-Project Name</th>
<th>EMP/ CEMP Part of Contract Documents (Y/N)</th>
<th>CEMP/ EMP Being Implemented (Y/N)</th>
<th>Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)</th>
<th>Action Proposed and Additional Measures Required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

III. Training Orientation program details – Date, Venue, Participants, Subjects
IV. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

Brief description on the approach and methodology used for environmental monitoring of each subproject

- Monitoring of environmental IMPACTS on PROJECT SURROUNDINGS (ambient air and noise levels)

- Brief discussion on the basis for monitoring

- Indicate type and location of environmental parameters to be monitored

- Indicate the method of monitoring and equipment to be used

- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements

As a minimum the results should be presented as per the tables below.

Air Quality Results

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Date of Testing</th>
<th>Site Location</th>
<th>Parameters (Monitoring Results)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>PM10 µg/m³</td>
</tr>
</tbody>
</table>

Noise Quality Results

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Date of Testing</th>
<th>Site Location</th>
<th>LAn (dBA) (Government Standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Day Time</td>
</tr>
</tbody>
</table>

V. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

Summary of follow up time-bound actions to be taken within a set timeframe

VI. APPENDIXES

Photos

Summary of consultations

Copies of environmental clearances and permits

Sample of environmental site inspection report

Others
Tranche III

Bidding Document

Procurement of Works for Septage Management

(Civil Works)

Contract No. AGT/SM/NCB/SM-02 (R)

Single-Stage: Two-Envelope Bidding Procedure under National Competitive Bidding

Volume – III.

Issued by:

Project Director, SIPMIU,
Urban Development Department,
Government of Tripura,
2nd Floor, Khadya Bhavan, Pandit Nehru Complex,
Agartala-799007.
Letter of Price Bid

Date: ..................................................
NCB No.: ..................................................
Invitation for Bid No.: ..................................................

To: ...............................................................................................................................................................

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8;

(b) We offer to execute in conformity with the Bidding Documents and the Technical Bid submitted for the following Works:

(c) The total price of our Bid, excluding any discounts offered in item (d) below is:

(d) The discounts offered and the methodology for their application are:

(e) Our Bid shall be valid for a period of . . . . . days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Documents;

(g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract: **

<table>
<thead>
<tr>
<th>Name of Recipient</th>
<th>Address</th>
<th>Reason</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

(h) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed; and
(i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(j) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.

Name ................................................................................................................................................

In the capacity of ................................................................................................................................

Signed ................................................................................................................................................

Duly authorized to sign the Bid for and on behalf of ..........................................................................

Date ..................................................................................................................................................

** If none has been paid or is to be paid, indicate "none"
PREAMBLE TO THE BILL OF QUANTITIES

1.0 General

1.1 The Bill of quantities shall be read in conjunction with the Instructions to Bidders, General and Particular condition of contract, Technical specifications and Drawings.

1.2 The Contractor shall be deemed to have visited the site and read and examined the Tender Documents before completing the Bill of Quantities and filling the rates. The Drawings, Specifications, Schedules etc. are to be considered as explanatory of each other and no advantage shall be taken of any omission in tender documents.

1.3 The Contractor shall be deemed to be fully conversant with and to have made full allowance in his Tender for the site conditions, the nature and complexity of the work to be undertaken, the other extensive development and construction work currently being or which may be executed on and around the Site and all changes in the nature and condition of the Site from that existing at the time of Tender.

1.4 General directions and descriptions of scope of work and materials given in the Specification or shown on the Drawings are not necessarily repeated in the Bill of Quantities and reference is to be made to the Specification and the Drawings for this information.

1.5 The Bill of Quantities is an estimate of the quantities of work involved and is to be used as a basis for pricing of the Tender and for valuation of the work executed, in conjunction with instructions to Tenderers, terms and conditions of contract, general, special and technical specifications and drawings etc.

1.6 Due to the nature of the work, all quantities shown in the Bill of Quantities are approximate only and may be subject to variation. The quantities shown should not be considered as limiting or defining the extent of work to be done and material to be supplied by the Contractor. The contractor shall ascertain the actual quantities of materials required before placing orders.

1.7 Quantities given in the annexed Bill of quantities for the Various items are approximate only and are given to provide a common basis for tendering. The basis of payment will be the actual quantities of work carried out, as measured by the Engineer and valued at the rates of prices quoted in the Bills of Quantities where applicable, and otherwise at such rates for prices as may be fixed within the terms of the contract. Variations in the quantities of work in the Schedule shall not vitiate the contract.

1.8 Extra items of work shall not vitiate the Contract. The Contractor shall be bound to execute extra items of work as directed by the Engineer. The rates for extra items of works will be as per rates decided under Contract Conditions.

1.9 The rates quoted in the schedule shall be the all inclusive value for the work described and be deemed to include for all the Contractor’s liabilities and obligations and all risks set forth or implied in the document and all matters and things necessary for the proper construction, of the Works including surveying, setting out, plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes and duties together with all general risks liabilities and obligations set out or implied in the Contract. The Charge for any obligation of the Contractor for which apparently no corresponding item is given in the Bills of Quantities shall be deemed to be included in the Contract Rates and Prices entered against the billed items.

1.10 It is to be expressly understood that the measured work is to be taken net (not withstanding any system or practice to the contrary) according to the actual quantities wherein finished according to the Drawings or as may be ordered from time to time by the Engineer and the cost calculated at the respective prices, without any additional charges for any necessary or contingent works connected therewith. The rates quoted are for works in-situ and complete in every respect. Unless the Bill of Quantities specially indicates to the contrary, the constructional plant and temporary works will not be measured.

1.11 Unless otherwise stated, all items are measured net and no allowance will be made for wastage, working space, bulking or shrinkage, overlaps and the like. For supply or transportation of earth/sand etc., deduction for bulkage/voids will be done as per provisions in IS / CPWD specifications.
1.12. The unit rate should be entered against each item in the Bill of Quantities and shall be written in ink in figures. Any item left un-priced will be deemed to be included for elsewhere in the Bill of Quantities or the Schedule and hence the rate for that item will be taken as NIL.

1.13. In case any discrepancy is found between the quoted rates and the amounts, the unit rates will be taken as correct.

1.14. Arithmetic errors will be corrected by the employer as follows:
   (a) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected.
   (b) If there is an error in a total corresponding to the addition or subtraction of subtotal, the subtotals shall prevail and the total shall be corrected; and
   (c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

2.0 Earthworks

2.1 The unit of measurement for earthworks/garbage etc where measured separately shall be Cubic Meters for all types of soils.

2.2 The rates for excavation shall include for all plant, materials and labour required for excavation irrespective of depth in any material and in any location and shall also include for all temporary diversions, support and protection of any existing services and utilities, temporary support and maintenance of the excavation, dewatering as required by the Specification or shown on the Drawing (including the cost of outside material) compaction item.

3.0 Concrete

The quantity of concrete for all structures shall be measured net as the volume shown on the Drawings or ordered by the Engineer.

4.0 Approach to Work Site

Provision for access and approach to all construction sites is the responsibility of contractor and no payment will be made on this account.

5.0 Safety

The contract rates shall be deemed to include all costs of compliance with safety requirements in the Specification.

6.0 Road Works

Item No.2 under Earth Work pertains to immediate restoration of road including WBM and bituminous works after backfilling, to open road for use by traffic. Items under Road Restoration Works will be executed after the lapse of at least one rainy season as directed by the Engineer.

7.0 Layout shall be given to the contractor for construction of pipe lines on the basis of information regarding existing services like water lines, telephone and electric lines/cables. In the event of some services coming in the alignment of pipe line the contractor shall arrange the shifting of utilities through the line agencies. The contractor shall take all due care to avoid damage to any such services and, in case of any damage occurring to them in progressing the work, the Contractor shall make good the same at his own cost. No additional time shall, however, be allowed on this account.
8.0 Mode of measurement of various items will be stated in the specification and/or in the bill of quantities. The items for which mode of measurement is not indicated in the document, will be as per relevant Indian standard.

9.0 Cost of all items in the BOQ shall include cost of labour, material (with all applicable taxes) as per specifications and drawings and as directed by the Engineer.

10.0 Trench width at the bottom clearance on both sides of the pipe as per IS code. Additional width shall be provided at position of sockets and flanges for jointing. Depth of trench at such places shall also be sufficient to permit finishing of joints.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Rate in figure</th>
<th>Rate In Word</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth work in excavation in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil (i) By mechanical means</td>
<td>Cum</td>
<td>143.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m (i) All kinds of soil</td>
<td>Cum</td>
<td>145.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering. All work upto plinth level: (i) 1 : 2 : 4 (1 cement : 2 fine sand : 4 graded stone aggregate of 20 mm nominal size)</td>
<td>Cum</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) 1 : 3 : 6 (1 cement : 3 fine sand : 6 graded stone aggregate of 40 mm nominal size)</td>
<td>Cum</td>
<td>42.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level: (i) 1 : 2 : 4 (1 cement : 2 fine sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>Cum</td>
<td>77.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Reinforced cement Concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and skirting courses, fillets, columns, pillars, abutments, posts and struts etc. upto floor five level excluding cost of centring, shuttering, finishing and reinforcement. In walls (any thickness), including attached pilasters, buttresses, piers, abutments etc.</td>
<td>Cum</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### BOQ for Septage Management

**Borewell, RCC Water Tank, Rest Room for O & M Workers, Toilet Block & Septage Collection Chamber**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Rate in figure</th>
<th>Rate In Word</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>1:11/2:3 ( 1 Cement: 1/2 fine sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Reinforced cement concrete work in beams, suspended floors, roofs having slope upto 15' landings, balconies, shelves, chajjas, lintels, bands, plain window sills, staircases and spiral stair cases upto floor five level excluding the cost of centring, shuttering, finishing and reinforcement.</td>
<td>Cum</td>
<td>5.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>Centering shuttering including struttings, propping etc. and removal of form work for:</td>
<td>Sqm</td>
<td>134.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>Columns, Pillars, Piers, Abutments, Posts and Struts with wooden plank</td>
<td>Sqm</td>
<td>36.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>Foundations, footings, bases for columns etc. for mass concrete with timber plank</td>
<td>Sqm</td>
<td>216.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(iii)</td>
<td>Suspended floors, roofs, landings, balconies and access platform with 12 mm thick shuttering ply</td>
<td>Sqm</td>
<td>20.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(iv)</td>
<td>Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc. using shuttering ply</td>
<td>Sqm</td>
<td>20.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## BOQ for Septage Management

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Rate in figure</th>
<th>Rate In Word</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto floor five level</td>
<td>Kg</td>
<td>9466.00</td>
<td>9466.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>Thermo-Mechanically Treated bars/ Cold twisted deformed steel bars</td>
<td>Kg</td>
<td>9466.00</td>
<td>9466.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>First class brick work In foundation and plinth including cost of all materials as required complete.</td>
<td>Cum</td>
<td>12.00</td>
<td>12.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>Cement mortar 1:6 (1 cement: 6 fine sand)</td>
<td>Cum</td>
<td>12.00</td>
<td>12.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>First class brick work in superstructure above plinth level and upto floor-five level including cost of all materials as required complete</td>
<td>Cum</td>
<td>37.00</td>
<td>37.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>Cement mortar 1:4 (1 cement: 4 fine sand)</td>
<td>Cum</td>
<td>37.00</td>
<td>37.00</td>
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<tr>
<td>11</td>
<td>Honey comb brick masonry work of half brick thickness with first class bricks in superstructure for all level including cost of all materials as required complete.</td>
<td>Sqm</td>
<td>25.00</td>
<td>25.00</td>
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</tr>
<tr>
<td>(i)</td>
<td>Cement mortar 1:5 (1 cement: 5 fine sand)</td>
<td>Sqm</td>
<td>25.00</td>
<td>25.00</td>
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</tr>
<tr>
<td>12</td>
<td>Half brick masonry work with first class bricks in foundation and plinth including cost of all materials as required complete.</td>
<td>Sqm</td>
<td>134.00</td>
<td>134.00</td>
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<td>Sl. No.</td>
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<tr>
<td>13</td>
<td>Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position.</td>
<td>cum</td>
<td>1.00</td>
<td></td>
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<tr>
<td></td>
<td>(i) Local Teak Wood</td>
<td></td>
<td></td>
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<tr>
<td>14</td>
<td>Providing and fixing panelled / or panelled and glazed shutters for doors, windows and clerestory windows including ISI marked bright finished / black enameled M.S. butt hinges with necessary screws excluding panelling and or glazing, which will be paid for separately but including the wooden beading of 20 x 12 mm for fixing panelling and or glazing as per direction of Engineer-In-Charge.</td>
<td>sqm</td>
<td>19.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) Local teak wood (35 mm thick shutters)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>24 mm thick factory made PVC door shutters made of styles and rails of a UPVC hollow section of size 59x24 nun and wall thickness 2 mm ± 0.2 mm with inbuilt edging on both sides. The styles and rails mitred and joined at the comers by means of M.S. galvanised /plastic brackets of size 75x220 mm having wall thickness 1.0 mm and stainless steel screws. The styles of the shutter reinforced by inserting galvanised MS tube of size 20x20 mm and 1 mm ± 0.1 mm wall thickness. The lock rail made up of &quot;H&quot; Section, a UPVC hollow section of size 100x24 mm and 2 mm ± 0.2 mm wall thickness fixed to the shutter styles by means of plastic /galvanised MS &quot;U&quot; cleats. The shutter frame filled with a UPVC multi-chambered single panel of size hot less than 620 mm, having overall thickness of 20 mm and 1 mm ± 0.1 mm wall thickness. The panels filled vertically and tie bar at two places by inserting horizontally 6 mm galvanised MS rod and fastened with nuts and washers, complete as per manufacturer's specification and direction of Engineer-In-Charge. (for W.C. and Bathroom door shutter).</td>
<td>sqm</td>
<td>12.00</td>
<td></td>
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<tr>
<td>Sl. No.</td>
<td>Description</td>
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<tr>
<td>16</td>
<td>Providing and laying 62 mm thick cement concrete flooring with concrete hardener topping under layer 50 mm thick cement concrete 1:2:4 (1 cement: 2 fine sand: 4 graded stone aggregate 20 mm nominal size) and top layer 12 mm metallic concrete hardener consisting of mix 1 : 2 ( 1 cement hardener mix : 2 stone aggregate 6 mm nominal size ) by volume with hardening compound @ 2 litre per 50 kg of cement including cement slurry, nosing of steps etc. complete.</td>
<td>Sqm</td>
<td>138</td>
<td>138.00</td>
<td></td>
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<tr>
<td>17</td>
<td>Providing and laying cement concrete 1:2:4 (1 cement: 2 fine sand: 4 graded stone aggregate 20 mm nominal size) flooring finished with a floating coat of neat cement including cement slurry, rounding of edges and strips and cost of glass strips etc. complete.</td>
<td>Sqm</td>
<td>16</td>
<td>16.00</td>
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<tr>
<td>(i)</td>
<td>40 mm thick</td>
<td></td>
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<tr>
<td>18</td>
<td>15 mm cement plaster in single layer including cost of materials required and finishing even and smooth and curing complete.</td>
<td>Sqm</td>
<td>640</td>
<td>640.00</td>
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<tr>
<td>(i)</td>
<td>In Cement mortar 1:4 (1 cement: 4 fine sand)</td>
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<tr>
<td>19</td>
<td>Providing steel work in built up tubular trusses including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, welded and bolted including special shaped washers etc. complete as per required.</td>
<td>Kg</td>
<td>3087</td>
<td>3087.00</td>
<td></td>
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<tr>
<td>(i)</td>
<td>Electric resistance or induction butt welded tubes.</td>
<td></td>
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<tr>
<td>20</td>
<td>Providing and fixing insulating board ceiling of approved quality with necessary nails etc. complete (frame work to be paid separately):</td>
<td>Sqm</td>
<td>92</td>
<td>92.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>12 mm thick White face insulating board</td>
<td></td>
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<tr>
<td>21</td>
<td>Providing and fixing T-iron frames for doors, windows and ventilators of mild steel Tee-sections, joints mitred and wetted with I5x3 mm lugs 10 cm long embedded in cement concrete blocks 15x6x10 cm of 1:3:6 (1 cement : 3 river sand : 6 graded jhama aggregate 20 mm nominal size) or with wooden plugs and screws or rawl plugs and screws or with dash fastener or With fixing clips or with bolts and nuts as required including fixing of necessary butt hinges and screws . and applying a priming coat of approved steel, primer complete as required.</td>
<td>Kg</td>
<td>270</td>
<td>270.00</td>
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</table>
### BOQ for Septage Management

**Borewell, RCC Water Tank, Rest Room for O & M Workers, Toilet Block & Septage Collection Chamber**

<table>
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<tr>
<th>Sl. No.</th>
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<th>Qty</th>
<th>Rate in figure</th>
<th>Rate In Word</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>22</td>
<td>Applying one coat of cement primer of approved brand and manufacturer on wall surface complete.</td>
<td>Sqm</td>
<td>100.00</td>
<td></td>
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<tr>
<td>23</td>
<td>Finishing walls with water proofing cement paint of required shade of approved brand and manufacture on new work (two or more coats applied @ 3.84 kg/10 sqm) complete.</td>
<td>Sqm</td>
<td>100.00</td>
<td></td>
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<tr>
<td>24</td>
<td>Colour washing such as green, blue or buff with whiting to give an even shade on new work (two or more coats) complete.</td>
<td>Sqm</td>
<td>120.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(i)</td>
<td>With a base coat of whiting</td>
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<tr>
<td>Sl. No.</td>
<td>Description</td>
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<tr>
<td>25</td>
<td>Distempering with dry distemper of approved brand and manufacture and of required shade on new work (two or more coats), over and including a priming coat of whiting to give an even shade complete.</td>
<td>Sqm</td>
<td>280.00</td>
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<tr>
<td>26</td>
<td>Finishing walls with acrylic smooth exterior paint of required shade of approved brand and manufacture on new work (two or more coats applied @ 1.67 kg/10 sqm) over and including base coat water proofing cement paint applied @ 2.20 kg/10 sqm complete.</td>
<td>Sqm</td>
<td>280.00</td>
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<tr>
<td>27</td>
<td>Applying priming coat. With ready mixed pink primer of approved brand and manufacture on wood work (hard &amp; soft wood).</td>
<td>Sqm</td>
<td>150.00</td>
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<tr>
<td>28</td>
<td>Neat cement punning.</td>
<td>Sqm</td>
<td>8.00</td>
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<tr>
<td>29</td>
<td>Painting on wood work with oil type wood preservative (two or more coats) of approved brand and manufacture on new work complete.</td>
<td>Sqm</td>
<td>150.00</td>
<td></td>
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<tr>
<td>30</td>
<td>Providing corrugated G.S. sheet roofing including vertical/curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and G.I. limpet washers filled with white lead and including a coat of approved steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal/vertical or curved surfaces) excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required. 0.80 mm thick with zinc coating not less than 275 gm / m2</td>
<td>Sqm</td>
<td>130.00</td>
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<tr>
<td>Sl. No.</td>
<td>Description</td>
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<tr>
<td>31</td>
<td>Providing and laying rectified glazed ceramic floor tiles 300 x 300 mm or more (thickness to be specified by the manufacturer) of 1st quality conforming to IS: 15622 of approved make in colours, shades such as white, ivory, grey, fume red, brown over 20 mm thick bed of cement mortar 1:4 (1 cement: 4 fine sand) jointed with ordinary cement slurry including pointing with white cement mixed with pigment of matching shade complete.</td>
<td>Sqm</td>
<td>108.00</td>
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<tr>
<td>32</td>
<td>Providing and fixing 1st quality ceramic glazed wall tiles conforming to IS: 15622 (thickness to be specified by the manufacturer) of approved make in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-charge in skirting, risers of steps and dados over 12 mm thick bed of cement mortar 1:3 (1 cement: 3 fine sand) jointed with ordinary cement slurry including pointing with white cement mixed with pigment of matching shade complete.</td>
<td>Sqm</td>
<td>60.00</td>
<td></td>
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<tr>
<td>33</td>
<td>Providing and fixing precast chequered cement concrete tiles 22 mm thick, laid in footpath &amp; courtyard, on 20 mm thick bed of cement mortar 1:4 (1 cement: 4 fine sand) jointed with neat cement slurry mixed with pigment to match the shade of tiles including rubbing and polishing complete. In dark shade using ordinary cement.</td>
<td>Sqm</td>
<td>18.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>34</td>
<td>Providing ridges or hips of width 60 mm over all width plain G.S. sheet fixed with polymer coated J. or L hooks, bolts and nuts 8 mm dia. G.I. limpet and bitumen washers including a coat of approved steel primer and two coats of approved paint complete. 0.80 mm thick with zinc coating not less than 275 gm / m2</td>
<td>Metre</td>
<td>30.00</td>
<td></td>
<td></td>
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<tr>
<td>35</td>
<td>Rain water harvesting for Rest room &amp; Toilet block (L.S.)</td>
<td>No</td>
<td>2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>36</td>
<td>Providing and fixing G.I.pipes medim class as per IS: 1239 with latest amendment complete with G.I. fitting including trenching and refilling, cutting and making good the walls etc.complete as per chapter 20 of CPWD specification and direction of the Engineer-in-charge.</td>
<td>Metre</td>
<td>30.00</td>
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A External work.

(i) 80 mm dia. Nominal bore.
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<th>Sl. No.</th>
<th>Description</th>
<th>Unit</th>
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<th>Rate in figure</th>
<th>Rate In Word</th>
<th>Amount</th>
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<tbody>
<tr>
<td>37</td>
<td>Pump with accessories</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>38</td>
<td>Supplying and fixing C.I. cover without frame for manholes:</td>
<td>No</td>
<td>2.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>39</td>
<td>Providing and fixing CI 100 mm dia air vent on roof top of the reservoir.</td>
<td>Kg</td>
<td>40.00</td>
<td></td>
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<tr>
<td>40</td>
<td>Providing and fixing C.I. sluice valves(with cap) complete with bolts,</td>
<td>No</td>
<td>2.00</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>nuts,rubber insertions etc.(the tail pieces if required will be paid</td>
<td></td>
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<td></td>
<td>separately) as per chapter 20 of CPWD specification and direction of the</td>
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<tr>
<td></td>
<td>Engineer-in-charge.</td>
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<td></td>
<td>80 mm dia (PN - 1.0)</td>
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<tr>
<td>41</td>
<td>Providing and fixing C.I. sluice valves(with cap) complete with bolts,</td>
<td>No</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>nuts,rubber insertions etc.(the tail pieces if required will be paid</td>
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<tr>
<td></td>
<td>separately) as per chapter 20 of CPWD specification and direction of the</td>
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<tr>
<td></td>
<td>Engineer-in-charge. (Scouring purposes of CI sluice valves).</td>
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<tr>
<td></td>
<td>80 mm dia (PN - 1.0)</td>
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<tr>
<td>42</td>
<td>Providing and laying S &amp; S C.I. standard specials such as tees, bends,</td>
<td>Kg</td>
<td>50.00</td>
<td></td>
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<tr>
<td></td>
<td>collars, tapers, caps etc. (Heavy class) as per chapter 20 of CPWD</td>
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<td></td>
<td>specification and direction of the Engineer-in-charge.</td>
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<td></td>
<td>Upto 300 mm dia</td>
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<td>43</td>
<td>Constructing masonry Chamber 60 x 60 x 75 cm, inside with brick work in cement mortar 1 : 4 (1 cement : 4 fine sand) for sluice valve, with C.I. surface box 100 mm top diameter, 160 mm bottom diameter and 180 mm deep (inside) with chained lid and RCC top slab 1 : 2 : 4 mix (1 cement : 2 fine sand : 4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1 : 5 : 10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1 : 3 (1 cement : 3 fine sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design, CPWD specification and direction of the Engineer - in - charge. With First class bricks.</td>
<td>Nos</td>
<td>3.00</td>
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<td>44</td>
<td>Providing and fixing safety foot rest having minimum cross section as 23 x 25 mm and overall minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm.</td>
<td>Kg</td>
<td>80.00</td>
<td></td>
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<td>Sl. No.</td>
<td>Description</td>
<td>Unit</td>
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<td></td>
<td><strong>TUBEWELL &amp; PUMPING MAIN</strong></td>
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<td>45</td>
<td>Drilling and boring pilot hole in any soil strata by Drilling rig, collection of soil samples of different strata met with during drilling at various suitable levels, preservation of samples in polythene bags/sample boxes and disposal of excess soil or mud, including the cost for bentonite, water etc., as required to maintain the pilot hole properly as per specification { IS: 2800 (Part-1)} and direction of the Engineer-in-charge. 200 mm dia.</td>
<td>Metre</td>
<td></td>
<td>240.00</td>
<td></td>
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<tr>
<td>46</td>
<td>Reaming of pilot hole to an enlarged bore hole in any soil strata by drilling rig, disposal of excess soil or mud, including the cost for bentonite, water etc., as required to maintain the bore hole properly as per specification { IS: 2800 (Part-1)} and direction of the Engineer-in-charge. (i) from 200 mm dia. Pilot hole to 550 mm bore hole (ii) from 200 mm dia. Pilot hole to 460 mm bore hole</td>
<td>Metre</td>
<td></td>
<td>45.00</td>
<td></td>
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<tr>
<td>47</td>
<td>Washing of enlarged bore hole of 460 - 550 mm dia. in any soil strata by drilling rig, disposal of excess soil or mud, including the cost for bentonites, water etc., as required to maintain the bore hole properly including lifting of drill pipes as per specification { IS: 2800 (Part-1)} and direction of the Engineer-in-charge.</td>
<td>Metre</td>
<td></td>
<td>180.00</td>
<td></td>
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<tr>
<td>48</td>
<td>Lowering of ERW pipe including painting with anti-corrosive bitumastic paints, fixing of M.S. ring, welding of all joints etc., complete after washing of the bore hole as per specification { IS: 2800 (Part-1)} and direction of the Engineer-in-charge. (Part of ERW pipes may be supplied free of cost by the dept. from the departmental store yard). (i) 200 mm dia. ERW housing pipes (ii) 150 mm dia. ERW blind pipes</td>
<td>Metre</td>
<td></td>
<td>42.00</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>120.00</td>
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<td></td>
<td><strong>BOQ for Septage Management</strong></td>
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<td></td>
<td><strong>Borewell, RCC Water Tank, Rest Room for O &amp; M Workers, Toilet Block &amp; Septage Collection Chamber</strong></td>
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<tr>
<td>49</td>
<td>Providing and fixing of bail plug (made with 8 mm thick MS sheet) by welding with blind pipe including applying of anti-corrosive bitumastic paint as per specification (IS: 2800 (Part-1)) and direction of the Engineer-in-charge.</td>
<td>Metre</td>
<td>40.00</td>
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<td></td>
<td>(i) for 150 mm dia. ERW pipes</td>
<td></td>
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<tr>
<td>50</td>
<td>Providing and fixing of reducing socket (made with 8 mm thick MS sheet) by welding with blind pipe including applying of anti-corrosive bitumastic paint as per specification (IS: 2800 (Part-1)) and direction of the Engineer-in-charge.</td>
<td>No</td>
<td>1.00</td>
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<tr>
<td></td>
<td>(i) 200 x 150 mm dia.</td>
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<tr>
<td>51</td>
<td>Providing and Shrouding of the deep tube well assembly with washed pea gravels (2.0 - 4.75 mm effective size) as per specification (IS: 4097) and direction of the Engineer-in-charge.</td>
<td>Cum</td>
<td>35.00</td>
<td></td>
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<tr>
<td></td>
<td>(i) Pea gravels obtained from Golaghat, Assam</td>
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<tr>
<td>52</td>
<td>Providing and fixing of housing clamp (made with 12 mm thick MS sheet) by welding with blind pipe including applying of anti-corrosive bitumastic paint as per specification (IS: 2800 (Part-1)) and direction of the Engineer-in-charge.</td>
<td>No</td>
<td>1.00</td>
<td></td>
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<tr>
<td></td>
<td>(i) 200 mm dia.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>53</td>
<td>Washing and development of tube well by using air compressor, and testing of the well as per specification (IS: 11189) and direction of the Engineer-in-charge.</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(i) using air compressor of 300 - 450 cfm output.</td>
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<td>Sl. No.</td>
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<tr>
<td>54</td>
<td>Installation of submersible pump with motor up to the depth of 100 ft by GI pipe (conforming to IS : 1239 medium class) with tailpiece as required welded with GI flange in/c providing fitting fixing by necessary rubber washer, nuts &amp; bolts, MS safety clamp etc. as per required size and making necessary electrical connection with main switch / starter with motor in/c commissioning &amp; trial run as per direction of the Engineer-in-charge (pump, motor with cable will be issued by the department at free of cost but GI pipe of medium class for column assembly will be supplied by the agency at his cost). (i) 5000/7500 GPH Capacity with 80 mm dia G.I pipe and 10 mm thick GI flange.</td>
<td>No</td>
<td>1.00</td>
<td></td>
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<tr>
<td>55</td>
<td>Providing &amp; fabrication of column pipe including fitting fixing of G.I. flange by cutting the G.I. pipe (Conforming to IS : 1239 medium class) into 3.05 mtr. long and welding the same with GI flange as per specification and direction of the Engineer-in-charge (G.I. pipe will be provided by the agency at his own cost &amp; risk). (i) For 100 mm dia G.I. pipe with 10 mm thick GI flange.</td>
<td>No</td>
<td>10.00</td>
<td></td>
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</tr>
<tr>
<td>56</td>
<td>Supplying, fixing, trial run &amp; commissioning of ISI mark CI double flanged sluice valve as per IS 14846 PN 1.0 rating complete with gaskets, fasteners etc. 150 dia for delivery line.</td>
<td>No</td>
<td>1.00</td>
<td></td>
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<tr>
<td>57</td>
<td>Supplying &amp; fixing ISI mark CI double flanged non return valves 150 mm (NB) dia as per IS : 5312 part 1 (1984) PN 1.0 rating complete with G.M. internals. Flanged and drilling to IS : 1538 flat face.</td>
<td>No</td>
<td>1.00</td>
<td></td>
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<tr>
<td>58</td>
<td>Supplying at site Submersible pump set for bore well complete with all accessories capable of delivering 20,000 GPH with 35 mtr double run cable. Details of Pump: Maximum stage of submersible pump shall be 5(five) Discharge:- Between 85 cum/hr and 95 cum/ hr Pressure Head:- Between 60 mtr and 65 mtr of water No of Pumps required:- 1 nos.</td>
<td>No</td>
<td>1.00</td>
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</tbody>
</table>
## BOQ for Septage Management

**Borewell, RCC Water Tank, Rest Room for O & M Workers, Toilet Block & Septage Collection Chamber**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
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<th>Rate in figure</th>
<th>Rate In Word</th>
<th>Amount</th>
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<tbody>
<tr>
<td>59</td>
<td>Providing and fixing centralising guide to be fitted to well assembly except</td>
<td>No</td>
<td>1.00</td>
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<td></td>
<td>the housing pipe at suitable spacing to keep the assembly in the</td>
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<td></td>
<td>centre of the hole so that an even thickness of gravel pack is</td>
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<td></td>
<td>achieved as per material conforming to IS : 226 : 1975 ( These guides</td>
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<td></td>
<td>should be fitted at approximately 10 m interval.</td>
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<tr>
<td>60</td>
<td>Electrical log of an uncased bore hole, up to a depth of 200m / Charges of</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>resistivity test (Electro-logging) for 1 no bore hole</td>
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</tbody>
</table>
## BOQ for Septage Management

### Description

- **Sl. No. 61**: Supply and delivery of 200 mm NB (219.1 mm OD) X 5.4 mm Wt MS ERW pipes conforming to IS: 4270 of grade Fe 410 including loading, unloading and stacking at site as per direction of the Engineer. Cost to include all charges of loading, unloading, stacking, transportation, insurance and all applicable taxes.
  - **Unit**: Metre
  - **Qty**: 42.00

- **Sl. No. 62**: Supply and delivery of 150 mm NB (168.3 mm OD) X 5.0 mm Wt MS ERW pipes conforming to IS: 4270 of grade Fe 410 including loading, unloading, stacking at site as per direction of the Engineer. Cost to include all charges of loading, unloading, stacking, transportation, insurance and all applicable taxes.
  - **Unit**: Metre
  - **Qty**: 160.00

- **Sl. No. 63**: Labour Charge for slotting of 150 mm NB (168.3 mm OD) x 5.0 mm thick MS ERW pipes conforming to IS : 4270 with slots of approved pattern & design (IS : 8110 - 2000) including receiving the blind pipes from stack yard and returning the same at the stack yard / site after slotting including carrying, loading, unloading and stacking the same properly in measurable stack as per direction of the Engineer-in-charge.
  - **Unit**: Metre
  - **Qty**: 40.00

### ELECTRO MECHANICAL WORKS.

- **Sl. No. 64**: Providing and fitting fixing steel sheet enclosed switch fuse unit (suitable for DIN fuses), triple pole with Neutral Link (TPN), current range 63 Amps, 415/500 Volt, L & T / Havel's/HPL make etc. complete as per specification and direction of the Engineer-in-charge.
  - **No**: 1.00

- **Sl. No. 65**: Providing and fitting fixing of Fully Automatic Star Delta type Motor starter (3 ph. 50 Hz, 415V, 50 HP/37 kw Relay range within 28-42 + 10% ) in steel sheet Enclosures with contractors and Timer etc. complete suitable for submersible Pump L & T, BCH, ABB make as per specification and direction of the Engineer-in-charge.
  - **No**: 1.00

- **Sl. No. 66**: Providing and fitting fixing of 6 feet x 4 feet x 1 inch (thickness) Gamair wood pannel board for fitting fixing of electrical items, in/c 2 nos MS angle post (size 2 inch x 2 inch x 9 feet), ), nuts & bolts etc. for erection of the same by 1 :1.5:3 cement concrete casting (1 feet x 1 feet x 2 feet) below the ground level and painting two or more coats & plastic paint as per specification and direction of the Engineer-in-charge.
  - **No**: 1.00
### BOQ for Septage Management

**Borewell, RCC Water Tank, Rest Room for O & M Workers, Toilet Block & Septage Collection Chamber**

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<tr>
<th>Sl. No.</th>
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<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>67</td>
<td>Providing and fitting fixing with PVC insulated single core multistrand Copper cable conforming to IS : 694 for inter connection with all electrical equipments of the panel board as per specification and direction of the Engineer-in-charge.</td>
<td>No</td>
<td>1.00</td>
<td></td>
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</tr>
<tr>
<td>68</td>
<td>Providing and fitting fixing of moving iron type, Range 0-500 V, 96 mm x 96 mm size AC Volt meter ( L &amp; T / AE make) with selector switch as a electrical instrument of the panel board as per specification and direction of the Engineer-in-charge.</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>69</td>
<td>Providing and fitting fixing of moving iron type, Range 0-100 V, 96 mm x 96 mm size AC Amps meter direct reading type ( L &amp; T / AE make) with selector switch and CT coil as a electrical instrument of the panel board as per specification and direction of the Engineer-in-charge.</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>70</td>
<td>Providing and fitting fixing to Moulded Case Circuit Breaker (MCCB) of Thermal release range 50-63 Amps, 415 + V, 50Hz (L&amp;T,BCH,ABB make) as per specification and direction of the Engineer -in-charge</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>71</td>
<td>Providing earthing with perforated 40 mm dia G.I. pipe (Medium class) ( 12 mm dia perforation) , 2.50 mtr. Long, laying of 4 mm dia GI wire from earth electrode to panel, including excavating hole of 600 mm dia and refilling with Salt and Charcoal / coke in alternate layers of 300 mm, as per specification and direction of the Engineer-in-charge.</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>Cost of 1 no. out door pole mounted sub-station including the cost of Transformer for Deep Tube well ( L.S.)</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>Sl. No.</td>
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<tr>
<td>73</td>
<td>Providing and fixing water closet squatting pan (Indian type W.C. pan) with 100 nun sand cast Iron P or Strap, 10 litre low level white P.V.C. flushing cistern with manually controlled device (handle lever) conforming to IS : 7231, with all fittings and fixtures complete including cutting and making good the walls and floors wherever required : Stainless Steel AISI-304(18/8) Orissa pattern W.C. pan of size 585x480 mm with flush pipe and integrated type of foot rests.</td>
<td>Each</td>
<td>3.00</td>
<td></td>
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<tr>
<td>74</td>
<td>Fixing white vitreous china flat back or wall corner type lipped front urinal basin of 430x260x350 mm and 340x410x265 mm size respectively with automatic flushing cistern with standard flush pipe and C.P brass spreaders with brass unions and G.I clamps complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required. One urinal basin with 5 litre white P.V.C automatic flushing cistern.</td>
<td>Each</td>
<td>2.00</td>
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<tr>
<td>75</td>
<td>Providing and fixing wash basin with C.I. brackets, 15 mm C.P. brass pillar taps, 32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever required : White Vitreous China wash basin size 630x450 mm with a pair of 15 mm C.P. brass pillar taps</td>
<td>Each</td>
<td>2.00</td>
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<tr>
<td>76</td>
<td>Providing and fixing mirror of superior glass (of approved quality) and of required shape and size with plastic moulded frame of approved make and shade with 6 nun thick hard board backing : Oval shape 450x350mm (outer dimensions)</td>
<td>Each</td>
<td>2.00</td>
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<td>Sl. No</td>
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<tr>
<td>77</td>
<td>Suplying &amp; fixing (i) Chlorinated Polyvinyl Chloride (CPVC) pipe lines for water supply inside protected with anti bacterial coatings concealed in walls using 32mm &amp; 25mm dia nominal bore pipes for interior works and 32mm, 40mm, 50mm &amp; 63mm dia nominal bore pipes buried under ground for external pipe lines with all fittings and specials, brass wheel valves &amp; bib cocks one in each toilet room, with minimum two nos. 40mm GM valves enclosed in 600mm square &amp; 600mm deep brick mansonry chambers with suitable CI manhole covers (ii) HDPE (PN-4) pipe for sanitary pipe lines concealed in walls using 40mm &amp; 50mm dia nominal bore pipes for interior works and 50mm, 63mm &amp; 75mm dia nominal bore pipes buried under ground for external pipe lines with all fittings and special, plastered smoothly finished brick chambers with precast RCC sewer chambers @ 2m linier interval at the points of direction deviations including all other labour charges &amp; specials for the successful commissioning of the water supply &amp; sewer lines of the satisfaction of the Engineer-in-charge etc complete.</td>
<td>No</td>
<td>1.00</td>
<td></td>
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<tr>
<td>78</td>
<td>Providing and placing on terrace (at all floor levels) polyethylene water storage tank ISI : 12701 marked with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank.</td>
<td>Per Litre</td>
<td>4000.00</td>
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<tr>
<td>79</td>
<td>Suppling &amp; installing septic tanks of capacity for 10 users (L.S).</td>
<td>No</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>80</td>
<td>Wiring for light/fan/exhaust fan/call bell point with 1.5 sq.mm PVC insulated copper conductor cable in PVC casing and capping etc. as required.</td>
<td>Each</td>
<td>6.00</td>
<td></td>
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<tr>
<td></td>
<td>(i) Short point:-</td>
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<td></td>
<td>(ii) Medium Point :-</td>
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</table>

BOQ for Septage Management

Borewell, RCC Water Tank, Rest Room for O & M Workers, Toilet Block & Septage Collection Chamber
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<tbody>
<tr>
<td>(iii)</td>
<td>Long Point :-</td>
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<tr>
<td>81</td>
<td>Wiring for 3pin 5/6 amps Plug point with 1.5 sq.mm PVC insulated copper conductor cable i/c providing and fixing 3pin 5/6amps socket outlet &amp; 5/6 amps piano type switch on switch board, earthing the 3rd pin etc. as required</td>
<td>Each</td>
<td>10.00</td>
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<tr>
<td>82</td>
<td>Wiring for circuit/sub-main wiring with the following size PVC insulated copper conductor cable in PVC casing and capping etc. as required.</td>
<td>Each</td>
<td>10.00</td>
<td></td>
<td></td>
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<tr>
<td>(i)</td>
<td>2 x 2.5 sq.mm:-</td>
<td>Metre</td>
<td>150.00</td>
<td></td>
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<tr>
<td>(ii)</td>
<td>2 x 4.0 sq.mm:-</td>
<td>Metre</td>
<td>50.00</td>
<td></td>
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</tr>
<tr>
<td>83</td>
<td>Earthing with G.I Earth pipe 4.5 m. long and 40 mm dia with masonry enclosure top etc. as required.</td>
<td>Set</td>
<td>2.00</td>
<td></td>
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<tr>
<td>84</td>
<td>Extra for using salt and charcoal for pipe earth electrode as required.</td>
<td>Set</td>
<td>2.00</td>
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<tr>
<td>85</td>
<td>Providing and fixing 4.06 mm dia (8 SWG) copper Wire on surface or in recess for loop earthing.</td>
<td>Metre</td>
<td>30.00</td>
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</tbody>
</table>
## BOQ for Septage Management

**Borewell, RCC Water Tank, Rest Room for O & M Workers, Toilet Block & Septage Collection Chamber**

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<tbody>
<tr>
<td>86</td>
<td>Supplying and drawing 4 sq.mm copper conductor wire for loop earthing along with other wire as required.</td>
<td>Metre</td>
<td>30.00</td>
<td></td>
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<tr>
<td>87</td>
<td>Providing and laying earth connection from earth electrode with 4.06 mm (8 SWG) dia G.I./copper wire in 15 mm dia G.I Pipe from earth electrode as required.</td>
<td>Metre</td>
<td>4.00</td>
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<tr>
<td>88</td>
<td>Supplying and fixing of the following PVC conduit in/c all accessories as required:</td>
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<tr>
<td>(i)</td>
<td>19 mm:</td>
<td></td>
<td>Metre</td>
<td>20.00</td>
<td></td>
<td></td>
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<tr>
<td>89</td>
<td>Supply, installation, testing and commissioning of A.C. ceiling fan 1200 mm sweep complete with regulator in/c wiring the down rod of standard length (up to 30 cm.) etc. as required.</td>
<td>Each</td>
<td>6.00</td>
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<tr>
<td>90</td>
<td>Supply, installation, testing and commissioning of Exhaust fan 300 mm sweep complete with all necessary connection etc. as required.</td>
<td>Each</td>
<td>4.00</td>
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<tr>
<td>91</td>
<td>Supplying and fixing of single FTL fittings complete with 1 no. 40/36 watt FTL, 1 no. 40/36 watt copper ballast, starter, holder etc in/c connection etc. as required.</td>
<td>No</td>
<td>10.00</td>
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<tr>
<td>92</td>
<td>Supplying and fixing of 150 watt HPSV lamp in/c all necessary connection etc. as required.</td>
<td>No</td>
<td>4.00</td>
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<td>Sl. No.</td>
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<tr>
<td>93</td>
<td>Supplying and fixing of 30/32 amps DP Main switch (rewireable) 250 volts in/c drilling holes on the board/ MS clamp, connections etc as required. (Category B)</td>
<td>Each</td>
<td>2.00</td>
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<tr>
<td>94</td>
<td>Supplying and fixing of 2 way metal enclosure for 240/415 volts MCB (SP/SPN/DP) or Isolator, complete with necessary bus bar, earth bar, neutral link, dim rail etc in/c connection as required. (Category B)</td>
<td>Each</td>
<td>2.00</td>
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<tr>
<td>95</td>
<td>Supplying and fixing of 5 to 32 amps rating 240 volts ‘G’ series MCB of Single pole in the existing MCB DB complete with connection etc. as required. (Category B)</td>
<td>Each</td>
<td>4.00</td>
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<tr>
<td>96</td>
<td>Supplying and fixing of 254 mm x 300mm size wooden Formica board with Bakelite cover.</td>
<td>Each</td>
<td>4.00</td>
<td></td>
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<tr>
<td>97</td>
<td>Supplying and fixing of 254 mm x 300 mm wooden board.</td>
<td>Each</td>
<td>4.00</td>
<td></td>
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