BIDDING DOCUMENTS

FOR

CONSTRUCTION OF 03 LOW-COST WASTEWATER TREATMENT PLANTS

JULY 2025

Local Government &
Community Development
Government of the Punjab

PRMSC

PUNJAB RURAL MUNICIPAL SERVICES COMPANY (PRMSC)

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INVITATION FOR BIDS

PUNJAB RURAL MUNICIPAL SERVICES COMPANY (PRMSC)

A COMPANY SET UP UNDER SECTION 42 OF THE COMPANIES ACT, 2017

TENDER NOTICE

Punjab Rural Municipal Services Company (PRMSC) (hereinafter referred to as the "client"), invites E-Bids (by uploading PDF File) from Contractors / Firms registered with the registration system available on the e-PADS and registered with **FBR, PRA (NTN** and **PNTN) & PPRA** for E-Procurement on "e-Pak Acquisition and Disposal system (e-PADS)". All e-bids must be submitted through e-PADS concerning following works:

Sr.	Description	PEC Category & Code	Estimated Cost (PKR)	Bid Security (PKR)
1	**CONSTRUCTION OF 03 LOW-COST WASTE-WATER TREATMENT PLANTS (TEHSILS: PAKPATTAN, BHOWANA & KALLAR KAHAR)**	**C2 & Above with CE-09 & CE-10**	**359,573,331/-**	**10,000,000/-**

2. All E-bids must be accompanied by a Bid-Security of the estimated price as mentioned in the above, in the name of "Punjab Rural Municipal Services Company", and in the form of CDR/ Bank Guarantee.

3. Original Bid Security instrument must be submitted in an envelope clearly marked with the Tender Title, before the E-bid Submission deadline at the Office of: **Punjab Rural Municipal Services Company.**

4. The bidders shall complete and authenticate their complete E-bids (by uploading PDF File) and it must be submitted online on e-Procurement System (EPADS) website i.e. https://punjab.eprocure.gov.pk as per the following schedule:

Pre-Bid Meeting Date, Time & Place	**04 August, 2025** at **12:00 PM** **Punjab Rural Municipal Services Company** **https://us06web.zoom.us/j/83341654081?pwd=DhHTFx58DG6g0Ql6MrKRxPjd0vNOfj.1** **Meeting ID: 833 4165 4081** **Passcode: 585737**
E-Bids submission Date & Time	**12 August, 2025** at **12:00 PM**
E-Bids opening Date & Time	**12 August, 2025** at **12:30 PM**

5. In case e-bid or proposal including record submitted on the e-PADS found corrupt, un-readable or contain virus, the e-bid or proposal shall be rejected.

6. Single stage two envelopes bidding procedure will be adopted. Submission of encrypted electronic file shall be deemed submission in "envelope" as mentioned in the rules

7. Only technically responsive bidder(s) will be qualified for opening of financial bid(s). Financial bid(s) of bidder(s) found technically nonresponsive shall remain unopened in the e-PADS.

8. The procuring Authority may reject all bids or proposals at any time prior to the acceptance of a bid or proposal under Punjab PP Rules 2014 **(Rule-35)**.

9. Conditional tender will not be accepted.

10. Tendered rates and amount should be filled in figures as well as in words.

11. In case, the last date of bid submission falls in / within the official holiday(s), the last date for submission of the bids shall be the next working day.

12. The bids will be valid for 120 days.

13. Bidders are advised to ensure uploading the Bid on E-PADS Portal, well before the submission deadline, and not wait for the last date and time to upload the bid. Bid submission on E-PADS Portal shall entirely be the responsibility of the bidder. Punjab Rural Municipal Services Company shall not be held responsible for any issue thereof. For any assistance regarding E-PADS Portal, system support email and phone numbers are provided hereunder:

E-PADS Helpline: 051-111-137-237

CHIEF EXECUTIVE OFFICER

PUNJAB RURAL MUNICIPAL SERVICES COMPANY (PRMSC)

5th Floor, KD Plaza, MM Alam Road, Lahore

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

A. GENERAL

IB.1 Scope of Bid

The Client "Punjab Rural Municipal Services Company" intends **"CONSTRUCTION OF 03 LOW-COST WASTE WATER TREATMENT PLANTS"**

Identification and number of Contract is: PRMSC/E-PADS/01-2025

IB.2 Source of Funds

2.1 The Source of fund is mentioned in bidding data.

IB.3 Eligible Bidders

3.1 The bidder (Firm/ Joint Venture) for the aforementioned bid must fulfill the basic eligibility criteria as per Appendix–M to Bid.

Sub-Clause 3.1

This Invitation for Bids is open to all bidders meeting the following requirements:

I. Registered with the registration system available on the e-PADS.

II. Registered with tax authorities & who are on Active Taxpayers list of FBR & PRA for NTN, STRN and PNTN.

III. Submission of Original Bid Security instrument in the shape of CDR / Bank Guarantee from any Scheduled Bank in Pakistan, in favor of **Punjab Rural Municipal Services Company** for amounting to **Rs. 10,000,000/-** in hard form, at the office of undersigned situated at **PRMSC, 5th Floor, KD Plaza, MM Alam Road, Lahore,** up till **12th August 2025 till 11:30 am**.

IV. A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be non-responsive. A Bidder may be considered to have a conflict of interest with one or more parties in this Bidding process, if they:

i. are associated or have been associated, directly or indirectly with a firm or any of its affiliates which have been engaged by the Procuring Agency to provide consulting services for the preparation of the design and other documents to be used.

ii. have controlling shareholders in common; or

iii. receive or have received any direct or indirect subsidy from any of them; or

iv. have the same legal representative for purposes of this Bid; or

v. 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 Procuring Agency regarding this Bidding process;

IB.4 One Bid per Bidder

4.1 Each bidder shall submit only one bid either by himself, or as a partner in a joint venture. A bidder who submits or participates in more than one bid (other than alternatives pursuant to Clause IB.16) will be disqualified.

IB.5 Cost of Bidding

5.1 The Bidder shall bear all costs associated with the preparation and submission of their respective Bids and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

IB.6 Site Visit

6.1 The Bidders are advised to visit and examine the Site of Works and its surroundings and obtain for themselves on their own responsibility all information that may be necessary for preparing the Bid

and entering into a contract for construction of the Works. All cost in this respect shall be at the Bidder's own expense.

6.2 The Bidders and any of their personnel or agents would be free to visit site for the purpose of such inspection, but only upon the express condition that the Bidders, their personnel and agents, will release and indemnify the Employer, his 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 such inspection.

B. BID DOCUMENTS

IB.7 Documents Comprising the Bid

7.1 The Bid Documents are those stated below and should be read in conjunction with any Addenda issued in accordance with Clause IB.9.

1. Instructions to Bidders
2. Bidding Data Sheet
3. Special Stipulations
4. Form of Bid & Appendices to Bid
5. Price Schedule (Appendix-D to Bid)
6. Form of Bid Security
7. Form of Contract Agreement
8. Forms of Performance Guarantee and Mobilization Advance Guarantee and Form of Indemnity Bond for Secured Advance
9. Special Provisions
10. Environment Social Management & Mitigation Plan

7.2 The Bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of Bid submission will be at the Bidders own risk. Pursuant to Clause IB.26, Bids which are not substantially responsive to the requirements of the Bid Documents will be rejected. Furthermore, the Employer is not responsible for the completeness of the Bidding Documents and its addenda (if any) if these were incorrectly downloaded / printed from website of the Authority, E-PADS, PPRA website and Punjab Rural Municipal Services Company's' website.

IB.8 Clarification of Bid Documents

8.1 The e-PADS contains a mechanism for clarifications. A prospective Bidder requiring any clarification of the Bidding documents may notify the Procuring Agency on e-PADS. The Procuring Agency will respond on e-PADS to any request for clarification of the Bidding documents which it receives no later than seven (7) days prior to the deadline for the submission of e-Bids prescribed in the Bid Data Sheet.

8.2 The Procuring Agency will within three (3) working days after receiving the request for clarification, respond on e-PADS to any request for clarification provided that such request is received not later than seven (7) days prior to the deadline for the submission of Bids.

IB.9 Amendment of Bid Documents

9.1 At any time prior to the deadline for submission of Bids, but not later than three (3) days before the closing time of the submission of Bid, the Procuring Agency, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, may modify the Bidding documents by amendment. Any such change/amendment in the Bidding documents shall be provided in a timely manner on e-PADS, not later than three (3) days, and on equal opportunity basis as per Rule-25(3) of PPR-14.

9.2 All prospective Bidders that intend to participate in Bidding process will be notified of the amendment on e-PADS, and the amendments will be binding on them.

9.3 Any addendum issued including the notice of any extension of the deadline shall be part of the

Bidding Documents and shall be uploaded on e-PADS.

9.4 In order to allow prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Procuring Agency, at its discretion, may extend the deadline for the submission of Bids, as per rule 29 of PPR-14, in the manner similar to the original advertisements, so as to avoid any inconvenience and to doubly ensure level playing field for all prospective bidders.

C. PREPARATION OF BIDS

IB.10 Language

10.1 The Bid and all correspondence and documents related to the Bid exchanged by a Bidder and the Employer shall be in the bid language stipulated in the Bidding Data Sheet and conditions of Particular Application. Supporting documents and printed literature furnished by the Bidders may be in any other language provided the same are accompanied by an accurate translation of the relevant parts in the English language, in which case, for purposes of evaluation of the Bid, the English translation shall prevail.

IB.11 Documents Accompanying the Bid

11.1 Submission of encrypted electronic file shall be deemed submission in "envelope" or "package" as mentioned in the rules.

11.2 Electronic signatures, individual identification, and encryptions generated by the approved system shall suffice to meet the requirement of the rules with respect to the signing and sealing of the documents.

11.3 The Bid shall comprise two portions (Technical + Financial) submitted simultaneously, one called the Technical Bid and the other the Financial Bid, containing the documents listed in Bidding Data Sheet. Each bidder shall furnish all the documents as specified in Bidding Data Sheet.

11.4 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 (in line with PEC JV modalities). The role to be played by each partner to be specified therein**;** and, the concerned partner should have the requisite qualification/ experience to successfully execute the assigned task. Bids submitted by a joint venture of two (2) or more firms shall also comply with the following requirements:

(a) In case of a successful bid, the Form of JV Agreement shall be signed so as to be legally binding on all partners within 7 days of the receipt of letter of acceptance failing which the contract and the letter of acceptance shall stand void and redundant.

(b) One of the joint venture partners shall be nominated as being in charge/ lead partner; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners;

(c) The partner-in-charge/ lead partner shall always be duly authorized to deal with the Employer regarding all matters related with and/or incidental to the execution of Works as per the terms and Conditions of JV Agreement and in this regard to incur any and all liabilities, receive instructions, give binding undertakings and receive payments on behalf of the joint venture;

(d) All partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the Contract terms; and, a statement to this effect shall be included in the authorization mentioned under Sub-Para (b) above as well as in the Form of Bid and in the Form of JV Agreement (in case of a successful bid); and

(e) A copy of JV agreement shall be submitted before signing of the Contract, stating the conditions under which JV will function, its period of duration, the persons authorized to represent and obligate it and which persons will be directly responsible for due

performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. The JV Agreement shall be made part of the contract. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partners without prior written consent of the Employer.

11.5 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 Bidding Forms, in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time referred to in Sub-Clause 1.2 hereof.

IB.12 Bid Prices

12.1 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in IB 1.1 hereof, based on the unit rates and / or prices submitted by the bidder.

12.2 The bidders 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 a bidder will not be paid for by the Employer when executed and shall be deemed covered by rates and prices for other items in the Bill of Quantities.

12.3 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date of opening of the bids shall be included in the rates and prices and the total Bid Price submitted by a bidder.

Additional / reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed / deducted as per the General Conditions of Contract.

12.4 Escalation shall be in accordance with the instructions issued by the Government of Punjab from time to time.

12.5 Sales Tax to the extent as provided in the Punjab Sales Tax on Services (Withholding) Rules 2015 shall be deducted and withheld from payment to be made to the service provider for depositing with the Government of Punjab.

IB.13 Currencies of Bid and Payment

13.1 The unit rates and the prices shall be quoted by the bidder entirely in Pak rupees. All payments to the bidders shall be made in Pak Rupees only and no foreign currency payment is admissible

IB.14 Bid Validity

14.1 Bids shall remain valid for the period stipulated in the Bidding Data Sheet after the Date of Bid Opening specified in sub-clause IB.23.

14.2 In exceptional circumstances, prior to expiry of the original Bid validity period, the Employer may request that the Bidders extend the period of validity for a specified additional period which shall in no case be more than the original bid validity period or 180 days whichever is more. The request and the responses thereto shall be made in writing. A Bidder may refuse the request without forfeiting his Bid Security. A Bidder agreeing to the request will not be required or permitted to modify his Bid, but will be required to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.15 in all respects. Rule 28 of PPR-14 shall be applicable for Bid Validity period.

IB.15 Bid Security

15.1 The Bidder shall submit, as part of its bid, hard copy of the financial instrument in addition to the soft copy uploaded on e-PADS as bid security of the amount specified in the Bid Data Sheet.

15.2 The Bid security shall be in Pakistan Rupees and shall be in form of CDR / Bank Guarantee from any Scheduled Bank in Pakistan, in favor of **Punjab Rural Municipal Services Company** valid for **28-days**, beyond the validity of Bid.

15.3 Any Bid for which bid security isn't received in hard form at the office of PRMSC before E-bid submission deadline may be rejected by the Procuring Agency as non-responsive.

15.4 The Bid security of unsuccessful bidder shall only be released upon the hard copy by adopting the following mechanism:

a) Written request certifying that bidder has no objection or grievance against the Procurement process.

b) Time for grievance period as provided by Punjab Procurement Rules-2014 has expired.

c) If he filed a grievance and same is dismissed by the Grievance Committee.

15.5 The successful Bidder's Bid security shall only be released upon the hard copy subsequent to the Bidder signing the contract and furnishing the Performance Guarantee.

15.6 The Bid Security may be forfeited:

a) If the bidder withdraws his bid except as provided in IB 22.1;

b) If the bidder does not accept the correction of his Bid Price pursuant to IB 27.2 hereof; or

c) In the case of successful bidder, if he fails within the specified time limit to:

i. Furnish the required Performance Guarantee;

ii. Sign the Contract Agreement, or

iii. Furnish the required JV agreement within 7 days of the receipt of letter of acceptance.

IB.16 Alternate Proposals by Bidder

16.1 Not Applicable

IB.17 Pre-Bid Meeting

17.1 The Employer may, on his own motion or at the request of any prospective bidder(s), hold a pre-bid meeting to clarify issues and to answer any questions on matters related to the Bidding Documents. The date, time and venue of pre-bid meeting, if convened, is as stipulated in the Bid data sheet. All prospective bidders or their authorized representatives shall be invited to attend such a pre-bid meeting.

17.2 The bidders are requested to submit questions, if any, in writing so as to reach the Employer not later than three (3) days before the proposed pre-bid meeting.

17.3 Minutes of the pre-Bid meeting, if applicable, including the text of the questions asked by Bidders, including those during the meeting (without identifying the source) and the responses given, together with any responses prepared after the meeting will be uploaded promptly on e-PADS for all prospective Bidders who intend to participate in the Bidding. Any modification of the Bidding Documents listed in IB 7.1 hereof, which 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 Clause IB.9 and not through the minutes of the pre-bid meeting.

17.4 Absence at the pre-bid meeting will not be a cause for disqualification of a bidder.

IB.18 Format and Signing of Bid

18.1 The procuring agency doesn't require the submission of hard copies of the bids. All the e-bids shall be submitted on the e-PADS in the manner as specified in the advertisement and the bidding documents.

18.2 Electronic signatures, individual identification, and encryptions generated by the approved system shall suffice to meet the requirement of the rules with respect to the signing and sealing of the documents.

18.3 In case e-bid or proposal including record submitted on the e-PADS found corrupt, un-readable or contain virus, the e-bid or proposal shall be rejected.

18.4 The Bidder shall furnish information as described in the Form of Bid on commissions or gratuities, if any, paid or to be paid to agents relating to this Bid and to contract execution if the Bidder is awarded the contract.

18.5 Bidders are particularly directed that the amount entered on the Letter of Financial Bid shall be for performing the Contract strictly in accordance with the Bidding Documents.

18.6 All appendices to Bid are to be uploaded after being properly completed and signed.

18.7 No alteration is to be made in the Financial Bids nor in the Appendices thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the bid may be rejected.

D. SUBMISSION OF BIDS FOR SINGLE STAGE TWO ENVELOPE PROCEDURE

IB.19 Sealing and Marking of Bids

19.1 **Single stage two envelopes** bidding procedure will be adopted by using **uploading files** on EPADS

19.2 Submission of encrypted electronic file shall be deemed submission in "envelope" or "package" as mentioned in the rules.

19.3 Electronic signatures, individual identification, and encryptions generated by the approved system shall suffice to meet the requirement of the rules with respect to the signing and sealing of the documents.

19.4 Each Bidder shall submit his Bid as under:

(a) ORIGINAL Electronic Bid on EPADS shall be submitted.

(b) The ORIGINAL bid will be addressed / identified as given in Sub- Clause 19.2 hereof.

(c) The technical bid should comprise of documents listed in IB11.1 (A) & the Financial Bid should comprise of documents listed in IB 11.1 (B) which shall be placed in separate files in accordance with IB 11.1.

19.5 The Bid Security shall;

(a) Be addressed to the Employer at the address provided in the Bidding Data Sheet.

(b) Bear the name and identification number of the contract as defined in the Bidding Data Sheet, and;

19.6 In addition to the identification required in IB 19.2 hereof, the envelope shall indicate the name and address of the Bidder to enable the Bid Security to be returned unopened in case it is declared "late" pursuant to Clause IB.21.

19.7 If the bid is not marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids

20.1 The complete E-bids must be submitted online on e-Procurement System (EPADS) website i.e. https://punjab.eprocure.gov.pk no later than the time and date specified in the Bid Data Sheet.

20.2 The bidder shall complete and authenticate his e-bid or proposal and submit it within time.

20.3 The Employer may, at his discretion, extend the deadline for submission of Bids by issuing an amendment in accordance with Clause IB.9, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.21 Corrupt, un-readable or virus containing e-bid

21.1 In case e-bid or proposal including record submitted on the e-PADS found corrupt, unreadable or contain virus, the e-bid or proposal shall be rejected.

IB.22 Modification and Withdrawal of Bids

22.1 The Bidder shall be allowed to alter or modify or withdraw his e-bid or proposal before the closing time for submission of the e-bid or proposal.

22.2 No e-Bid may be modified after the deadline for submission of e-Bids.

22.3 No e-Bid may be withdrawn in the interval between the deadline for submission of e-Bids and the expiration of the period of Bid validity specified by the Bidder on the Bid Form. Withdrawal of a Bid during this interval through written notice may result in the Bidder's forfeiture of its Bid security (along with other remedies available under PPR-14).

22.4 Revised e-bid may be submitted after the withdrawal of the original e-bid before the deadline for submission of e-Bids.

E. BID OPENING AND EVALUATION SINGLE STAGE TWO ENVELOPE PROCEDURE

IB. 23 Bid Opening

23.1 **Single stage two envelopes** bidding procedure will be adopted by using **uploading files** on EPADS. The Employer will open the Technical Bids as per Punjab Procurement Regulations 2024. The Financial Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening as per ibid regulations.

23.2 Pre-liminary Examination of Technical Bids

(a) The Employer shall first examine qualification and experience Data as per appendix M and N submitted by the Bidder. The technical proposal examination of those bidders only shall be taken in hand who meet the minimum requirement as mentioned in appendix M and N. Only substantially responsive qualification shall be considered for further evaluation.

(b) The Employer shall examine the Technical Bid to confirm that all the documents have been provided, and to determine the completeness of each document submitted

23.3 The Employer shall confirm that all the documents and information have been provided for evaluation of Technical bid as required under these bidding documents.

23.4 At the end of the evaluation of the Technical Bids, the Employer will upload the evaluation on EPADS, PPRA and PUNJAB RURAL MUNICIPAL SERVICES COMPANYs' website regarding those bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Financial Bids. The date, time, and location of the opening of Financial Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice for the opening of Financial Bids.

23.5 The Employer will upload the evaluation on EPADS, PPRA and PUNJAB RURAL MUNICIPAL SERVICES COMPANYs' website regarding their Technical Bids being substantially non-responsive to the requirements of the Bidding Document and return their Financial Bids unopened before inviting others, who are determined as being qualified, to attend the opening of Financial Bids.

23.6 The Employer shall conduct the opening of Financial Bids of all Bidders who submitted substantially responsive Technical Bids, on EPADS.

23.7 Financial Bids shall be opened as per Punjab Procurement Regulations 2024:
Only Financial Bids and discounts, read out and recorded during the opening of Financial Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Financial Bids.

23.8 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 is that which is most economical to the Employer.

IB.24 Process to be Confidential

24.1 Information relating to the examination, clarification, evaluation and comparison of bid and recommendations for the award of a contract shall not be disclosed to bidders or any other person not officially concerned with such process before the announcement of bid evaluation report which shall be done at least ten (10) days prior to issue of Letter of Acceptance. The announcement to all Bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the bids evaluated. Any effort by a bidder to influence the Employer's processing of bids or award decisions may result in the rejection of such bidder's bid. Whereas any bidder feeling aggrieved may lodge a written complaint not later than ten (10) days after the announcement of the bid evaluation report; however mere fact of lodging a complaint shall not warrant suspension of the procurement process.

IB.25 Clarification of Bids

25.1 As per rule 33(2) of PPR-14, to assist in the examination, evaluation and comparison of Bids and post-qualification of the Bidders, the Procuring Agency may, at its discretion, ask any Bidder for a clarification of its Bid including breakdown of prices. Any clarification submitted by a Bidder that is not in response to a request by the Procuring Agency shall not be considered.

25.2 The request for clarification and the response shall be through e-PADS.

25.3 The alteration or modification in The Bid which in any way affect the following parameters will be considered as a change in the substance of a bid:

a) Evaluation & qualification criteria;
b) Required scope of operation and maintenance services and related materials;
c) All securities requirements;
d) Tax requirements;
e) Terms and conditions of bidding documents.
f) Change in the ranking of the Bidder

25.4 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. Rule 33 of PPR-14 shall be applicable for clarifications.

IB.26 Examination of Bids and Determination of Responsiveness

26.1 Prior to the detailed evaluation of bids, the Employer will determine whether each bid is substantially responsive to the requirements of the basic eligibility stipulated in the Bidding Documents.

26.2 If a bid is not substantially responsive, it may not subsequently be made responsive by correction or withdrawal of the non-conforming material deviation or reservation. The Employer may, however, seek confirmation/ clarification through e-PADS which shall be provided on e-PADS.

IB.27 Correction of Errors

27.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

(a) Where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; and

(b) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected.

27.2 The amount stated in the Letter of Financial Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected Bid Price, his Bid will be rejected, and the Bid Security shall be forfeited in accordance with IB.15.6 (b) hereof.

IB.28 Evaluation and Comparison of Bids

28.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause IB.26.

28.2 In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:

(a) Making any correction for errors pursuant to Clause IB.27;

(b) Excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced Day work; and

(c) Making an appropriate adjustment for any other acceptable variation or deviation.

28.3 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.

F. AWARD OF CONTRACT

IB.29 Award

29.1 Subject to Clauses IB.30 and IB.34, the Employer will award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price**,** provided that such bidder has been determined to be eligible in accordance with the provisions of Clause IB.3 and qualify pursuant to IB 29.2.

29.2 The Employer, at any stage of the bid evaluation, having credible reasons for or *prima facie* evidence of any defect in Bidder's capacities, may require the bidders to provide information concerning their professional, technical, financial, legal or managerial competence whether already pre-qualified or not:

Provided that such qualification shall only be laid down after recording reasons in writing. They shall form part of the records of that bid evaluation report.

IB.30 Employer's Right to Accept any Bid and to Reject any or all Bids

30.1 Notwithstanding Clause IB.29, 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 award of Contract, without thereby incurring any liability to the affected bidders or any obligation except that the grounds for rejection of all bids shall upon request be communicated to any bidder who submitted a bid, without justification of grounds. Rejection of all bids shall be notified to all bidders promptly.

IB.31 Notification of Award

31.1 Prior to expiration of the period of bid validity prescribed by the Employer, the Employer will notify the successful bidder in writing ("Letter of Acceptance") that his Bid has been accepted. This letter shall name the sum which the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called the "Contract Price").

31.2 No Negotiation with the bidder having evaluated as lowest responsive or any other bidder shall be permitted, However, the lowest evaluated bidder may further reduce the Bid Price voluntarily without compromising the quality/ quantity.

31.3 The notification of award and its acceptance by the bidder will constitute the formation of the

Contract, binding the Employer and the bidder till signing of the formal Contract Agreement.

31.4 The procuring agency and the successful bidder shall sign the contract manually. A signed copy of the Contract Agreement, where applicable, shall also be uploaded on the e-PADS.

31.5 The successful bidder or contractor, if required, shall submit hard copy of the financial instrument in addition to the soft copy uploaded on e-PADS as performance guarantee. The performance guarantee shall only be released upon the hard copy.

31.6 Upon furnishing by the successful bidder of a Performance Guarantee, the Employer will promptly notify the other bidders that their Bids have been unsuccessful. No bid security can be returned without exhausting the grievance period or without finally disposing off the complaint of the non-responsive bidder. However, bid security may be returned earlier if any bidder submits affidavit that he is satisfied with the proceedings and hence his bid security may be returned.

IB.32 Performance Guarantee

32.1 Within fifteen (15) days of the receipt of notification of award from the Procuring Agency, the successful Bidder shall furnish hard copy of the financial instrument in addition to the soft copy uploaded on e-PADS of the Performance Guarantee in accordance with the Conditions of Contract, in the Performance Guarantee Form provided in the Bidding documents, or in another form acceptable to the Procuring Agency.

32.2 Failure of the successful bidder to comply with the requirements of IB.32.1 or IB.33 or IB.35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security along with other remedies available under PPR-14. After that, the Procuring Agency may decide to award the contract to the next lowest evaluated Bidder, keeping in view the Bid validity time, or call for new Bids keeping in view the concept of value for money as defined under rule-2(ae) read with Principles of Procurement as enunciated in rule-4 of PPR-14.

IB.33 Signing of Agreement

33.1 Within 14 days from the date of furnishing of acceptable Performance guarantee under the Conditions of Contract, the Employer will send the successful bidder the Contract Agreement in the form provided in the Bidding Documents, incorporating all agreements between the parties.

33.2 The formal Agreement between the Employer and the successful bidder shall be executed manually within 14 days of the receipt of the Contract Agreement by the successful bidder from the Employer. A signed copy of the Contract Agreement, where applicable, shall also be uploaded on the e-PADS.

IB.34 General Performance of the Bidders

34.1 The Employer reserves the right to obtain information regarding performance of the bidders on their previously awarded contracts/works. The Employer may in case of consistent poor performance of any Bidder as reported by the employers of the previously awarded contracts, inter-alia, reject his bid and/or refer the case to the Pakistan Engineering Council (PEC). Upon such reference, PEC in accordance with its rules, procedures and relevant laws of the land take such action as may be deemed appropriate under the circumstances of the case including black listing of such Bidder and debarring him from participation in future bidding for similar works.

34.2 The Successful Contractor/Joint Venture shall comply with and acquire all consents, approvals, permits and licenses applicable under the laws of Pakistan in relation to the performance of the work & services.

IB.35 Integrity Pact

35.1 The Bidder shall sign and stamp the Integrity Pact provided at Appendix-L to Bid in the Bidding Documents for all Federal / Provincial Government procurement contracts exceeding Rupees ten million. Failure to provide such Integrity Pact shall make the bidder non-responsive.

IB.36 Instructions not Part of Contract

36.1 Bids shall be prepared and submitted in accordance with these Instructions which are provided to assist bidders in preparing their bids, and do not constitute part of the Bid or the Contract Documents. Submission of Bids shall be construed as evidence that the bidder has admitted all provisions of the Instruction to the Bidders.

IB.37 PPRA Act, 2009 and PPR-14 will have over-riding effect

37.1 PPRA Act, 2009 and PPR-14 as amended upto date will supersede and will have an over-riding effect in case in case of any contradiction with these Instructions, the Contract or any other part of the Bidding Documents.

37.2 General Directions for Tenders and general conditions of contract issued from Finance Department Government of Punjab shall be applicable. In case of any inconsistency with Punjab Procurement Rules & Regulations, the latter shall prevail.

BIDDING DATA SHEET

BID DATA SHEET

The following specific data for the Works to be bid shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders.

1.1 Name and address of the Employer:

Punjab Rural Municipal Services Company
5th Floor, KD Plaza, MM Alam Road, Lahore
042-99333613
E-mail: proc.prmsc@punjab.gov.pk

Name of the Project & Summary of the Works:

CONSTRUCTION OF 03 LOW-COST WASTE WATER TREATMENT PLANTS

The Client "Punjab Rural Municipal Services Company"

Identification and number of Contract is: PRMSC/E-PADS/01-2025

The procurement shall be National Competitive Bidding based on Single Stage One Envelope Bidding Procedure on e-PADS (by uploading PDF File) as per Punjab Procurement Rules 2014 and e-Procurement Regulations issued from time to time.

Summary of Works

The work included in this Contract are as follows but not limited to these items only.

A. WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

SR. NO	DESCRIPTION
1	SEWAGE TREATMENT PLANT
2	FISH POND
3	CHEMICAL ROOM
4	OFFICE BUILDING
5	TREE PLANTATION
6	BOUNDARY WALL AND MAIN GATE
7	ELECTRIFICATION
8	CCTV CAMERA (SCADA)
9	MONITORING PROBS
10	SOLAR SYSTEM

B. WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

SR. NO	DESCRIPTION
1	ANAEROBIC AND FACULTATIVE PONDS
2	STAFF BUILDING
3	CHEMICAL ROOM
4	DISINFECTION TANK AND COLLECTION CHAMBERS
5	FISH POND
6	TREE PLANTATION
7	ELECTRIFICATION

8	MAIN GATE AND BOUNDARY WALL
9	CCTV CAMERA (SCADA)
10	MONITORING PROBS
11	SOLAR SYSTEM

C. WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

SR. NO	DESCRIPTION
1	PRIMARY SEDIMENTATION TANK (PST) (01 NOS)
2	TRICKLING FILTER (01 NOS)
3	SECONDARY SEDIMENTATION TANK (SST) (01 NOS)
4	SLUDGE THICKENER (ST) (1 NOS)
5	PUMPING PIT (01 NOS)
6	SLUDGE PUMPING STATION (SPS) (03 NOS)
7	INTERNAL/YARD PIPING
8	SLUDGE DRYING BED
9	ACCESS AND INTERNAL ROADS
10	STAFF BUILDING
11	DISINFECTION TANK & VALVE CHAMBERS
12	CHEMICAL BUILDING
13	FISH POND
14	TREE PLANTATION
15	MAIN GATE AND BOUNDARY WALL
16	RCC DRAIN
17	ELECTRICAL WORK
18	CCTV CAMERA (SCADA)
19	MONITORING PROBS
20	SOLAR SYSTEM

2.1 Source of Funds:

The Project is funded by Environment Protection & Climate Change Department, Government of Punjab through PGDP.

8.1 Time limit for clarification:

At least 07 days prior to the date of submission of bids.

10.1 Bid language:

The language of bid and all correspondence related thereto shall be English.

11.1 The Bidder shall submit with its Technical Bid the following documents:

(a) Letter of Technical Bid
(b) Bid Security (IB.15)
(c) Written confirmation authorizing signatory of the bid to commit the Bidder. (IB 18.5)
(d) Pending litigation information.
(e) Special Stipulations Appendix-A
(f) Proposed Construction Schedule Appendix-E
(g) Method of Performing the work Appendix-F
(h) Availability of Critical Equipment Appendix-G
(i) Construction Camp and Housing Facilities Appendix-H

(j) List of Sub-Contractor — Appendix-I
(k) Organization Chart for Supervisory Staff — Appendix-K
(l) Integrity Pact — Appendix-L
(m) Eligibility Criteria — Appendix-M1&M2
(n) Qualification Criteria — Appendix-N

B) The Bidder shall submit with its Financial Bid the following documents:
(o) Letter of Financial Bid
(p) Bill of Quantities
(q) Bid Security
(r) Price Schedule — Appendix-D
(s) Estimate Progress Payment — Appendix-J

13.1 The unit rates and the prices shall be quoted by the Bidder entirely in Pakistani Rupees and likewise payments will also be made entirely in Pakistani Rupees.

14.1 **Period of Bid Validity:**

Bids shall remain valid for a period of 120 days from the deadline for submission of Bids.

15.1 **Amount of Bid Security**:

Rs. 10,000,000/-
The bids must be accompanied with Bid Security for the Project in the form of CDR/Bank Guarantee of amount Specified above in the name of the undersigned from a Scheduled Bank of Pakistan. No bid security in cash will be accepted. Original Bid Security instrument must be submitted in an envelope clearly marked with the Number and Title, before the E-bid Submission deadline at: Punjab Rural Municipal Services Company Office.

17.1 Venue, time, and date of the pre-Bid meeting:

The pre bid meeting with bidders and their authorize representatives will be held on 04 August, 2025 at 12:00 PM in the office of PUNJAB RURAL MUNICIPAL SERVICES COMPANY or any other date or time which may separately be notified by the Client to clarify the issues and to answer any questions on matters related to bid documents.
Committee Room of Punjab Rural Municipal Services Company, 5th Floor, KD Plaza, MM Alam Road, Lahore

For Online Participants:
https://us06web.zoom.us/j/83341654081?pwd=DhHTFx58DG6g0Ql6MrKRxPjd0vNOfj.1
Meeting ID: 833 4165 4081
Passcode: 585737

19.2 (b)Name and Number of the Contract:

As per clause 1.1

20.1 (a)Deadline for submission of e-bids on e-PADS:

12:00 PM on 12-August-2025

23.1 Venue, time, and date of Bid opening:

The bids will be opened on e-PADS at:
Committee Room of Punjab Rural Municipal Services Company, 5th Floor, KD Plaza, MM Alam Road, Lahore

12:00 PM on 12-August-2025

32.1 Delete the text sub-clause 32.1 and substitute with the following: -
The Performance Guarantee shall be 05% of Contract Amount mentioned in the Letter of Acceptance on the prescribed form10 [PS-1] in shape of Bank Guarantee from any Scheduled Bank in Pakistan in favor of the Punjab Rural Municipal Services Company.

Add at the end of Sub-Clause 32.2:

Next lowest Bidder

In the event, the Performance Guarantee is not provided by the lowest bidder, and the award is annulled, 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.

36 **Instructions not part of Contract:**

Fraud and Corrupt Practices:

Bidders and their sub-contractors under contracts must observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the Employer:

a) Defines, for the purposes of this provision, the terms set forth below are defined as follows:
   - "Corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party.
   - "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
   - "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;
   - "Collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.
   - obstructive practice" means (a) deliberately destroying· falsifying· altering· or concealing of evidence material to an investigation by the Employer; making false statements to investigators in order to materially impede an investigation by the Employer; (c) failing to comply with requests to provide information· documents· or records in connection with an office of Anticorruption investigation; (d) 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 (e) materially impeding the Employer's contractual rights of audit or access to information
   - "Integrity violation" is any act which violates the Government's Anticorruption Policy· including (i) to (v) above and the following: abuse, conflict of interest· violations of the Government sanctions, retaliation against whistleblowers or witnesses· and other violations of the Government's Anticorruption Policy including failure to adhere to the highest ethical standard.

b) will reject any Bid/proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive,

coercive, or obstructive practices or other integrity violations in competing for the Contract;

c) will cancel the contract if it determines at any time that its representatives or those of the Bidder were engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the selection process or the execution of the Contract; and

d) will sanction bidders or its successor including declaring ineligible, either indefinitely or for a stated period of time, to participate in bidding activities in Pakistan 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 Contract

e) Will have the right to require that consultants permit the Government or its appointed agent to inspect their accounts and records and other documents relating to the submission of proposals and contract performance and to have them audited by auditors appointed by the government.

FORM OF BID
AND
APPENDICES TO BID

Letter of Technical Bid

Date:
Bid Reference No:
(Name of Contract/Works): ……..

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 (IB) 9;

We offer to execute and complete in conformity with the Bidding Documents the following Works: **"CONSTRUCTION OF 03 LOW-COST WASTE WATER TREATMENT PLANTS"**

(a) Our Bid consisting of the Technical Bid and the Financial Bid shall be valid for a period of 120 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;

(b) As security for due performance of the under takings and obligations of our bid, we submit here with a Bid security, in the amount specified in Bidding Data Sheet, which is valid (at least) 30 days beyond validity of Bid itself.

(c) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process, other than alternative offers submitted in accordance with IB16 (as applicable).

(d) We agree to permit Employer or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors. This permission is extended for verification of any information provided in our Technical Bid which comprises all documents enclosed herewith in accordance with IB.11.1 of the Bidding Data Sheet.

Name .....

In the capacity of .....

Signed .....

.....

Duly authorized to sign the Bid for and on behalf of .....

Date .....

.....

Address……..

Letter of Financial Bid

Date:
Bid Reference No:
(Name of Contract/Works): ……..
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 (IB)9;

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

_____

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

_____

(d) Our Bid shall be valid for a period of 120 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;

(e) If our Bid is accepted, we commit to obtain a Performance Guarantee and Quality Assurance Security in accordance with the Bidding Documents;

(f) 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 we do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other bidder for the Works.

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

(h) We agree to permit Employer or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors. This permission is extended for verification of any information provided in our Technical Bid which comprises all documents enclosed herewith in accordance with IB.11.1 of the Bidding Data Sheet.

(i) 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 .....

Address……..

Appendix-A to Bid

SPECIAL STIPULATIONS
Clause
Conditions of Contract

1.	The Engineer's (Consultant) Authority to issue Variation in emergency	**2% of the Contract Price** stated in the Letter of Acceptance with the written approval of client.
2.	Law applicable	The relevant laws applied in the Province of Punjab.
3.	Amount of Performance Guarantee	The Performance Guarantee shall be **05%** of **Contract Amount** mentioned in the Letter of Acceptance on the prescribed form [PS-1] in the shape of Bank Guarantee from any Scheduled Bank in Pakistan in favor of the Punjab Rural Municipal Services Company.
4.	Time for Furnishing Work Programme	Within **14 days** from the date of receipt of Letter of Acceptance.
5.	Minimum amount of Third-Party Insurance	The amount of insurance taken out by the Contractor per occurrence with number of occurrences unlimited shall be as follows: a. Bodily injury (any one person) PKR 0.5 (Half) Million (Max) b. Fatal Case (any one person) PKR 01 (one) million (Minimum) c. Property Damages Depending upon nature of loss (100% of the Damage)
6.	Time for Commencement	Within 7 days from the date of receipt of Engineer's Notice to Commence which shall be issued within 14 days after signing of Contract Agreement.
7.	Time for Completion	**06 Months** from the date of Commencement of the Project
8.	a) Amount of Liquidated Damages	**0.1 %** of the Contract Price for each day of delay in completion of the Works subject to a maximum of **10%** of Contract Price stated in the Letter of Acceptance.
	b) Amount of Bonus for early completion	**Not Applicable.**
9.	Defects Liability Period	**365 days** from the effective date of Taking Over Certificate.
10	Percentage of Retention Money	10 % on the amount of work done up to Rs. 5 million and 5 % on the amount of work done beyond 5 million
11	Limit of Retention Money	**05%** of Contract Price stated in the Letter of Acceptance.
12	Minimum amount of Interim Payment Certificates (Running Bills)	Greater than **PKR. Fifty Million (50 million) except last 2 IPC's**
13	Time of Payment from delivery of Engineer's Interim Payment Certificate to the Employer.	30 days
14	List of material	NOT USED

15	Mobilization Advance (Interest Free)	15% of Contract Price as stated in the Letter of Acceptance on the prescribed form [MG-1] in the shape of unconditional Bank Guarantee from any Scheduled Bank in Pakistan in favor of the Punjab Rural Municipal Services Company Advance payment shall be recovered in equal installation over the remaining contract period after one months from the date of receipt of mobilization advance.
16	Environment, Health & Safety	Contractor will be bound to comply the Environmental Health Safety SOPs and Environmental & Social Mitigation for Labor /Construction Workers including Women Workers to fulfill E&S safeguards compliance otherwise, 1% of contractual amount will be forfeited upon Engineer's report from last IPC

NAME OF ELIGIBLE COUNTRIES

All countries of the World with whom Islamic Republic of Pakistan have commercial trade relations**.**

Appendix-B to Bid

FOREIGN CURRENCY REQUIREMENTS

NOT APPLICABLE

Appendix-C to Bid

PRICE ADJUSTMENT

Price adjustment / variation for the materials specified by the Government of Punjab will be paid as per rates issued by Finance department Government of Punjab from time to time and in the line with prevailing rules.

Appendix –D to Bid

BILL OF QUANTITIES

SUMMARY
ABSTRACT OF TENDER PRICE

BOQ ATTACHED

Note: All Provisional Sums are to be expended in whole or in part at the direction and discretion of the Engineer in-charge

Appendix – E to Bid

PROPOSED CONSTRUCTION SCHEDULE

The Works shall be completed on or before the date stated in Appendix-A to Bid. The Bidder shall provide as Appendix-E to Bid his Construction Schedule in the Bar Chart form showing the sequence of work items and the period of time during which he proposes to complete each work item in such a manner that his proposed program for completion of the whole of the Works and parts of the works may meet Employer's completion targets in days noted below and counted from the date of issue of Engineer's Notice to Commence (Bidder to attach sheets as required for the specified form of Construction Schedule):

	Description	**Time for Completion**
a)	Whole Works	_____days
b)	Part-A	_____days
c)	Part-B	_____days
d)	_____	_____days
e)	_____	_____days

Appendix-F to Bid

METHOD OF PERFORMING THE WORK

The Bidder is required to submit a narrative outlining the method of performing the Work. The narrative should indicate in detail and include but not be limited to:

1. Organization Chart indicating head office and field office personnel involved in management and supervision, engineering, equipment maintenance and purchasing.

2. Mobilization at site of works, the type of facilities including personnel accommodation, office accommodation, provision for maintenance and for Storage, communications, security and other services to be used.

3. The method of executing the Works, the procedures for installation of equipment and machinery and transportation of equipment and materials to the site.

4. Quality control/ Quality assurance measures to be adopted including procedures to be followed for carrying out all tests required under specifications.

5. Production of Authorization from Original Equipment Manufacturer.

6. Pre-shipment inspection at the factory premises shall be carried out by an independent Third-Party Firm having specialization in the task and possess the relevant professionals of the field. Third Party Validation Firm (TPV) shall be engaged by the Chief Infrastructure Development if required. The expenses in this connection shall be borne by the Contractor.

7. The Contractor should submit appropriate plans detailing how they intend to coordinate the Works with the ongoing system so that the existing system is not disturbed in any manner, and how they will ensure that the necessary facilities are available to enable it.

Note

- The Bidder shall provide the methods for performing the work in such manner that the works falling under the Construction must be in compliance with the Technical Specifications. These shall form part of and be included at the relevant appendix in the respective Contracts.
- Import documents like bill of lading, custom clearance, Air-way bill, port of shipment etc. will be provided by the contractor to the consultant/employer for verification of imported plants & equipment prior to submit the bill invoice of the same.

Appendix-G to Bid

LIST OF MAJOR EQUIPMENT – RELATED ITEMS

The Bidder will provide a list of all major equipment and related items, under separate heading for items owned, to be purchased or to be arranged on lease by him to carry out the Works. The information shall include make, type, capacity, and anticipated period of utilization for all equipment which shall be in sufficient detail to demonstrate fully that the equipment will meet all requirements of the Specifications.

LIST OF MAJOR EQUIPMENT

Owned Purchased or Leased	Description of Unit (Make, Model, Year)	Capacity HP Rating	Condition	Present Location or Source	Date of Delivery at Site	Period of Work on Project
1	2	3	4	5	6	7
a. Owned						
b. To be Purchased						
c. To be arranged on Lease						

Appendix-H to Bid

CONSTRUCTION CAMPS AND HOUSING FACILITIES

The Contractor in accordance with Clause 34 of the Conditions of Contract shall provide description of his construction camp's facilities and staff housing requirements.

The Contractor shall be responsible for pumps, electrical power, water and electrical distribution systems, and sewerage system including all fittings, pipes and other items necessary for servicing the Contractor's construction camp.

The Tenderer shall list or explain his plans for providing these facilities for the service of the Contract as follows:

1. Site Preparation (clearing, land preparation, etc.).
2. Provision of Services.
   a) Power (expected power load, etc.).
   b) Water (required amount and system proposed).
   c) Sanitation (sewage disposal system, etc.)
3. Construction of Facilities
   a) Contractor's Office. Workshop and Work Areas (areas required and proposed layout, type of construction of buildings, etc.).
   b) Warehouses and Storage Areas (area required, type of construction and layout).
   c) Housing and Staff Facilities (Plans for housing for proposed staff, layout, type of construction, etc.)
4. Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity)
5. Other Items Proposed (Security services, etc.)

Appendix-I to Bid

LIST OF SUBCONTRACTORS

I/We intend to subcontract the following parts of the Work to sub-contractors. In my/our opinion, the sub-contractors named hereunder are reliable and competent to perform that part of the work for which each is listed.

Enclosed are documentation outlining experience of sub-contractors, the curriculum vitae and experience of their key personnel who will be assigned to the Contract, equipment to be supplied by them, size, location and type of contracts carried out in the past.

Part of Works **(Give Details)**	**Sub-Contractor** **(With Complete Address**
1	**2**

Appendix-J to Bid

ESTIMATED PROGRESS PAYMENTS

Note: Appendix – J duly filled by the Contractor should only be included in the **Financial Proposal/Financial Bid.**

Month	**Amounts (Million Rs.)**
1	
Ist	
2nd	
3rd	
4th	
5th	
6th	
Bid Price	

Appendix-K to Bid

ORGANIZATION CHART
FOR THE
SUPERVISORY STAFF AND LABOUR

Appendix-L to Bid

(INTEGRITY PACT)
DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC. PAYABLE BY THE SUPPLIERS OF GOODS, SERVICES & WORKS IN CONTRACTS WORTH RS 10.00 MILLION OR MORE

Contract No._____Dated _____
Contract Value:_____
Contract Title: _____

….....[Name of Supplier] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan (GoP) or any administrative subdivision or agency thereof or any other owned or controlled by GoP through any business practice.

Without limiting the generality of the foregoing, [name of Supplier] represents and warrants that it has fully declared the brokerage, commission, fees, etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bride, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever from GoP, except that which has been expressly declared pursuant hereto.

[Name of Supplier] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with GoP and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[Name of Supplier] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to GoP under any law, contract or other instrument, be voidable at the option of GoP.

Notwithstanding any rights and remedies exercised by GoP in this regard, [name of Supplier] agrees to indemnify GoP for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoP in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Supplier] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever from GoP.

Name of Employer:……..	Name of Contractor:…….
Signature:……	Signature: …….
Seal/Stamp…….	Seal/Stamp…….

Appendix-M to Bid

Eligibility Criteria

C2 & Above with

The Bidders (Firm/ Joint Venture) fulfilling the following basic eligibility criteria shall only be considered for further evaluation. (Relevant documents to be attached):

a) Duly licensed by the Pakistan Engineering Council (PEC) in the category **C2 & Above** with relevant code **CE-09 & CE-10**.
b) In case of Joint Venture, the Lead partner must be registered in the category **C2 & Above** with the relevant codes. No foreign Firm(s) is allowed to participate whether as Single entity or Lead member of JV.
c) Valid legal entity of the bidder / firm/ company e.g. Certificate of registration from SECP or registrar of firms or sole proprietorship affidavit or partnership deed etc.
d) Certificate of registration with active Income Tax & active Sales Tax on Services under Relevant Authority.
e) Affidavit on Non-Judicial Stamp paper for No litigation OR submission of Litigation History of last 10 years.
f) Affidavit declaring "Neither the firms nor its Directors, Stakeholders, as a whole or as a part of the firm have ever been black listed/ defaulted by any government agency department / organization / Donors or settled dispute in plea bargain or Volunteer recovery". PRMSC will check and maintain the record of verification of Blacklisting status of the firm/company/contractor from PPRA website and also from the World Bank debarred/blacklisting list
g) Signed and stamped Integrity Pact as per Appendix-L.

Note: In case of Joint Venture, all the members have to meet in full the afore-mentioned basic eligibility criteria. In case of foreign firm, PEC registration is required before the submission of first IPC.

Appendix-M to Bid

Eligibility Criteria (Part-B)

TECHNICAL SPECIFICATIONS

ATTACHED

Appendix-N to Bid

QUALIFICATION CRITERIA

Technical Evaluation will be based on the criteria given in succeeding paras regarding the Bidder's General Experience, Specific Experience, Personnel Capabilities, Equipment Capabilities and Method Information as demonstrated by the Bidder's responses in the forms attached. The Procuring Agency reserves the right to waive minor deviations, if these don't materially affect the capability of a Bidder to perform the contract. Sub-contractor's experience and resources shall not be taken into account in determining the Bidder's compliance with the qualifying criteria. However, Joint Venture experience & resources shall be considered. Consortium or Association of Contractors will be considered for similar treatment as in case of Joint Venture. The detailed qualification criteria for Evaluation are provided as follows:

Sr. No.	Category	Weightage/Marks
1.	Financial Soundness	30
2.	General & Relevant Experience	45
3.	Personnel Capabilities	15
4.	Equipment Capabilities	10
	Total:	**100**

The applicants must score total 65 marks and at least 50 % marks in each category, to qualify.

SUB CATEGORY A: FINANCIAL SOUNDNESS

For financial soundness, Letter from Banks and audited financial statements for *last five financial years shall be submitted**. if Bank statement (In case of Cash), letter from Banks (In case of Credit Line) & audited financial statements of last three financial years are not attached, no consideration will be given to bidder**.*

Sr. No.	Description	Maximum Marks
i)	Available Cash / Bank Credit Line Limit (or combination of both) **A= Available Cash/Bank Credit Line limit or combination of both (in PKR Million)** **(15 - Marks)**	• Full Marks will be given if "A" is PKR 250 Million or above. • For 'A' less than PKR 250 Million, marks will be awarded as: (A/250) *15 • No Marks will be given if "A" is less than PKR 150 Million. **No marks shall be allotted if Bank statement (In case of Cash) & letter from Bank (In case of Credit Line as proof of Credit Line) is not attached.**
ii)	Minimum Average Annual Construction Turnover in last Three financial years. **A= Average Annual Construction Turnover in last three financial years (in PKR Million)** **(15 - Marks)**	• Full Marks will be given if "A" is PKR 360 Million or above. • No Marks will be given if "A" is less than PKR 360 Million. **No marks shall be allotted if audited financial statements of last three financial years are not attached.**
	Sub-total:	**30**

SUB-CATEGORY B: EXPERIENCE RECORD

Bidder must meet following criteria for evaluation of the experience of the Firm/JV.

Sr. No.	Description	Max. Marks
i)	Projects of General Nature completed over last 1 0 years. a. Max 03-projects having minimum cost Rs. 360 Million each. (General nature project includes buildings, roads, bridges, water supply, water/sewerage treatment and other engineering works.) Each project having above-said minimum cost bracket; will have equal marks. (i.e. 3*5=15)	15
ii)	Projects of similar nature and complexity: a. Max 02-projects of Waste Water Treatment Plants (ABR) having Min Cost Rs. 45 Million each (completed over last 10 years) (2*7.5=15) b. Max 01-project of Waste Water Treatment Plants (Bio-trickling) having Min Cost Rs. 40 Million each (completed over last 10 years) (1*7.5=7.5) c. Max 01-project of Waste Water Treatment Plants (Waste Stabilization Ponds) having Min Cost Rs. 20 Million each (completed over last 10 years) (1*7.5=7.5)	30
	Sub-total:	**45**

The Employer reserves the right the verify the work orders through all means.

SUB-CATEGORY C: PERSONNEL CAPABILITIES

The following key experts at a minimum shall be evaluated:

No personnel will be considered for evaluation if declaration of Professional Staff Employment & availability for this Project **(Form T11-12-13) duly signed by authorized signatory** is not attached. Bidder will also provide **affidavit of employee** on judicial stamp paper.

Bidders will submit the detailed particular of his experts considering that all staff **will serve at site full time during execution of works** In case bidder fails to appoint full time Project Manager at site, a penalty of PKR 100,000 will be imposed on monthly basis and in case bidder fails to appoint full time other supporting staff (all personnel or partly) mentioned below (other than Project Manager) at site, a penalty of Rs. 100,000/- will be imposed on monthly basis.

Sr. No.	Description	Maximum Points
i)	Engineers in employment of the contractor & Registered with PEC a) Minimum 02 Number of Engineers (1 No. Civil & 1 No. Mechanical) b) Experience of Engineers (Minimum 07 years)	 6 3
ii)	Number of Diploma Engineers in Employment of the Contractor a) Number of Sub Engineers having Diploma in Associate Engineering (Min 3 No. Civil) b) Experience of Engineers in number of Years (Minimum 05 -years)	 3 3
	Sub-total:	**15**

Bidders will provide **short CVs,** showing details of experts are desired by highlighting the name of expert, qualification, year of graduation or other degree(s), general experience, specific experience, designation, time of association with this firm. Experience certificates, affidavit of employee on judicial stamp paper. No marks if required documents are not attached.

SUB-CATEGORY D: EQUIPMENT CAPABILITIES

The following Equipment shall be evaluated:

Declaration of ownership/lease of Equipment (Form T- 15) duly signed by authorized signatory shall be attached.
Form T-14 shall be filled along with manufacturer authorization.

No.	Equipment	Minimum Number required	Maximum Marks
1	Excavator	01 No	1
2	Concrete mixing machine capacity one bag	06 No	1.5
3	Concrete mixing machine capacity half bag	06 No	1.5
4	Scaffoldings and shattering	20,000 Sft	1
5	Water Bowsers	06 No	1.5
6	Total Station Machine	02 No	1
7	Level Machine	02 No	1
8	Concrete Vibrators	04 No	1.5
Sub-Total:			**10**

Bidder will provide evidence of ownership in case of his purchased equipment or Lease paper in case of any rented equipment OR Affidavit on his letter head that he will arrange the following equipment subject to award the work.

Joint Venture (JV)

Joint Venture must comply with the following requirements: -

a) Minimum qualification requirements: -

i) The lead partner shall meet not less than 50 percent of all qualifying criteria given in paras A to D heretofore.

ii) The joint venture must collectively satisfy the criteria of paras A to D, for which purpose the relevant figures for each of the partners shall be added together to arrive at the JV's total capacity.

b) Any change in a qualified JV after qualification, shall be subject to the written approval of the Employer prior to the deadline for submission of bids. Such approval may be denied if:-

i) Partner(s) withdrawn from a JV and remaining partners do not meet the qualifying requirements;

ii) The new partners to a JV are not qualified individually or as another JV; or

iii) In the opinion of the Employer, a substantial reduction in competition would result.

c) Bid shall be signed by all members in the JV so as to legally bind all partners, jointly and severally, and any bid shall be submitted with a copy of the JV agreement providing the joint and several liability with respect to the contract.

Form -T-1

General Information

Bidder (or each Member of a Joint Venture) applying for qualification is required to complete the information in this form.

1.	Name of Firm:	
2.	Head Office Address:	
3.	Telephone:	
4.	Email:	
5.	Type of Organization:	
6.	Place of Incorporation/Registration:	Year of incorporation/registration:
7.	PEC Registration Category: PEC Registration No:	Validity:
8.	NTN#	
9.	Name, Designation, email and Mobile Number of Firm's Representative	

Detail of Owners/ Directors

Name		**Designation**	**Nationality**
1.			
2.			
3.			
4.			
5.			

Form -T-2

Financial Soundness

Name of Bidder (Lead Member of a Joint Venture, in case of JV)

Bidder (Lead Member of a Joint Venture, in case of JV) applying for qualification is required to provide financial information to demonstrate that they meet the requirements of Evaluation Criteria. If necessary, use separate sheets to provide complete information. ***A copy of the audited financial statements of the past five (5) financial years must be attached.***

Bidder's Legal Name:_____ Date:_____

JV Members Legal Name:_____

Information Balance Sheet

	Year-1	**Year-2**	**Year-3**	**-**	**-**	**Overall Average**
Total Assets (TA)						
Total Liabilities (TL)						
Net Worth (TA-TL)						
Current Assets (CA)						
Current Liabilities (CL)						
		Average Annual Turnover (AATO)				
Average Annual Turnover						
		Financial Resources				
Cash/Bank Balance						
Credit Line Limit						

Form -T-3

Summary of Similar Nature Project Completed

Name of Bidder or Member of a Joint Venture

Bidder and each Member of a Joint Venture applying for qualification is required to complete the information in this form.

Use a separate sheet for each Member of a Joint Venture.

Project Name	Year of Completion	Location	Value in PKR (Million)

Form -T-4

Details of Similar Nature Projects Completed

Name of Bidder or Member of a Joint Venture

*A separate form with adequate documentary evidence (**Completion Certificate indicating Cost of Project**) shall be provided for each project in **Form T-03**.*

1.	Name of Contract
	Location
2.	Name of Employer
3.	Employer Address .....
4.	Nature of Works and special features of the contract ....
5.	Contract Role (Tick One) (a)Sole Contractor (b)Sub-Contractor (c) Member in JV
6.	Value of the total contract(in specified currencies) at completion, or at date of award for current contract PKR……. USD……
7.	Date of Award
8.	Date of Completion
9.	Contract Duration (Years and Months) _____Years _____Months

Form -T-5

Summary of Similar Nature Project in hand

Name of Bidder or Member of a Joint Venture

Bidder and each Member of a Joint Venture applying for qualification is required to complete the information in this form.

Use a separate sheet for each Member of a Joint Venture.

Project Name	Date of Award	Expected Date of Completion	Location	Value in PKR (Million)

.

Form -T-6

Details of Similar Nature Projects in hand

Name of Bidder or Member of a Joint Venture

*A separate form with adequate documentary evidence (**Letter of Award/ Agreement indicating Cost of Project**) shall be provided for each project in **Form T-5**.*

1.	Name of Contract
	Location
2.	Name of Employer
3.	Employer Address .....
4.	Nature of Works and special features of the contract ....
5.	Contract Role (Tick One) (a)Sole Contractor (b)Sub-Contractor (c) Member in a JV
6.	Value of the total contract(in specified currencies) at completion, or at date of award for current contract PKR……. USD……
7.	Date of Award
8.	Planned Date of Completion

Form -T-7

Summary of General Nature Project Completed

Name of Bidder or Member of a Joint Venture

Bidder and each Member of a Joint Venture applying for qualification is required to complete the information in this form.

Use a separate sheet for each Member of a Joint Venture.

Project Name	Year of Completion	Location	Value in PKR (Million)

Form -T-8

Details of General Nature Projects Completed in Last 5 Years

Name of Bidder or Member of a Joint Venture

*A separate form with adequate documentary evidence (**Completion Certificate indicating Cost of Project**) shall be provided for each project in **Form T-07**.*

1.	Name of Contract
	Location
2.	Name of Employer
3.	Employer Address .....
4.	Nature of Works and special features of the contract ....
5.	Contract Role (Tick One) (a)Sole Contractor (b)Sub-Contractor (c) Member in a JV
6.	Value of the total contract(in specified currencies) at completion, or at date of award for current contract PKR……. USD……
7.	Date of Award
8.	Date of Completion
9.	Contract Duration (Years and Months) _____Years _____Months

Form -T-9

Summary of Fast Track Project Completed

Name of Bidder or Member of a Joint Venture

Bidder and each Member of a Joint Venture applying for qualification is required to complete the information in this form.

Use a separate sheet for each Member of a Joint Venture.

Project Name	Year of Completion	Location	Value in PKR (Million)	Completion Duration

NOT USED

Form -T-10

Details of Fast Track Similar Nature Projects Completed in Last Ten (10) Years

Name of Bidder or Member of a Joint Venture

*A separate form with adequate documentary evidence (**Completion Certificate indicating Cost of Project**) shall be provided for each project in **Form T-09**.*

1.	Name of Contract
	Location
2.	Name of Employer
3.	Employer Address .....
4.	Nature of ... .
5.	Contr... (a)Sole-C... (b)Sub-Contractor (c) Member in a JV
6.	Value of t... total contract (in specified currencies) at completion, or at date of award for current contract PKR……. USD……
7.	Date of Award
8.	Date of Completion
9.	Contract Duration (Years and Months) _____Years _____Months

NOT USED

Form -T-11

List of Proposed Staff

Name of Bidder: _____

(Bidder or Member of Joint Venture)

1	Title of Position	
	Name of Candidate	
	Education	
	Experience	
	PEC Registration No.	
2	Title of Position	
	Name of Candidate	
	Education	
	Experience	
	PEC Registration No.	

Form -T-12

Candidate Summary

Name of Bidder: _____

(Bidder or Member of Joint Venture)

Position	Candidate	
	Prime	Alternate
Candidate Information	Name of Candidate	Date of Birth
	Professional Qualification:	
PEC Registration No. (Only for Engineer)		
Present Employer	Name of Employer:	
	Address of Employer	
	Telephone:	Fax:
	Job Title of Candidate	Years with Present Employer

Summarize professional experience in reverse chronological order.

From	To	Company	Project	Position	Relevant Technical & Management Experience

Form -T-13

DECLARATION OF PROFESSIONAL STAFF EMPLOYMENT

[To be submitted on Company Letterhead/Stamp paper]

TO WHOM IT MAY CONCERN

PROJECT: _____

SUBJECT: DECLARATION OF PROFESSIONAL STAFF EMPLOYMENT & AVAILABILITY

We hereby certify that the personnel nominated in Form-T-11 are employed by our firm and are available for the above-mentioned Assignment.

Yours Sincerely,

COMPANY NAME:

_____

AUTHORIZED REPRESENTATIVE

Form -T-14

Equipment Detail

Name of Bidder or Member of Joint Venture

Bidder and each Member of Joint Venture is required to provide adequate information to demonstrate clearly that it has the sufficient capability to undertake the Project. A separate form shall be prepared for each item of equipment listed in the Evaluation Criteria.

Item of Equipment		
Equipment information	1. Name of manufacturer	2. Model and power rating
	3. Capacity	4. Year of manufacture
Current status	5. Current location	
	6. Details of current commitments	
Source	7. Indicate source of the equipment ☐ Owned ☐ Rented ☐ Leased	

Omit the following information if it is owned by the Bidder or Member of JV.

Owner	8. Name of owner	
	9. Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreement	Details of rental/lease specific to the Project.	

Form -T-15

Affidavit of ownership/Availability of Equipment

PROJECT: _____

SUBJECT: DECLARATION OF OWNERSHIP/ LEASE OF EQUIPMENT

We hereby certify that the equipment nominated in T-14 is owned by/Leased by our firm and is available in Pakistan for the above-mentioned Assignment.

Yours Sincerely,

COMPANY NAME:

_____

AUTHORIZED REPRESENTATIVE

Form -T-16

Litigation History for the last Ten (10) Years

Name: _____
(Bidder or Member of Joint Venture)

Description of Contract	Year	Name of Client, Cause of litigation and matter in dispute	Disputed amount (Current value in PKR or US$ equivalent)	Award FOR or AGAINST Bidder	Remarks by Bidder

Attach Affidavit/undertaking that non-performance of a contract did not occur within the last ten years based on information on all settled disputes or litigation.

Form -T-17

AFFIDAVIT FOR CORRECTNESS OF INFORMATION

(To be printed on PKR 100 Stamp Paper)

Name:_____

(Bidder or member of Joint Venture)

I, the undersigned, do hereby certify that all the statements made in the Forms and in the supporting documents are true, correct and valid to the best of my knowledge and belief and may be verified by employer if the Employer, at any time, deems it necessary.

The undersigned hereby authorize and request the bank, person, firm or corporation to furnish any additional information requested by the Employer deemed necessary to verify this statement regarding my (our) competence and general reputation.

The undersigned understands and agrees that further qualifying information may be requested and agrees to furnish any such information at the request of the Employer.

Employer undertakes to treat all information provided as confidential.

Signed by an authorized Officer of the firm

Title of Officer

Name of Firm

Date

FORMS

BID SECURITY
PERFORMANCE GUARANTEE
CONTRACT AGREEMENT
MOBILIZATION ADVANCE GUARANTEE/BOND

CA-
BS-1

BID SECURITY
(Bank Guarantee)

BID SECURITY
(Bank Guarantee)

Security Executed on _____
(Date)
Name of Surety (Bank) with Address: _____
(Scheduled Bank in Pakistan)
Name of Principal (Bidder) with Address _____
_____
Penal Sum of Security Rupees . _____(Rs. _____)
Bid Reference No. _____
KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal (Bidder) we, the Surety above named, are held and firmly bound unto _____
(hereinafter called the 'Employer') in the sum stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Bidder has submitted the accompanying Bid dated _____ for Bid No. _____ for_____(Particulars of Bid) to the said Employer; and

WHEREAS, the Employer has required as a condition for considering said Bid that the Bidder furnishes a Bid Security in the above said sum from a Scheduled Bank in Pakistan or from a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan, to the Employer, conditioned as under:

(1) that the Bid Security shall remain in force up to and including the date 30 days after the deadline for validity of bids as stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Surety is hereby waived;

(2) that the Bid Security of unsuccessful Bidders will be returned by the Employer after expiry of its validity or upon signing of the Contract Agreement; and

(3) that in the event of failure of the successful Bidder to execute the proposed Contract Agreement for such work and furnish the required Performance guarantee, the entire said sum be paid immediately to the said Employer pursuant to Clause 15.6 of the Instruction to Bidders for the successful Bidder's failure to perform.

NOW THEREFORE, if the successful Bidder shall, within the period specified therefore, on the prescribed form presented to him for signature enter into a formal Contract with the said Employer in accordance with his Bid as accepted and furnish within fourteen (14)days of his being requested to do so, a Performance guarantee with good and

sufficient surety, as may be required, upon the form prescribed by the said Employer for the faithful performance and proper fulfilment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified for its validity then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

PROVIDED THAT the Surety shall forthwith pay the Employer, the said sum upon first written demand of the Employer (without cavil or argument) and without requiring the Employer to prove or to show grounds or reasons for such demand, notice of which shall be sent by the Employer by registered post duly addressed to the Surety at its address given above.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal (Bidder) has duly performed his obligations to sign the Contract Agreement and to furnish the requisite Performance guarantee within the time stated above, or has defaulted in fulfilling said requirements and the Surety shall pay without objection the said sum upon demand from the Employer forthwith and without any reference to the Principal (Bidder) or any other person.

IN WITNESS WHEREOF, the above bounden Surety has executed the instrument under its seal on the date indicated above, the name and seal of the Surety being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

SURETY (Bank)

WITNESS: Signature _____

1. _____ Name _____

_____ Title _____

Corporate Secretary (Seal) Corporate Guarantor (Seal)

2. _____

_____

Name, Title & Address

_____

CA-

FORM OF PERFORMANCE GUARANTEE
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor (Bank) with address:_____
(Scheduled Bank in Pakistan)
Name of Principal (Contractor) with address:_____
_____
Penal Sum of Security (express in words and figures)_____
_____
Letter of Acceptance No. _____Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the _____ (hereinafter called the Employer) in the penal sum of the amount stated above for the payment of which sum well and truly to be made to the said Employer, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has accepted the Employer's above said Letter of Acceptance for _____ _____ (Name of Contract) for the _____

_____ (Name of Project).

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Employer, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 49, Defects Liability, of Conditions of Contract are fulfilled.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of any liability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, if any, under this Guarantee.

We, _____ (the Guarantor), waiving all objections and defences under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer without delay upon the Employer's first written demand without cavil or arguments and without requiring the Employer to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Employer's written declaration that the Principal has refused or failed to perform the obligations under the Contract which payment will be effected by the Guarantor to Employer’s designated Bank & Account Number.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal (Contractor) has duly performed his obligations under the Contract or has defaulted in fulfilling said obligations and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above-bounden Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____

Guarantor (Bank)

Witness:

1. _____ Signature _____

_____ Name _____

Corporate Secretary (Seal)

Title _____

2. _____

_____ _____

Name, Title & Address Corporate Guarantor (Seal)

CA-

MOBILIZATION ADVANCE GUARANTEE

(Unconditional Bank Guarantee)

Guarantee No._____ Date _____

WHEREAS _____ (hereinafter called the 'Employer') has entered into a Contract for _____
(Particulars of Contract)
with _____ (hereinafter called the "Contractor').

AND WHEREAS, the Employer has agreed to advance to the Contractor, at the Contractor's request, an amount of Rupees _____ (Rs _____) which amount shall be advanced to the Contractor as per provisions of the Contract.

AND WHEREAS, the Employer has asked the Contractor to furnish Guarantee to secure the mobilization advance for the performance of his obligations under the said Contract.

AND WHEREAS, _____
(Scheduled Bank in Pakistan acceptable to the Employer)
(hereinafter called the "Guarantor") at the request of the Contractor and in consideration of the Employer agreeing to make the above advance to the Contractor, has agreed to furnish the said Guarantee.

NOW, THEREFORE, the Guarantor hereby guarantees that the Contractor shall use the advance for the purpose of above mentioned Contract and if he fails and commits default in fulfilment of any of his obligations for which the advance payment is made, the Guarantor shall be liable to the Employer for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the Employer shall be the sole and final judge, on the part of the Contractor, shall be given by the Employer to the Guarantor, and on such first written demand, payment shall be made by the Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

This Guarantee shall remain in force until the advance is fully adjusted against payments from the Interim Payment Certificates of the Contractor or until _____whichever is earlier.
(Date)
The Guarantor's liability under this Guarantee shall not in any case exceed the sum of Rupees _____(Rs _____).

This Guarantee shall remain valid up to the aforesaid date and shall be null and void after the aforesaid date or earlier if the advance made to the Contractor is fully adjusted against payments from Interim Payment Certificates of the Contractor provided that the Guarantor agrees that the aforesaid period of validity shall be deemed to be extended if on the above mentioned date the advance payment is not fully adjusted.

GUARANTOR

1. Signature _____
2. Name _____
3. Title _____

WITNESS

1. _____
_____
Corporate Secretary (Seal)

2. _____ _____
(Name Title & Address) Corporate Guarantor(Seal)

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the _____ day of_____(month) 20_____ between _____ (hereafter called the "Employer") of the one part and _____(hereafter called the "Contractor") of the other part.

WHEREAS the Employer is desirous that certain Works, viz _____ should be executed by the Contractor and has accepted a Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

NOW this Agreement witnessed as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents after incorporating addenda / Clarification as agreed or otherwise, if any, except those parts relating to Instructions to Bidders shall be deemed to form and be read and construed as part of this Contract, viz:

    a. The Contract Agreement;
    b. The Letter of Acceptance;
    c. The completed Form of Bid;
    d. Special Stipulations (Appendix-A to Bid);
    e. Contract form for execution of work;
    f. The PRICE SCHEDULE (Appendix-D to Bid);
    g. The completed Appendices to Bid (B, C, E to O);
    h. Special Provisions;
    i. The Drawings;
    j. The Specifications;
    k. Work Schedule;
    l. (any other)

3. The contractor will have to complete the work within the stipulated period, according to specifications as mentioned in the acceptance letter and Contract Agreement to the entire satisfaction of the engineer in-charge
.

4. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy defects therein in conformity and in all respects with the provisions of the Contract.

5. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, 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.

6. That if the contractor fails to comply with any of the conditions of the contract, he will be held liable for the consequences thereof which shall be either in the form of liquidated damages or allotment of work at his risk and cost or both. The damages so incurred shall be recovered from the contractor, either from his security money or his running/outstanding bills. Further, if any information/ document submitted by contractor/ firm, founds false, fabricated, materially incorrect at any stage, he/firm will be liable for blacklisting.

7. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, 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 on the day, month and year first before written in accordance with their respective laws.

Signature of the Contactor	Signature of Employer
_____	_____
(Seal)	(Seal)
Signed, Sealed and Delivered in the presence of:	
Witness:	Witness:
_____	_____
(Name, Title and Address)	(Name, Title and Address)

IB-

INDEMNITY BOND

FOR SECURED ADVANCE

AGAINST MATERIALS BROUGHT AT SITE

(ON RS.100 NON JUDICIAL STAMP PAPER)

This Deed of Indemnity is issued by M/s. _____ _____ *(Name* of *the Contractor)* in favour of *M/s.*_____*(Name* of *the Employer).*

Whereas _____ (hereinafter called the Employer) has paid the Secured Advance against the cost of material through any Bank or like agency by any other method by virtue of the terms of the contract existing between the parties. The details of the material and their price for which secured advance is being [illegible] t for the period _____till consum[illegible] material is as under:-

1. _____ at Rs.____ __ = Rs.
2. _____ at Rs. _____ = Rs.
3. _____ [illegible] _____ = Rs.
4. _____ _ per _____ = Rs.

NOT USED

THEREFORE THI[illegible]Y WITNESSETH AS FOLLOWS:

I/We _____ ___ of M/s. _____ do hereby indemnify M[illegible] _____ for all losses due to thefts, arson, pilferage, loss due to flood and inundation, [illegible]ortage, deterioration and depreciation etc. through any act of Man or God or slump in the Market of any or all the materials financed or paid by the Employer on our request for financing payment against material.

I/We_____ shall indemnify _____ against any or all claims, action damages arising out of or resulting to the said material.

I/We _____ further declare that we will faithfully abide by the above declaration and solemnly affirm that we will not remove, sell, pilferage any of the materials against which M/s _____ has paid us such a secured advance and will not pledge the same with any Bank, Finance Corporation, Firm, Company, Individual or the like agency or create any change whereon in any from what so ever.

I/We_____do hereby also declare that in the event of my/our infringement of the declaration made above

_____will be entitled to forfeit all such material and also proceed against me/us according to the relevant clause pertaining to breach of co and further invoke the power or seek any remedies secured of _____ contract Agreement signed with us or otherwise

available under law.

NOT USED

Place_____ _____

Contractor _____ _____

GENERAL / PARTICULAR CONDITIONS OF CONTRACT FOR WORKS

GOVERNMENT OF THE PUNJAB

CONTRACT FORM FOR EXECUTION OF WORK

(To be procured by the Contractor)

Copies of the Contract Form for Execution of Work can be obtained from Finance Department Punjab's Website as well as from the Employer.

SPECIAL PROVISIONS

SPECIAL PROVISIONS (CIVIL WORKS)

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SPECIFICATIONS - SPECIAL PROVISIONS (CIVIL WORKS)

SP-2 DESCRIPTION OF THE WORKS

1.1 The work included in this Contract are as follows but not limited to these items only:

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

SR. NO	DESCRIPTION
1	SEWAGE TREATMENT PLANT
2	FISH POND
3	CHEMICAL ROOM
4	OFFICE BUILDING
5	TREE PLANTATION
6	BOUNDARY WALL AND MAIN GATE
7	ELECTRIFICATION
8	CCTV CAMERA (SCADA)
9	MONITORING PROBS
10	SOLAR SYSTEM

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

SR. NO	DESCRIPTION
1	ANAEROBIC AND FACULTATIVE PONDS
2	STAFF BUILDING
3	CHEMICAL ROOM
4	DISINFECTION TANK AND COLLECTION CHAMBERS
5	FISH POND
6	TREE PLANTATION
7	ELECTRIFICATION
8	MAIN GATE AND BOUNDARY WALL
9	CCTV CAMERA (SCADA)
10	MONITORING PROBS
11	SOLAR SYSTEM

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

SR. NO	DESCRIPTION
1	PRIMARY SEDIMENTATION TANK (PST) (01 NOS)
2	TRICKLING FILTER (01 NOS)
3	SECONDARY SEDIMENTATION TANK (SST) (01 NOS)
4	SLUDGE THICKENER (ST) (1 NOS)
5	PUMPING PIT (01 NOS)
6	SLUDGE PUMPING STATION (SPS) (03 NOS)
7	INTERNAL/YARD PIPING
8	SLUDGE DRYING BED
9	ACCESS AND INTERNAL ROADS
10	STAFF BUILDING
11	DISINFECTION TANK & VALVE CHAMBERS
12	CHEMICAL BUILDING
13	FISH POND
14	TREE PLANTATION
15	MAIN GATE AND BOUNDARY WALL
16	RCC DRAIN
17	ELECTRICAL WORK
18	CCTV CAMERA (SCADA)
19	MONITORING PROBS
20	SOLAR SYSTEM

SP-3 SITE OF WORKS

The work mainly comprising of **"CONSTRUCTION OF 03 LOW-COST WASTE WATER TREATMENT PLANTS"**

SP-4 SETTING OUT

Setting out data and control points for the construction of the road and allied works will be provided by the Engineer following the Notice to Commence but, in any case, prior to start of work.

SP-5 CLIMATOLOGICAL DATA

Not used.

SP-6 UTILITIES

The Contractor shall directly enquire from the utility companies about availability of connections of electric power supply and telephone lines for his use at the Site. In case of non-availability of electric power supply from national grid to meet his requirements the Contractor shall provide at his own cost electric power generators as necessary for supply of power for the various parts of the Works including his camps, offices, stores, workshops and other installations as well as for the Engineer's Site office provided under Sub-Clause SP 20.1. The Contractor shall bear all costs for constructing, operating and maintaining the generation system, including the standby generation system, and distribution system including providing diesel, oil or other consumables and all services and necessary attendance to ensure uninterrupted power supply at all times.

The Contractor shall make his own investigations and arrangements for supply of water of acceptable quality for construction requirements and safe drinking water for his staff and workmen and for the staff of the Engineer.

No separate payment will be made to the Contractor for works performed under this Clause and the costs thereof shall be deemed to be included in the rates and prices of the various items in the Bill of Quantities.

SP-7 TOPOGRAPHY AND GEOLOGY OF THE SITE

The details of Topography is with the Employer / Engineer.

SP-8 EXTENT OF WORK

The Contractor shall remove all debris and unsuitable construction to the Engineer's satisfaction with no additional cost.

The Contractor shall construct the Works in accordance with the Drawings and Specifications and as directed by the Engineer. The Contractor shall procure, furnish, provide and arrange all the necessary construction materials, equipment, transportation, fuel, electric power, water and services; be responsible for the construction and maintenance of the construction camps, offices, workshops and warehouses that he may require, and perform all other work necessary for completion of the Works described herein, in complete conformity with the Contract.

SP-9 DRAWINGS

9.1 Bidding Drawings

The Drawings provided as separate volume of Bid Documents and hereinafter referred to as Bid Drawings show the scope of the work to be performed by the Contractor. The Bid Drawings shall not be used as a basis for fabrication or construction, but may be used as the basis for planning, scheduling and placing preliminary orders for materials, subject to corrections based on future issue of Construction Drawings. Any other Drawings if issued through Addenda, before opening of Tenders, shall become part of the Bid Drawings.

9.2 Construction Drawings

After award of Contract, Bidding Drawings will be replaced by Drawings issued by the Engineer for Construction, with such modifications as may be necessary. The Drawings Issued for Construction will include Bid Drawings re-issued, Bidding Drawings modified and additional Drawings as required to develop in greater detail the construction required and shall be referred to hereinafter as "Construction Drawings". The Construction Drawings that show changes from the Tender Drawings and Specifications, will be reviewed by the Engineer for determination of adjustments, if any, of the Contract Price in accordance with the provisions of Clause 51.1, Variations, of the Conditions of Contract. The work shall be executed in conformity with the Construction Drawings.

The Engineer and Contractor shall jointly prepare a schedule for issuance of Drawings Issued for Construction of the various parts of the Works based on a list of drawings provided by the Engineer.

9.3 Checking of Drawings

The Contractor shall carefully check all Construction Drawings as soon as practicable after receipt thereof, and shall promptly advise the Engineer of any errors if discovered.

SP-10 RIGHT TO CHANGE

The Engineer may find it desirable to change location, alignment, dimensions or designof one or more of the features of the Works to conform to the newly disclosed conditions. Toward this end, the Engineer reserves the right to make such reasonable changes, and the Contractor's operations shall be conducted so as to accommodate any such changes in the Works.

SP-11 DRAWINGS/DATA TO BE FURNISHED BY EMPLOYER /ENGINEER

11.1 Procedure for Submittal of Contractor's Drawings

All drawings showing construction details shall be provided by the Employer/Engineer.

11.2 Other Drawings

Other drawings additional to those referred to herein-above required by the Specifications showing proposed methods of constructing Temporary Works and all bar bending schedules shall be submitted by the Contractor to the Engineer for approval.

11.3 Ownership of Drawings etc.

All the drawings, details, and any other information or documents furnished by the Engineer shall become the property of the Employer.

SP-12 COOPERATION WITH OTHER CONTRACTORS

The Contractor shall cooperate and coordinate his work with that of the other contractors working at the Site, to whatever extent may be necessary to complete the Works in accordance with the approved programme and the Engineer's instructions.

SP-13 QUALITY OF MATERIALS

All materials, fixtures, fittings, and supplies furnished under the Contract shall be new and unused, of standard first grade quality and of the best workmanship and design. No inferior or low grade materials and supplies will be either approved or accepted, and all work of assembly and construction shall be done in a first class and workmanlike manner. In asking for prices of materials intended for delivery to the Site and incorporation in the Works under any portion of these Specifications, the Contractor shall provide the manufacturer or supplier with complete information as may be necessary to secure compliance with these requirements and, in every case, he shall quote this Clause in full to each such manufacturer or supplier.

Prior to procurement, the Contractor shall furnish to the Engineer, for his approval, the names of the manufacturers of all equipment and materials which he contemplates incorporating in the Works. With this information, the Contractor shall also furnish such pertinent information as to capacities, efficiencies and sizes, and such other information as may be required by the Engineer. Samples of materials shall be submitted to the Engineer for approval unless waived of by the Engineer. Equipment, materials, supplies and articles installed or used without the Engineer's approval shall be at the risk of subsequent rejection.

The Contractor shall use non-reactive aggregates from suitable quarries for concrete work. The Contractor shall use deformed steel reinforcement bars rolled from Pakistan Steel Mills billet or equivalent from re-rolling mills proposed by the Contractor and approved by the Engineer.

SP-14 INSPECTIONS AND TESTS

14.1 Inspection

All equipment and materials furnished under the Contract and all work performed in connection therewith under the Contract shall be subject to inspection and testing by the Engineer or his authorized agent at all times and in all stages of completion. Inspection at the manufacturer's plant may be made to determine that the equipment and materials meet the requirements of these Specifications. The Contractor shall notify the Engineer not less than 05 days in advance of the date and place that the equipment or materials will be available for inspection and testing. No equipment or materials shall be transported until inspection at the manufacturer's plant has been made Acceptance of equipment and materials or the waiving of inspection and testing thereof shall in no way relieve the Contractor of the responsibility for furnishing equipment and materials meeting the requirements of the Contract Documents. Confirmatory tests shall also be carried out at the Site or at an approved laboratory, as instructed by the Engineer. These tests shall be witnessed by the Engineer and performed at no additional cost to the Employer.

Contractor will submit his submittal to Engineer/Employer in case of Non-scheduled items or Items to be imported for approval prior to booking to supplier/manufacturer before undertaking the item into execution. Submittal proposed from contractor must comprise minimum three proposed manufacturers to be submitted to Engineer for approval purposes. It will be discretion of Engineer to recommend for approval one of them or as contractor for other than those manufacturer proposed in shape of submittal by contractor for someone else on equivalency basis. Pre-shipment inspection of the selected manufacturer's equipment will be carried out by the engineer/employer. Contractor must submit Bill of lading of such imported equipment prior to transport to site. Confirmatory tests shall also be carried out at the Site or at an approved laboratory, as instructed by the Engineer. These tests shall be witnessed by the Engineer and performed at no additional cost to the Employer.

14.2 Testing

The Engineer will make such tests on concrete, aggregates, fill materials, reinforcing steel and other materials as he may from time to time select, and the Contractor shall provide at his own cost such samples or assistance in sampling materials at the Site as the Engineer may reasonably require. Testing by the Engineer shall in no way relieve the Contractor of his responsibility to test materials to ensure that they meet all the specified requirements and to control their quality. The Engineer may accept that items manufactured away from the Site meeting the specified requirements without further testing subject to the Contractor furnishing satisfactory proof of compliance with these Specifications in one or more of the ways described below.

The Contractor shall provide free of charge such material testing equipment, labour, materials, electricity, fuel, water, stores, apparatus and feedstock as may be reasonably required by the Employer to carry out the Tests as per the required frequency. Further contractor shall make all kind of arrangements for third party inspection/ Witnessing of Factory Acceptance Tests of major components of manufacturing factory whether located in Pakistan/abroad for four officials (02 from Employer and 02 from Engineer-In-charge side). All expanses regarding air tickets, visa in case of abroad, boarding/lodging, food, transport, hoteling etc. will be borne by the Contractor and no extra/additional payment will be made to contractor. Contractor shall quote his prices keeping in view of such expanses.

Manufacturer's Certificate of Compliance

In the case of standard labelled stock products of standard manufacture which have a record of satisfactory performance in similar work over a period of not less than five years, the Engineer may accept a notarised statement from the approved manufacturer certifying that the product conforms to the applicable specifications.

Mill Certificates

Regarding materials for which such practice is usual, the Engineer may accept the approved manufacturer's certified mill and laboratory certificates.

Testing Laboratory Certificates

The Engineer may accept a certificate from a renowned commercial testing laboratory, satisfactory to him, certifying that the product has been tested within a period acceptable to the Engineer and that it conforms to the requirements of these Specifications.

Service Record

If a demonstrable satisfactory service record for a period not less than five (05) years is available for a material, certain specified tests may be waived off by the Engineer.

14.3 Cost

The cost of any laboratory, field and shop tests required from any agency of compliance with under Specifications shall be borne by the Contractor.

SP-15 CONSTRUCTION PROGRAMME

15.1 General

The Contractor shall submit his programme for execution of the Works in accordance with Clause 14.1 [*Programme to be Submitted*], under the Conditions of Contract, to the Engineer for approval. The programme may contain adjustments if any, to the CPM (Critical Path Method) based Bar Chart submitted with the Bid. The completion date, milestones, and key targets indicated in Appendix-E to Bid, or dates earlier than the said milestone and key target dates, shall be shown on the construction programme to be submitted by the Contractor. Other dates including rates of progress for various parts of the Works in the construction programme may be changed by the Contractor and submitted for approval. The operations under each section of the programme submitted by the Contractor shall be broken down in greater detail than those shown on the Schedule submitted with the Bid.

The programme shall also show the timing of provision of any facilities the Contractor is required to supply for use by the Employer and the Engineer, in such manner that these shall be available as stipulated in the Contract and instructed by the Engineer.

15.2 Submittals

(a) The initial submittal of network analysis shall include a description of the major items of construction equipment planned to be used. The description of the equipment shall include the type, number of units, their capacity, etc. The forecast shall include the estimated dates on which each major item of construction equipment will be on the job. The Bar Chart and the Network Analysis shall be submitted within 14 days after receipt of the Letter of Acceptance.

The submittal shall consist of:

(i) 4 copies of the Bar Chart.
(ii) A narrative summary of the construction plan.
(iii) A backup of the schedule files on re-writable CD disks or pen drive.

The Engineer will review the construction schedule and the approved initial submittal will be the Project Baseline Schedule by which the performance of the Contractor will be measured

(b) Monthly submittals shall show completed progress of each activity during the past month, with forecast for the coming month. Hammock networks shall be incorporated on the Base Line Schedule of activities. Each monthly submittal shall contain:

(i) 4 copies of the Bar Chart.

(ii) 4 copies of a time scaled logic diagram for the next three months.
(iii) A narrative summary of the schedule related issues and status. The narrative shall include discussion of pending schedule changes submitted to the Engineer in the past month.
(iv) A backup of the schedule files on rewritable CDs or pen drive.

(c) The successful bidder shall submit the supervision plan in respect of Environmental Health Safety SOPs & Environmental & Social Management Plan on monthly basis along-with other deliverables manifesting the progress activities as per schedule.

15.3 Progress Schedule

Both the bar charts and network analysis schedules shall be continuously monitored and kept current and updated by the Contractor throughout the work, and at least on every milestone date and submitted for approval. The Contractor's schedules shall be available for examination during normal business hours. All revisions shall be accompanied by a detailed explanation of the reasons for the changes and describing any new or modified construction procedure proposed and, if applicable, any steps being taken to improve progress to achieve completion within the Time for Completion.

SP-16 LAY OUT OF WORKS

16.1 Reference Points, Lines and Levels

The Engineer will lay out a reference line or lines in the field with accompanying points and/or bench-marks to enable the Contractor to establish there from survey control for construction.

16.2 Verification

The Engineer may make checks as the work progresses to verify lines, levels and grades established by the Contractor and to determine the conformance of the work as it progresses with the requirements of the Specifications and the Drawings. Shall not relieve the Contractor of his responsibility to perform all work in accordance with the Drawings and Specifications and the lines, levels and grades given therein.

16.3 Primary Control Points

Based upon the Engineer's basic control, the Contractor shall provide his own primary control points, as needed for the Works, and shall preserve and maintain them until otherwise authorized.

The Contractor shall be responsible for maintaining all survey markers/monuments, and property corners. If any markers/monuments are disturbed or destroyed by the Contractor, the Contractor shall arrange, at his own cost, to retrace and replace them to the entire satisfaction of the Engineer. If a monument cannot be replaced in its original position, the Contractor shall install a witness corner. The Contractor shall complete and file monument reference cards on all monuments as per instructions of the Engineer.

16.4 Construction Surveyors

The Contractor shall provide experienced construction surveyor/s with adequate experience in the construction surveys similar in nature as required by this Contract.

16.5 Basic Control Monument

Based upon the Engineer's established basic control monuments, the Contractor shall establish all lines and grades necessary to control the Works, and shall be responsible for all measurements that may be required for execution of the Works to the tolerance prescribed in Sub-Clause 16.7 below.

16.6 Surveys and Computations

The Contractor shall perform such surveys and computations as are necessary to determine quantities of work performed or placed during each progress payment period, and shall also perform all surveys required by the Engineer to determine final quantities of work in place. The Engineer will determine final quantities based on original ground levels determined by the Contractor and agreed by the Engineer.

The Contractor shall notify the Engineer at least 24 hours before performing a quantity survey and, unless specifically waived, quantity surveys shall be performed in the presence of and agreed by an authorized representative of the Engineer.

16.7 Tolerances

Degree of accuracy for the survey works shall satisfy the following specified tolerances:

(a) Alignment of tangents and curves shall be within 0.1 foot for 1,000 feet i.e., an accuracy of 1:10,000.

(b) Structure points shall be set within 0.01foot accuracy from point to point, except where tighter tolerances are required.

(c) Cross-section points shall be located within 0.10 foot, horizontally and 0.01 foot vertically.

(d) Permissible closing error for a levelling line meant for establishing Temporary Bench Mark (TBMs) shall not exceed $0.045 \times \sqrt{M}$ foot, where M is in miles. The permissible closing error shall be duly adjusted.

16.8 Material and Equipment

The Contractor shall provide all materials, equipment and labour required for work.

SP-17 STANDARDS AND SPECIFICATIONS

Except as otherwise provided by these Specifications or the Drawings all materials, equipment and fabrication and testing thereof shall conform to the latest applicable Standards and Specifications contained in the following list or to equivalent applicable Standards and Specifications. Copies of these Standards and Specifications may be purchased from the indicated agency, which publishes them:

-	British Standard	BS
-	American Concrete Institute	ACI
-	American Society for Testing and Materials	ASTM

Where relevant Standards and Codes of Practice now quote metric units only, these are to be interpreted as required to the nearest equivalent imperial (foot/pound) unit for the purposes of this Contract.

All materials and workmanship not fully specified herein or covered by an approved Standard shall be of such a kind as is used in first class work and suitable to the climate in the Project Area.

If the Contractor, at any time and for any reason, wishes to deviate from the above standards or desires to use material or equipment not covered by the above standards, he shall state the exact nature of the changes, the reason for making the change and shall submit complete specifications of the materials and equipment to the Engineer for approval.

SP-18 ACCESS TO SITE

18.1 Right of Way for Access and Haul Routes

The Contractor shall be responsible for providing and maintaining access routes for the Works. The right of way for access to the Works from existing roads will be provided by the Employer. The Contractor shall make his own investigations of the condition of available public or private roads and of clearances, restrictions, bridge load limits and other limitations that affect or may affect transportation and ingress and egress at the job sites. The repair and reinstatement of roadways, drain and canal banks if damaged during operation shall be the responsibility of the Contractor without any additional cost to the Employer. The Employer controlled right of way shall be the Right of Way (ROW) available to the Contractor for carrying out the Works.

18.2 Restoration of Site

On completion of the Works, the Site shall be restored by the Contractor to its original conditions as far as practicable and left in tidy condition.

SP-19 FACILITIES TO BE PROVIDED BY THE CONTRACTOR AT SITE

19.1 Contractor's Camps

The Contractor is required to arrange the facility of housing in nearby area of the project for the labour through portable containers or house on rent.

19.2 Temporary Sanitary Facilities

(a) The Contractor shall provide adequate temporary sanitary conveniences for the use of his employees and persons engaged on the work, including the Engineer and his employees. He shall ensure that his employees and labour make proper use of the latrines and do not foul the Site.

(b) In addition to toilet facilities, suitable and adequate washing facilities shall be provided.

(c) Sanitary facilities shall be located as directed or approved by the Engineer and shall be maintained in a clean and sanitary condition during the entire course of the work.

(d) The septic tank and/or temporary holding tank(s) shall be kept pumped out at such intervals that the tank(s) will not overflow and contaminate the ground, flowing streams or surface drainage.

(e) On completion of the Works, sanitary facilities shall be properly disinfected and all evidence of same including temporary buried tanks and foundations removed from the Site.

19.3 Medical Facilities

The Contractor shall arrange provision of adequate medical facilities for his employees.

Adequately equipped dispensary/ies with qualified and experienced staff shall be provided by the Contractor at his camps. In addition suitably equipped first aid stations manned by trained staff shall be provided at strategic locations, to administer first aid treatment at all times free of charge to all persons on the Site, including personnel of the Engineer and the Employer. The nature, number and location of facilities furnished and the Contractor's staff for administering first-aid treatment shall meet the requirements of the Health Services of the Government of Pakistan.

19.4 Operation and Maintenance of the Camps and Facilities

For the purpose of operation and maintenance of the camps and facilities provided as above, the Contractor shall comply with all applicable provisions of the Pakistani Labour Laws and specifically to the following requirements:

(a) Camp areas shall be kept dry and free from dense vegetation. Measures shall be taken to control dust within the camp area, by water or oil spraying or otherapproved means.

(b) Any ponded water around a camp shall be sprayed weekly with oil or other approved anti-malaria liquid.

(c) The Contractor shall provide garbage collection and disposal services for his construction camps and the Engineer's office. Disposal shall be by burial (landfill) and/or incineration. Disposal area shall be located a sufficient distance away and downwind from camp facilities and offices so as not to create objectionable odours or health hazards. Equipment, methods of collection and disposal and location of disposal areas shall be submitted to the Engineer for approval.

(d) The interior walls and ceilings of buildings shall be lime washed or painted. The whole of the open spaces around the buildings shall be swept each day and all rubbish removed. The living areas shall be suitable for the climatic conditions. Roof height shall not be less than 10.5 ft. and adequate number of ceiling fans shall be provided.

(e) Adequate sanitary conveniences, including washing and bathing places shall be maintained at each of the camps. All sanitary fixtures, receptacles, toilet rooms, lavatories and wash rooms shall be cleaned and disinfected at least once every day.

19.5 Drainage

The ground around the buildings shall be graded to slope away from building perimeters so as to provide adequate drainage and shall be thoroughly compacted. Excavated material shall be disposed of by filling in low areas or as otherwise directed by the Engineer.

19.6 Water Supply

The Contractor shall arrange for the water supply for his staff residences, labour camps, site offices, work yards, workshops, and various camp facilities. Construction of pumps, storage tanks, overhead tank, distribution system, and their proper running and maintenance shall be his responsibility. Water shall be supplied to the camps 24 hours a day. Adequate supply of water, cooled in summer, shall be ensured in camps and sites

of work. Water samples shall be tested periodically to ensure that it is fit for human consumption.

19.7 Electricity Supply

The Contractor shall provide electricity required for the Works including labour camps, staff residences, offices including the Engineer's Site office and various camp facilities. The Contractor shall also provide sufficient standby electricity supply arrangements for his needs.

19.8 Utility Lines

The Contractor Shall conduct his operations, make necessary arrangements, take suitable precautions and perform all required work incidental to the protection of and avoidance of interference with power, telephone, water and other utilities within the areas of his operations in connection with the Contract. No separate payment shall be made for such incidental work. In case the utility lines are required to be relocated the Contractor shall arrange their relocation with the concerned departments and organizations. The Contractor shall obtain cost estimates for relocation of utilities for the Engineer/Employer's approval before execution of the Work. The Contractor shall be reimbursed the actual approved cost carried in by him.

19.9 Handing Over/Removal after Completion

Upon completion of the Works, the Contractor shall remove all the Contractor's camps, labour and staff accommodation, site office, other installations and buildings constructed and all facilities provided by the Contractor under this Clause, and the Site cleared and reinstated to the satisfaction of the Engineer.

19.10 Measurement and Payment

Except as provided in SP-19.8 no separate payment will be made for the work included under the Clause SP-19; the cost thereof is deemed to be included in the rates and prices of other items entered in the Price Schedule. The contractor is bound to comply with all the instructions stated in SP-19 and in case of otherwise or if any complaint lodged by the labour to the Engineer / Client, the contractor will be penalized for amounting to Rs. 5000 / day.

SP-20 PROVISION OF FACILITIES FOR THE ENGINEER (FOR CONSULTANT STAFF) /EMPLOYER

20.1 Facilities for Engineer/Employer's Staff:

(a) **<u>Site offices</u>:**
One furnished portacabin with all the requisite accessories for the Engineer / Employer

20.2 Ownership of Site facilities

All facilities/utilities provided by the contractor as stated above in Clause-20.1 will be property of Engineer In charge after successful handing taking over of project and expiration of defect liability period considering that the said amount is included in all items listed in Price Schedule.

20.3 Measurement and Payment

No extra/separate payment will be made to Contractor considering that Contractor has

quoted his bid keeping in view of such expanses.

SP-21 PROGRESS PHOTOGRAPHS

The Contractor shall furnish to the Engineer every month, for the site of Fifteen colour photographs on CD or pen drive and 4 colour prints of each photograph taken with a digital camera to clearly show the progress of construction. Each photograph shall be submitted in four prints of size 20 cm x 25 cm. Each print shall be marked on the back side with the caption of the activity, date and serial number. There shall be no writing, lettering or marking on the face of the photograph. Progress photographs shall be submitted from the month, following the month in which Notice to Commence is issued and continued till completion of the Works.

No separate payment will be made for the work specified herein and the cost thereof shall be deemed to be included in the other items of the Price Schedule.

SP-22 SITE FACILITIES TO BE PROVIDED BY THE EMPLOYER

22.1 General

Without prejudice to the generality of the various clauses of the Contract and except for the facilities referred to hereinafter, particular attention is drawn to the obligations of the Contractor to make his own arrangements for providing, maintenance and furnishing of labour camps, staff residences, offices, workshops, stores watching and guarding thereof.

The Contractor shall submit his written demand of his requirements of land for his Site Facilities as herein specified, at least 28 days in advance.

22.2 Area for Storage and Workshop

The contractor will arrange an open area of adequate size for the facilities listed in Appendix-H to Tender and approved by the Engineer, for use as storage, and workshop areas. The Contractor shall provide and maintain at his own cost, all fencing, any necessary clearing, land levelling, foundations and above ground structures for sheds, covered areas, workshops, electricity, telephone, water distribution and waste water disposal etc, as he may need to meet his requirements.

SP-23 SAFETY MEASURES AT CONSTRUCTION SITE

a) Pursuant to the provisions of Sub-Clause, for Safety Measures the Contractor shall observe high standards of safety for men and machines at all times and with regard to safety.

b) The Contractor shall take all possible measures to protect his personnel from harm. In case of any casualty or injury to any person due to the Contractor's operations, the Contractor shall ensure quality medical treatment and payment of due compensation.

c) The Contractor shall not permit casual observers to come close to the sites where excavation and other hazardous operations are being performed.

SP-24 ENVIRONMENTAL PROTECTION

The Contractor shall exercise care to protect the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring or defacing of the natural surroundings in the vicinity of the Works. Except where clearing is required for the Permanent Works, approved construction roads and the Temporary Works, and for excavation operations, all trees and native vegetation shall be preserved

and shall be protected from damage which may be caused by the Contractor's construction operations and equipment. On completion of the Works, all work areas shall be smoothed and graded in a manner to conform to the natural appearance of the landscape. Where unnecessary destruction, scarring, damage or defacing may occur as a result of the Contractor's operations, it shall be repaired, replanted, or otherwise corrected as directed by the Engineer at no additional cost to the Employer.

Environment, Health & Safety

Category	PforR (Program-for-Results)	IPF (Investment Project Financing)	Remarks
Project Design Document	Program Appraisal Document (PAD)	Project Appraisal Document (PAD)	
Environmental & Social Framework	ESSA (Environmental & Social Systems Assessment) – system-based	Environmental and Social Framework (ESF) (post-2018) or Operational Policies (OPs) (pre-2018)	
Safeguard Instruments	No site-specific ESMP, RAP, etc. required by WB; borrower system is assessed	Project-specific: ESIA, ESMP, RAP, CESMP, etc. (required depending on risk and scope)	
Commitment Plan	Actions embedded in Program Action Plan (PAP)	Environmental and Social Commitment Plan (ESCP) required	
Fiduciary Review	Fiduciary Systems Assessment (FSA)	Financial Management Assessment + Procurement Plan	
Grievance Redressal Mechanism	Required at the program/system level	Required at project and stakeholder level	
Procurement framework	Borrower's procurement system	World Bank's **Procurement Regulations**	
Disbursement Conditions	Disbursement-Linked Indicators (DLIs) – funds released after achieving agreed results	Disbursement based on eligible expenditures and procurement plan execution	
Program Action Plan (PAP)	Required – includes environmental, social, fiduciary strengthening actions	Not required as a stand-alone document; actions included in implementation plans	
Risk Assessment	Integrated Risk Assessment (included in PAD)	Integrated Risk Assessment + Detailed E&S Risk Categorization	
Monitoring Mechanism	Independent Verification Agent (IVA) for DLI tracking	World Bank supervision, third-party audits	

Requirement	**ESF Standard**
Environmental and Social Impact Assessment (ESIA)	**ESS1**: Assessment and Management of E&S Risks and Impacts
Environmental and Social Management Plan (ESMP)	**ESS1**
Construction ESMP (C-ESMP)	**ESS1**, **ESS4**
Labor Camp Management Plan	**ESS2**: Labor and Working Conditions
Medical Screening of Workers	**ESS2**
Labor Code of Conduct	**ESS2**, **ESS4**, **ESS10**
Contractors HSE Staff and PPE	**ESS2**, **ESS4**
Resettlement Action Plan (RAP)	**ESS5**: Land Acquisition, Restrictions on Land Use, etc.
Traffic Management Plan	**ESS4**: Community Health and Safety
Waste Management Plan	**ESS3**: Resource Efficiency and Pollution Prevention
Emergency Preparedness and Response Plan	**ESS4**
Grievance Redress Mechanism (GRM)	**ESS2**, **ESS10**
Stakeholder Engagement Plan (SEP)	**ESS10**: Stakeholder Engagement and Information Disclosure
Biodiversity Management Plan	**ESS6**: Biodiversity Conservation
Cultural Heritage Management Plan	**ESS8**: Cultural Heritage
Livelihood Restoration Plan	**ESS5**

Bill of Quantities
&
Technical Specifications

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

GRAND SUMMARY

Sr. No	Description	Amount (Rs.)
1	ANAEROBIC FILTER AT CHAK 191	
2	WSP AT CHAK 2KB	
3	TRICKLING FILTER AT VILLAGE SARKALAN	
	TOTAL COST (Rs.)	
	ADD 5% (PRA charges)	
	GRAND TOTAL	
	Rs. in Million	

ANAEROBIC FILTER

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

ABSTRACT OF COST

Sr. No	Description	Amount (Rs.)
1	SEWAGE TREATMENT PLANT	
2	FISH POND	
3	CHEMICAL ROOM	
4	OFFICE BUILDING	
5	TREE PLANTATION	
6	BOUNDARY WALL AND MAIN GATE	
7	ELECTRIFICATION	
8	CCTV CAMERA (SCADA)	
9	MONITORING PROBS	
10	SOLAR SYSTEM	
	TOTAL COST (Rs.)	
	Rs. in Million	

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: SEWAGE TREATMENT PLANT

SR. NO.	DESCRIPTION	UNIT	QUANTITY	UNIT RATE		AMOUNT
				Rupees in Figures	Rupees in Words	(Rs)
A						
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m). **2 (b) By Excavator** ii) Ordinary soil	1000 Cft.	35.12			
2	Providing and laying sand under and around the sewer pipe, including leveling, manual compaction, complete in all respect.	100Cft	3.44			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate): **(h) Ratio 1: 3: 6**	100 Cft.	22.39			
4	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):- (a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- (1) Type A (nominal mix 1:1:2)	Cft.	9,522.23			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 6 (a) (i) above not requiring form work (i.e. horizental shuttering) complete in all respects:- 1) Type A (nominal mix 1: 1: 2)	Cft.	4,233.11			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: SEWAGE TREATMENT PLANT

SR. NO.	DESCRIPTION	UNIT	QUANTITY	UNIT RATE		AMOUNT
				Rupees in Figures	Rupees in Words	(Rs)
5	Fabrication of mild steel reinforcement for cement concrete, including providing at site, cutting, bending, laying in position, making joints and steel chairs, etc. complete in all respect. and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also Includes removal of rust from bars):- (ii) Deformed bars (Grade-60)	100 Kg	521.42			
6	Pacca brick work in ground floor:- i) cement, sand mortar:- Ratio 1:3	100 Cft	0.26			
7	Cement plaster 1:3 upto 20' (6.00 m) height:- b) ½" (13 mm) thick	100 Sft	0.63			
8	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or equivalent including the cost of specials, in trenches, as approved & directed by the engineer incharge, complete in all respects. **b) PN-8 (SDR-21)** 110 mm	P.Rft	421.00			
9	Providing and fixing heavy duty Gate valve of specified diameter and material for pressure rating PN-16 mde of Crane (USA), Hatersly (UK) or Scon (Pakistan) i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge. (b) Flange Ended Ductile Iron Valve (xi) 6" dia (xiv) 12" dia	 Each Each	 23.00 2.00			
10	Providing and fixing heavy duty Check valve of specified diameter and material for pressure rating PN-16 made of Crane (USA), Hatersly (UK), Scon (Pakistan) or approved equivalent manufacturer i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge.					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: SEWAGE TREATMENT PLANT

SR. NO.	DESCRIPTION	UNIT	QUANTITY	UNIT RATE		AMOUNT
				Rupees in Figures	Rupees in Words	(Rs)
	(b) Flange Ended Ductile Iron Valve					
	(xi) 6" dia	Each	2.00			
11	Providing, laying, cutting, jointing, testing and disinfecting cast iron pipe line (BS-2035) in trenches (and vent), with flanged and flanged joints, complete in all respects:-					
	d) 6" (150 mm) i/d	P.Rft	324.00			
12	Providing and fixing cast iron specials of B.S.S. Class 'B' (such as bend, tee, cross collar, reducer, tail piece, flanged socket, flanged spigot, cap, taper, angle branch, plug, etc) for Asbestos cement pipe line, with comet joint and rubber ring, complete.					
	i) 3" to 6" (75 to 150 mm) i/d	Per Kg	1,862.00			
13	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect.					
	i) 10"wide 6 mm thick	Rft	341.33			
14	Rehandling of earthwork:					
	a) Lead upto a single throw of Kassi, phaorah or shovel	1000Cft	10.54			
15	Preparing surface and painting with Matt/ Glossy high chemical resistant/hard wearing Polyurethane paint (Epoxy Paint) by sprayer/ Brush i/c the cost of Primer coat , all material and labour complete in all respects as approved and directed by the Engineer Incharge.					
	(i)Priming Coat	Per Sft	11,586.23			
	(ii) Each and subsequent Coat	Per Sft	23,172.46			
16	Providing, laying, watering and ramming brick or stone ballast 1½" to 2"(40 mm to 50 mm) gauge mixed with 25% sand, for floor foundation, complete in all respects.	100Cft	6.69			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: SEWAGE TREATMENT PLANT

SR. NO.	DESCRIPTION	UNIT	QUANTITY	UNIT RATE		AMOUNT
				Rupees in Figures	Rupees in Words	(Rs)
17	Providing and laying Tuff Pavers, having 7000 PSI, crushing strength of approved manufacturer, over 2" to 3" sand cushion i/c grouting with sand in joints i/c finishing to require slope complete in all respect. (50% Grey / 50% Coloured)					
	c) 80-mm thick	Per Sft	2,025.00			
18	Dry rammed brick or stone ballast, 1½" to 2"(40 mm to 50 mm) gauge.	100 Cft	23.88			
19	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From nearest quarry (Sargodha Quarry 100km)	100Cft.	127.00			
					A-Total Amount	
B	**NON MRS**					
20	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification and as directed by the engineer.	Per Cft.	13,585.00			
21	Providing and fixing GI cover (size 2'-0" x 2'-0") with angle iron frame 2"x2"x1/4". Angle iron 1-1/2"x1-1/2"x1/4" for cover thickness of cover will be 1/5"thick GI sheet with hooks, hinges etc complete in all respect as per drawing, specifications and as directed by the engineer.	Each	13.00			
22	Providing and fixing GI cover (size 4'-0" x 3'-0") with angle iron frame 2"x2"x1/4". Angle iron 1-1/2"x1-1/2"x1/4" for cover thickness of cover will be 1/5"thick GI sheet with hooks, hinges etc complete in all respect as per drawing, specifications and as directed by the engineer.	Each	38.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: SEWAGE TREATMENT PLANT

SR. NO.	DESCRIPTION	UNIT	QUANTITY	UNIT RATE		AMOUNT
				Rupees in Figures	Rupees in Words	(Rs)
23	Providing and fixing malleable iron rungs with outer dimensions 12"x15"x3" and weight not less than 7.5kg including carriage and setting the same in work, to correct lines and levelsas per drawing, specification and as directed by the engineer.	Each	320.00			
	FILTER MEDIA					
24	Providing and laying filter media of graded gravels 2" to 4" as per drawings, specifications and as directed by the engineer.	Per Cft.	10,631.25			
					B-Total Amount	
					Grand Total (A+B)	

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 2: FISH POND

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Compaction of earthwork (soft, ordinary or hard soil) :-					
	c) Ramming earthwork (all types of soil).	1000 Cft	0.10			
2	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	1) By Manual					
	ii) in ordinary soil.	1000 Cft.	1.70			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(h) Nominal mix Ratio 1: 3: 6	100 Cft	0.80			
4	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	181.94			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 6(a)& (b) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	99.40			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 2: FISH POND

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5	Fabrication of mild steel reinforcement for cement concrete, including providing and site, cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	(ii) Deformed bars (Grade-60)	100 kg	6.40			
6	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or equivalent including the cost of specials, in trenches, as approved & directed by the engineer incharge, complete in all respects.					
	b) PN-8 (SDR-21)					
	7) 90 mm	Rft	35.00			
7	Providing and fixing sluice valve of B.S.S. quality and weight, Class `B', for cast iron pipe line, and Asbestos cement pipe line (including cost of jointing material):-					
	a) 3" i/d (75 mm)	Each	2.00			
8	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipeline in trenches, with socket joints, using G.I. pipes of B.S.S. 1387-1967 complete in all respects, with specials and valves.					
	f) 2" i/d (50 mm) 3.65mm thick	Rft	156.00			
					A-Total Amount	
	Non-Mrs Items					
9	Providing and fixing Sp air pump Lp-100, 100 watt including nano bubble diffuser with piping.	Each	1.00			
10	Providing and fixing green tarpal at top of Fish Pond including all accessories complete in all respect as per drawing and as directed by the engineer.	Sft	289.00			
					B-Total Amount	
					Grand Total (A+B)	

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	(ii) in ordinary soil	1000 Cft	0.80			
2	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent @ specified suspension concenterate (SC), Mixing Ability- HEXTAR with Ratio (1:250) =540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10-years complete in all respect as approved by the Engineer Incharge.	Per Sft	850.85			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(f) Nominal mix Ratio 1: 2: 4	100 Cft	0.55			
	(f) Nominal mix Ratio 1: 1.5: 3	100 Cft.	0.30			
	(h) Nominal mix Ratio 1: 3: 6	100 Cft	0.80			
4	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	201.25			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 6(a) (b) above not requiring form work (i.e. horizental shuttering) complete in all respects:- (2) Type B (nominal mix 1: 1½: 3)	Cft	49.30			
5	Fabrication of mild steel reinforcement for cement concrete, including providing and site, cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (ii) Deformed bars (Grade-60)	100 kg	9.80			
6	Pacca brick work in foundation and plinth in:- i) Cement, sand mortar:- Ratio 1:3	100Cft.	3.50			
7	Pacca brick work in ground floor:- i) cement, sand mortar:- Ratio 1:4	100Cft.	3.50			
8	Cement plaster 1:4 upto 20' (6.00 m) height:- b) ½" (13 mm) thick	100 Sft	14.80			
9	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height. c) 1:4	100 Sft	2.60			
10	Filling, watering and ramming earth under floors:- (i) with surplus earth from foundation, et	1000 Cft	0.25			
	(ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft	0.50			
11	Extra for every 50 ft. (15 m) additional lead or part thereo i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft	10.00			
12	Supplying and filling sand under floor; or plugging in wells.	100 Cft	0.65			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
13	1½"(40 mm) thick mosaic flooring, consisting of ½ "(13 mm) mosaic topping of one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over 1"(25 mm) thick floor of 1:2:4 cement concrete, including rubbing and polishing complete with finishing :-					
	(b) using white cement	100 Sft	1.55			
14	Mosaic dado or skirting with one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over ½"(13 mm) thick cement plaster 1:3, including rubbing and polishing, complete with finishing:					
	(b) using white cement :					
	ii) ½"(13 mm) thick	100 Sft	0.30			
15	Providing and fixing marble strip of any shade for dividing the mosaic flooring into panels					
	a) Size 1½" x3/8" (40 x 10 mm)	Rft	15.00			
16	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft	3.00			
17	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc.					
	(i) 300 gauge (0.003" thick)	Sft	3.00			
18	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm)	Each	1.00			
19	Bottom Khuras of brick masonry in cement mortar 1:6, 4'x2'x4½" (1200x600x113 mm) over 3" (75 mm) cement concrete 1:4:8.	Each	1.00			
20	Providing and fixing sliding bolt to doors:-					
	i) brass sliding bolt, 10" (250 mm) long	Each	1.00			
21	Priming coat of chalk under distemper.	100 Sft	6.50			
22	Distempering					
	(a) new surface					
	ii) two coats	100 Sft	6.50			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
23	Providing and applying weather shield paint of approved quality on external surface of building including preparation of surface, application of primer complete in all respect: (external wall)					
	i) 1st coat	100 Sft	7.90			
	ii) 2nd coat	100 Sft	7.90			
24	P/F Iron door comprising of specified leaves made of 1-1/4" x1-1/4" x3/16" MS angle iron for leaf frame, diagonal and horizontal braces duly welded with MS. sheet 18-SWG i/c the cost of sliding bolt, tower bolt and painting 3-coats but excluding the cost of Chowkat complete in all respect as approved and directed by the Engineer incharge.					
	(ii) Double Leaf	Per Sft	24.50			
25	Providing and fixing 2" wide MS/ GI Chowkat singel/double rebate made of 16 SWG MS sheet pressed/ welded/ supported with M.S. flat 1- 1/4"x1/8" i/c 6"long M.S. Flat 1"x1/8"hold fasts (6-Nos) welded/ screwed, punching of lock hole covered with MS Box,coating with antirust paint including filling with cement sand mortar (1:8) and embedding hold fast in cement concrete (1:2:4) ,complete in all respect as approved and directed by Engineer Incharge.					
	(ii) 10.50 " wide	Per Sft	24.50			
26	Providing and fixing steel windows using M.S. sheet (16 SWG) moulded tubular pipe 1½"x1½" (40x40mm) for frame and 1¼"x1¼" (30x30mm) for leaves including M.S. square bars ¼"x¼" (6x6 mm) welded around each panel of frame, 5 mm thick glass panes fixed with double M.S. square tubular pipe 3/8"x3/8" (10x10mm) (22 SWG) beading with U' shaped rubber lining, brass fitting, holdfast, including painting three coats complete in all respects.					
	a) For openable panels fixed with wire gauze 24 SWG, 12x12 mesh and glass panes ¼" (6 mm) thick.	Per Sft	36.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
27	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized Polyvinyl Chloride) Nikasi/ SWV pipe, Dadex / Popular / Beta or approved equivalent manufacturer, plain / Bell Ended / Z - Joints conforming to BS 4514 / BS 5255 EN-1329 including the cost of specials and Solvents complete in all respects, as per drawings & specifications and / or as approved and directed by the Engineer Incharge. **b) Type (SDR 32.5/SN-8)** (v)4"(110 mm)	Rft	13			
28	Brick on edge flooring, laid in 1:6 cement mortar, over a bed of ¾" (20 mm) thick cement mortar 1:6.	100 Sft	2.15			
29	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From nearest quarry (Sargodha Quarry 100km)	100 Cft	4			
					A-Total Amount	

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
B	**NON MRS**					
30	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification and as directed by the engineer.	Per cft	1,191.00			
31	Providing, fixing, commissioning & testing of Hypo Chlorinator (make Europe/USA or equivalent) consisting of multifunction dosing pump with a microcontroller (RX controller) make Europe/USA complying to EU directives 2006/95/EC and 2004/108/EC, having capacity of 8-10 Liter/hour and maximum pressure of 10 bar, having standard power supply of 230V A.C ± 10%, 50 Hz single phase, Insulation protection rating of IP65, complete with all accessories like injection valve, suction hose, discharge hose, valves, RX probe, level switch, dosing tank complete in all respect.	Job	1			
32	Electricity Connection including all appurtenances.	Job	1			
					B-Total Amount	
					Grand Total (A+B)	

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) lift upto 5 ft (1.5m)..					
	(ii) in ordinary soil	4.300	1000 Cft.			
2	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/Ms Hextar or equivalent @specified suspension concenterate (SC), Mixing Ability-HEXTAR with Ratio (1:250) = 540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10-years complete in all respect as approved by the Engineer Incharge.	2198.26	Sft			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(f) Nominal mix Ratio 1: 2: 4	2.11	100 Cft.			
	(i) Nominal mix Ratio 1: 3: 6	3.71	100 Cft.			
4	Pacca brick work in foundation and plinth					
	i) Cement, sand mortar Ratio 1 : 3	8.24	100 Cft.			
5	Providing and laying damp proof course of cement concrete 1:2:4 (cement, sand, shingle), including bitumen coating.					
	(b) with 2 coats of bitumen: i) 1½" thick (40 mm)	1.81	100 Sft.			
6	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:- (a) with one coat of bitumen and one coat of polythene sheet 500 gauge:					
	ii) Ratio 1:3 b) ¾" thick (20 mm)	1.43	100 Sft.			
7	Pacca brick work in ground floor:-					
	i) cement, sand mortar Ratio 1:4	8.85	100 Cft.			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
8	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	386.38	Per Cft			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 6(a)&(b) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	306.75	Per Cft			
9	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	(ii) Deformed bars (Grade-60)	14.35	100 kg			
10	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From nearest quarry (Sargodha Quarry -200km)	12.00	100Cft.			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
11	Cement plaster 1:4 upto 20' (6.00 m) height:-					
	a) 3/8" (10 mm) thick	27.92	100 Sft.			
12	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height.					
	c) 1:4	12.00	100 Sft.			
13	Filling, watering and ramming earth under floors:-					
	(i) with surplus earth from foundation, et	0.98	1000 Cft.			
	(ii) with new earth excavated from out side, lead upto one chain (30m)	1.74	1000 Cft.			
14	Extra for every 50 ft. (15 m) additional lead or part thereof					
	i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	34.80	1000 Cft.			
15	Supplying and filling sand under floor; or plugging in wells. (Provisional as Slect Fill)	13.36	100 Cft.			
16	Dry rammed brick or stone ballast, 1½" to 2"(40 mm to 50 mm) gauge.	2.26	100 Cft.			
17	Providing and laying superb quality Porcelain glazed tiles flooring of MASTER brand of specified size in approved design,Color and Shade with adhesive/bondover 3/4" thick (1:3) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respect as approved and directed by the Engineer Incharge. a) Full body Glazed tiles (i) 400 mm x 400 mm	580.34	Sft			
18	Tile skirting laid in 1:2 cement mortar, over ¾"(20 mm) thick cement mortar, 1:2 including cement washing and filling joints complete:-					
	(b) mosaic tiles	0.89	100 Sft.			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
19	Providing and laying 3/8" thick Prepolished Marble skirting/ risers having uniform texture (spotless) of size 24" x 6" of approved quality and shade with adhesive bond over 3/4" thick (1:2) cement sand mortor complete in all respect i/c the cost of matching sealer to finish the joints as approved and directed by the Engineer Incharge. **i) China Verona**	143.36	Sft			
20	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	6.85	100 Sft.			
21	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc. (i) 300 gauge (0.003" thick)	685	Per Sft.			
22	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm)	1	Each			
23	Bottom Khuras of brick masonry in cement mortar 1:6, 4'x2'x4½" (1200x600x113 mm) over 3" (75 mm) cement concrete 1:4:8.	1	Each			
24	Providing and fixing M.S. sheet hollow pressed frame of doors, windows, C. windows, etc. (chowkat only) of 20 SWG welded with M.S. flat 6"x 1¼" x 1/8" (150 mmx30mmx3mm) M.S. holdfast 9"x1"x1/8" (225mmx25mmx3mm) welded/screwed 4" (100 mm) long iron hinges, including filling chowkat with cement sand mortar 1:8 and embedding holdfast in cement concrete 1:2:4, complete in all respects:					
	a) single rebate	66.50	Per Sft.			
	b) double rebate	21.00	Per Sft.			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
25	P/F 1-1/2" thick solid flush door comprising of 2.5 mm thick Deodar/ Ash/ Oak ply with grooves, compressed over 2.5 mm thick commercial ply over 1" thick packing wood in style and rails under proper pressure i/c the cost of nails, tower bolt, handles, glue, sawing charges and lacquar polishing to show the grains of ply properly, sand papering and 3/8" thick matching wooden lipping as approved and directed by the Engineer Incharge.	87.50	Per Sft.			
26	Dry brick on edge paving, sand grouted, including preparation of bed by watering, ramming & bringing the same to proper camber, by ½ " (13 mm) thick mud plaster.	2.94	100 Sft.			
27	Grouting 4½" (113 mm) dry brick work with cement mortar ratio 1: 5	2.94	100 Sft.			
28	Providing and fixing sliding bolt to doors:- iii) brass sliding bolt, 10" (250 mm) long	4	Each			
29	Painting new surface:- c) Preparing surface and painting of doors and windows any type (including edges):- i) priming coat. ii) each subsequent coat of paint. (2 coats)	1.75	100 Sft.			
30	Providing and fitting all types of glazed aluminium windows of anodised bronze colour partly fixed and partly sliding using delux sections of approved manufacturer having frame size of 100 x 20 mm (4"x¾") and leaf frame sections of 50 x 20 mm (2"x¾"), all of 1.6mm thickness including 5 mm thick imported tinted glass with rubber gasket using pproved standard latches, hardware etc., as approved by the Engineer in-charge.	84.00	Per Sft.			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
31	Providing and fixing M.S. flat ½"x1/8" (13mm x 3mm) grill including ¾" x 1/8" (20 mmx3 mm) M.S. flat f rame, in windows of approved design, including painting three coats, complete in all respects.	84.00	Per Sft.			
32	Priming coat of chalk under distemper.	22.96	100 Sft.			
33	Distempering (a) new surface ii) two coats	22.96	100 Sft.			
34	Cement pointing struck joints, on walls, upto 20' (6.00 m) hiehgt:- (external wall) a) ratio 1:2	21.69	100 Sft.			
	PLUMBING WORKS					
35	Providing and fitting glazed earthen ware wash hand basin 56x40cm, including bracket set, waste pipe and waste coupling, etc. ii) coloured, with pedestal	1	Each			
36	Providing and fixing stainless steel sink with drain board, size 120x60 cm (48"x24") including bracket set, waste pipe and waste coupling.	1	Each			
37	Providing and fixing chromium plated shower rose:- ii) 2x15 cm (¾"x6")	1	Each			
38	Providing and fixing, chromium plated mixing valve, for wash hand basin, sink or shower.	3	Each			
39	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipe line in trenches, with socket joints, using G.I pipes of B.S.S. 1387-1967complete in all respects with specials and valves:- ii) Medium Quality (Provisional)					
	b) ¾" i/d (20 mm) 2.65mm thick	27.60	Per Rft.			
	c) 1" i/d (25 mm) 3.25mm thick	20.00	Per Rft.			
40	Providing and fitting glazed earthen ware water closet, squatter type, combined with foot rest. ii) coloured	1	Each			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
41	Providing and fitting plastic made low down flushing cistern 1363 liters (3 gallons) capacity, including bracket set, copper connection etc., complete.					
	ii) coloured	1	Each			
42	Providing and fixing looking glass 55x40 cm size and 5mm thick, first quality	1	Each			
43	Providing and fitting					
	i) Plastic Soap Dish	1	Each			
	ii) Plastic toilet paper holder	1	Each			
	iii) Plastic towel rail	1	Each			
	iv) Plastic shelf 60X13cm with bracket and railing	1	Each			
44	Providing and fixing chromium plated bib cock					
	i) 2 cm (¾")	4	Each			
45	Providing and fixing floor trap of cast iron, including concrete chamber all round, and C.I grating:					
	ii) 10x7.5 cm (4"x3")	2.00	Each			
46	Providing and fitting gully trap, including cement concrete, cost of PVC grating 15x15cm and masonry chamber 30x30cm.	2.00	Each			
47	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe (Dadex/ Popular/ Beta or approved equivalent manufacturer, with specified pressure rating PN (PRESSURE NOMINAL) and conforming to DIN 8077-8078 code i/c cost of solvent, specials, making jharries complete in all respect as approved and directed by Engineer Incharge. (Internal/ External Diameters mentioned). **b) PN-20 pipe**					
	(ii) (3/4") 25 mm	69.00	Rft			
	(iii) (1") 32 mm	20.00	Rft			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
48	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized Polyvinyl Chloride) Nikasi/ SWV pipe, Dadex/ Popular/ Beta or approved equivalent manufacturer, plain/ Bell Ended/ Z-Joints conforming to BS 4514/ BS5255 - EN 1329 including the cost of specials and Solvents complete in all respects, as per drawings & specifications and/ or as approved and directed by the Engineer Incharge.					
	(v)4"(110 mm)	15.00	Rft			
	(vi)6"(160 mm)	40.00	Rft			
49	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized polyvinyl Chloride) Nikasi/ waste pipe Fittings make of Dadex/ Popular/ Beta or approved equivalent manufacturer, conforming to code EN-1329 including the cost of Solvents complete in all respect as approved and directed by the Engineer Incharge. **a) P-Trap**					
	(i) 4" dia	4.00	Each			
50	Providing and hoisting vertical/ horizontal type storage tank of required capacity made of rotationally molded from (HDPE), double ply polyethelene of approved manufacturer i/c cost of making connection for inlet/ outlet pipe, float valve i/c all cost of specials & labour complete in all respect as approved and directed by the Engineer Incharge.	200.00	Per gallon			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 4: STAFF QUARTERS

Sr. No.	Description	Unit	Quantity	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
51	Providing and fixing almirah shutter comprising of 3/4" thick both side Laminated/Glossy MDF (Karachi) sheet with 1"x3/4" deodar wood golla all around the leaf fixed on (3"x1")Kail wood frame i/c the cost of 1/2" full brass hinges, C.P.handles, catchers, screws, and rawal plugs, polishing/painting 3 coat to gola & frame i/c the cost of locking arrangement complete in all respect as approved and directed by Engineer Incharge.	60.00	Per Sft			
52	Providing and installing domestic pump and motor including boring, pipe, strainer, fittings etc. Compete in all respect.	1.00	Each			
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

Bill No. 5: TREE PLANTATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	NON MRS					
1	**Native trees**					
a.	Populus (Poplar)	20	Each			
b.	Bombax ceiba (Simal)	5	Each			
c.	Ficus religiosa (Pipal)	10	Each			
d.	Salix (Willow)	9	Each			
	Mortaility 20% (during 1 year of operation)	10	Each			
2	**Input Requirements**					
2	Providing and laying at site the following items as per direction of the engineer.					
a.	Fertilizer (NPK)	2	Bags			
b.	FYM	1,000	Kg			
3	Development (For 12 Months)					
a.	Gardner	12	Month			
b.	Miscellaneous (Vehicle expenditures, wear & tear of tools etc)		L/S			
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 6 Boundary wall & Main Gate

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m). 2) a) By Excavator					
	ii) in ordinary soil.	1000 Cft	6.55			
2	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(h) Ratio 1:3:6	100 Cft	4.75			
3	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	277.00			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 6(a)&(b) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	439.45			
4	Providing and Fabrication of mild steel reinforcement for cement concrete, including cutting, laying in position making joints and fastenings including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars)					
	ii) Deformed bars (Grade 60)	100 Kg	25.08			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 6 Boundary wall & Main Gate

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From sargodha quarry	100 Cft	10.95			
6	Pacca brick work in foundation and plinth in:- i) Cement, sand mortar:-					
	Ratio 1:3	100 Cft	49.15			
7	Providing and laying damp proof course of cement concrete 1:2:4 (using cement, sand and shingle), including bi tumen coating :- (b) with 2 coats of bitumen:					
	ii) 2" thick (50 mm)	100 Sft	5.30			
8	Pacca brick work other than building upto 10ft. (3 m) height.					
	Ratio 1:3	100 Cft	26.45			
9	Cement plaster 1:3 upto 20' (6.00 m) height:-					
	b) ½" (13 mm) thick	100 Sft	37.00			
10	Cement pointing struck joints, on walls, upto 20' (6.00 m) hiehgt:-					
	a) Ratio 1:2	100 Sft	37.00			
11	Rehandling of earthwork, lead upto a single throw of kassi, phaorah or shovel, including Ramming earthwork (all types of soil).	1000 Cft	3.30			
12	Making and fixing steel grated door with 1/16" thick (1.5mm) sheeting, including angle iron frame 2"x2"x3/8" (50x50x10 mm) and ¾" (20 mm) square bars 4" (100 mm) centre to centre, with locking arrangement .	Sft	94.50			
13	Painting new surface:- d) Preparing surface and painting guard bars, gates of iron bars, gratings, railing (including standards, braces, etc.) and in similar open work:-					
	i) priming coat.	100 Sft	0.95			
	ii) each subsequent coat of paint.(2 Coats)	100 Sft	1.89			
Total Amount						

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 7: ELECTRIFICATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1.0	**WIRING AND ACCESSORIES**					
1.1	Wiring of light or fan point from switch board/dimmer to the point with 3x1.5 mm^2 (P+N+E) PVC insulated single core stranded cables in 25 mm PVC conduit/pipe concealed in walls, columns and slabs including accessories, PVC box, 10 Amp. gang switch 1 or 2 way as required, one for each light or fan and installed as in specifications complete in all respects.	Each	15			
1.2	Circuit wiring from DB/ MCBs to gang switches board and from switch board to another switch board with 3x2.5 mm^2 (P+N+E) PVC insulated single core stranded cables in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	8			
1.3	The same as item No. 1.1 but from one light point to another light point.	Each	15			
1.4	10/13 Amp 3 pin universal flush mounting switch socket outlet wired from DB/MCBs to first outlet with 3x4 mm^2 (P+N+E) single core cable stranded (away from switch board) in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	5			
1.5	The same as item No.1.4 but wiring from one socket outlet to another socket outlet with 3x2.5 mm^2 (P+N+E) single core stranded cable in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	6			
1.6	15/20 Amp 3 pin mounting switch socket outlet wired from DB MCBs to independent socket outlet with 3x6 mm^2 (P+N+E) single core stranded cable (away from switchboard) in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	7			

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 7: ELECTRIFICATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
2.0	**CONDUIT/PIPE**					
2.1	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables in walls/barriers/structure.	Rft.	350			
2.2	PVC pipe/conduit Class-B 200 mm dia with accessories suitable for laying multi-core cables in walls/barriers/structure.	Rft.	200			
2.3	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables from pole to pole in trenches/directly burried including excavation.	Rft.	1,200			
2.4	PVC pipe/conduit Class-D 100 mm dia with accessories suitable for laying multi-core cables in trenches/directly burried on road crossings including excavation.	Rft.	300			
3.0	**Power Cables**					
3.1	Supply and erection of copper conductor cables for service connection, in prelaid pipe/G.I. wire/trenches, etc. (rate for cable only)					
	PVC insulated, PVC sheathed 4 core, 600/1000 volt non armoured cable					
(a)	10 mm (7/0.052")	Rft.	1,800			
(b)	16 mm (7/0.064")	Rft.	350			
3.2	Supply and erection of single core PVC insulated copper conductor cables, in prelaid PVC pipe/M.S. conduit/G.I pipe/wooden strip batten/wooden casing an capping/G.I. wire/trenches (rate for cables only)					
	450/750 volts, PVC insulated:					
(a)	10 mm sq (7/0.052")	Rft.	1,800			
(b)	16 mm sq. (7/0.064")	Rft.	500			
3.3	3 Nos. 1 core 2.5 mm^2 Cu/PVC 450/750 Voltage grade cable (stranded conductor) (Imported copper shall be used. Verified documentary evidence for source of copper & PVC shall be furnished prior to manufacturing) from junction box to the fitting through the hollow of pole.					
-	For 10m Pole	Each	4			

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 7: ELECTRIFICATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
4.0	**EXHAUST FAN**					
4.1	Providing and fixing Copper winded Exhaust fan with louver and shutter made of Pak/Younas/G.F.C. i/c the cost of necessary cable and hardware for connection from ceiling rose complete as approved and directed by Engineer Incharge.					
	Plastic Body (12" dia)	Each	4			
4.2	Providing and fixing Copper winded wall bracket fan made of Pak/ Younas/G.F.C or NEECA approved equivalent i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer.					
	18" Sweep dia	Each	2			
4.3	Providing and fixing Copper winded ceiling fan made of Pak/ Younas/G.F.C or NEECA approved equivalent i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer.					
	56" dia	Each	1			
5.0	**Road / Street Lighting Poles and Foundations**					
5.1	10m high single arm octagonal shape electric street light pole, made of hot dipped 4.5 mm thick (7 SWG) galvanized steel, tappered from 225 mm at bottom to 100 mm at top, with 1500 mmx60 mmx4mm thick dia. arm for luminaire installation, duly G.I.welded with 470x470x20 mm base plate with the help of 4 no triangular stiffeners 100x350x20 mm of GI sheet, with built in junction box with shutter & one (01) no. 2A SP MCB 10kA breaker, i/c the cost of nuts & J-rag bolts, duly fixed in prelaid concrete foundation, foundation will be paid additionally as approved and directed by the Engineer Incharge.					
		Each	4			
5.2	Road/Street Lighting Pole Foundations including 04 nos. of dia 25mm J-Bolts, PVC long Bends Class (3000 Psi-cylinder strength) concrete, 60 grade reinforced steel, Excavation, Blinding Concrete, Common Backfilling & Pitchmen Coating etc. as shown on drawing. Complete in all respect.					
		Each	4			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 7: ELECTRIFICATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
6.0	**<u>LED Road Light Fixtures</u>**					
6.1	Road Lighting LED Cobra-head Luminaries of 90 Watt with 10800 Lumens conforming to IP 66 & IK 08 or above Philips/Osram/Thorn or equivalent with corrosion resistant die casted Aluminium housing, silicon gasket in special groove, UV stable & scratch resistant synthetic materials, thermally hardened glass complete with LED Chip (Philips Lumiled/Cree/Nichia/Osram make or equivalent), programmable LED driver (Harvard/ TCI/ Lumotech/ Philips/VOSSLOHSchwabe/ Lightech make or equivalent), minimum 10kV surge protection rating i/c the cost of all accessories/ components required for proper operation, fully flexible for future upgradation and easy replacements for maintenance purposes, bucket elevator charges as approved and directed by the Engineer Incharge.	Each	4			
Total Amount (MRS)						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 7: ELECTRIFICATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Supply, stroage, installation, testing and commissioning of the following items of work (unless specifically stated otherwise) including all material, labour, tools, accessories, etc. required for proper completion of each item as per specification, drawings and as directed by the Engineer.					
1.0	**LIGHT FITTINGS AND FANS**					
	Following LED Luminaries of suitable wattage make suitable for the project requirements. Contractor to submit lighting design calculation to determine the adequacy of the wattage and should adjust the number of LEDs/wattage as per project lighting requirements. The fitting shall be approved by the Engineer.					
1.1	Light Fixture Type LED Batten Ceiling/surface mounted, 18W complete in all respect with allied accessories . The fitting shall be approved by the Engineer.	Each	12			
1.2	Light Fixture Type LED Batten Ceiling/surface mounted, 10W above mirror in toilets complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	4			
1.3	Light Fixture Type LED surface mounted down lighter, 12W complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	12			
1.4	20W LED Water tight light fixture IP 65 complete in all respect with all allied accessories. The fitting shall be approved by the Engineer.	Each	4			
2.0	**DISTRIBUTION BOARDS**					
	D.Bs with TP incoming adjustable moulded case circuit breaker and SP miniature outgoing circuit breakers, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories. alongwith all installation and operational accessories as per specification or as shown on the drawings.					
2.1	**DB- Pump Room**	Each	1			
-	1 No. 16 Amps (Adj.) MCCB TP, RC=18kA, Icu=100%Ics					
-	3 Nos. outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 7: ELECTRIFICATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	- Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
2.2	**DB- Chemical Room**	Each	1			
	- 1 No. 16 Amps (Adj.) MCCB TP, RC=18kA, Icu=100%Ics					
	- 2 Nos. outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
	- 4 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
	- 3 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					
	- Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
2.3	**D B- Staff Building**	Each	1			
	- 1 No. 63 Amps (Adj.) MCCB TP, RC=25kA, Icu=100%Ics					
	- 04 Nos.outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
	- 05 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
	01 No. 16 Amp MCCB TP, (Adj.) RC=18kA, Icu=100%Ics (For DB Chemical Room)					
	01 No. 16 Amp MCCB TP, (Adj.) RC=18kA, Icu=100%Ics (For DB Pump Room)					
	02 No. 16 Amps (Adj.) MCCB TP, RC= 18 kA, Icu=Ics 100%, 02 No. 26 Amps (Adj.), Megnatic Contactor (AC-3), 2 Nos. Push Button (ON/OFF), 5 Nos. indication lights (ON, OFF) (R,Y,B), Brass cable glands/ accessories, 1 No. Auto-Manual-OFF (3 position switches for operation in auto (with photocell) and normal (manual mode- photocell overide), 3 Nos. photo-electric switches- (For External Lighting)					
	- 03 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					
	- Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
3.0	**EARTHING**					
3.1	Bore type, earthing up to permanent water level/moist soil by arrangement of earth pit/point comprising of concrete/ brickwork housing with lifting cover 50mm perforated GI pipe, appropriate bare copper stranded conductor as per details in drawing. The earthing and bonding shall be complete with fixing clamps etc. & all metal works shall be bonded to the proposed earthing network.	No.	2			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 7: ELECTRIFICATION

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	MATERIAL					
-	**Drilling of earth bore 3" dia 100 ft. deep or up to permanent water level.**					
-	**Supply and installation of G.I pipe 2" dia 14 SWG to be installed in pre-made bore including all accessories like tees, bends, sockets etc. Pipe shall be connected to tinned copper spike as per detail shown on drawing, complete in all respects.**					
-	Supply and installation of tinned copper spike to be manufactured as per detail shown on drawing. Spike shall be connected/screwed at bottom of G.I pipe including all accessories like nuts and bolts complete in all respect.					
-	Supply and installation of 70 mm^2 bare stranded electrolytic copper conductor lead in prelaid G.I pipe and connected to tinned copper spike as shown on drawing. 2 Nos. of leads to be installed including all accessories like brass nuts, bolts, washers etc complete in all respect.					
-	Supply and installation of tinned earth test link in earthing pit consisting of copper plate (12"x2"x1/2") with fixing arrangement on the wall of man hole including brass nuts, bolts washers lugs etc. complete in all respect.					
-	Construction of earthing pit (manhole) of internal size 18"x18"x24" deep with 9" thick brick wall with cement mortar, internal plaster 1:4, RCC 4" thick cover with lifting hooks including all accessories complete in all respect.					
-	Testing and commissioning of the earthing system alongwith all testing accessories complete in all respect.					
	TOTAL COST					

Note:

- The cost of materials are inclusive of General Sales Tax (G.S.T)
- The cost of the security deposit and obtaining of 11 kV electrical connection with installation material from DESCO/WAPDA shall be finalized as per site requirement and the cost for the same is not included in the above.
- The above referred cost is for estimation purposes only and are based on budgetary quotations from the different manufacturers/suppliers. The final cost for the referred items shall be decided/finalized by the Client as per method of procurement i.e. open tendering, limited quotations from prequalified manufacturers/suppliers or any other.

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Supply, wiring, tagging, termination, design, installation, testing and commissioning of following system complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards and technical specifications attached herewith					
1	**Fixed Bullet IP Camera 8MP** • 08 MPX Sony Starvis 4K Sensor 1/2.8” • Lens Type : Motorized with auto-iris and auto-focus functions, f=2.7 ~ 13.5 mm/F1.4 • Resolution: 3840 x 2160 pixels • Frame Rate: 20 fps (4K) • Min. Illumination: 0.1 lux (0 lx, IR on) • IR LED, range up to 50 m •Video Intelligent Analytics: Perimeter Intrusion Detection, Line Crossing Detection, Stationary Object Detection, Pedestrian Detection, Face Detection, Cross Counting and Face Recognition. • Operating Temperature -40°C ~ 60°C	No.	9			
2	**IP Based Outdoor PTZ Camera 5MP** • Resolution: 5MP • 30X Optical Zoom • Lens Type motorized, auto-iris function, f=4.7 ~ 141 mm/F1.5 ~ F4 • Edge Analytics • facial recognition. • Deep learning algorithm having People and Vehicle Counting technology • Detect, track, capture vehicle, non-motor vehicle and people	No.	2			
3	**PTZ Controller**	No.	1			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
4	**32 channels NVR Network Video Recorder (NVR)** • Video and audio channels: 32 • Supported protocols: ONVIF, RTSP • Supports resolution 3840 x 2160 • Recorded stream size: 320 Mb/s in total from all cameras • Internal HDDs mount: 8 • Internal storage for recording mount: 2 x HDD 3.5” 6 TB SATA • Minimum storage12 TB • Monitor outputs: 3 (HDMI (4K UltraHD), HDMI, VGA) • RAID protects recordings • Intelligent image analysis •Video Intelligence Analytics • Facial Recognition Advanced Analytics • Compatible with all Onvif IP cameras • Power Supply 100 ~ 240 VAC with 140 W PoE • Operating Temperature -10°C ~ 50°C	No.	1			
5	**Video Management Server with 24" VDU** Management & Client Software, • Intel Xeon gold Processor (16 Core with 32 threads) latest version • 32 GB DDR 4 RAM • 8TB Internal Hard disk drive SATA • HDMI port for connection to the High quality monitor • DVD/RW drive • 24” LED monitor FHD with HDMI and VGA • 10G optical connectivity • Keyboard, Mouse and Peripheral Interface Cards • 2U Rack mount chassis including redundant power supply (Minimum 500W) • Latest MS WINDOWS software 64 bit pre-installed Operating System and associated software.	No.	1			
6	**55" LED Display**	No.	1			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
7	**16-port Access Switches layer 3 with SFP Managed** • 1000 Base –T (RJ-45) Ports(PoE / PoE+) : 16 Ports • 1000 Base-X (SFP) : 2 Ports • Console Port RS-232/RJ-45 • Switching Capacity Bandwidth 128 Gbps • Packet forwarding rate (64B) : 92.1Mpps • Buffer memory 12 Mb • RAM (DDR3) : 512 MB • ROM (RAW HAND) : 512 MB • MAC table : 16K • VLAN table : 4k • Link aggregation Group (LAG) : 16, upto 8 ports per LAG • Maximum size of ECMP group : 8 • Maximum Jumbo – frames size : 10240 B • Stacking : 08 devices • Max power consumption : 400W (PoE)	No.	2			
8	**24-Port PoE+ SFP Managed Switch (For Monitoring Room)** • 1000 Base –T (RJ-45) Ports(PoE / PoE+) : 24 Ports • 1000 Base-X (SFP) : 4 Ports • Console Port RS-232/RJ-45 • Switching Capacity Bandwidth 128 Gbps • Packet forwarding rate (64B) : 92.1Mpps • Buffer memory 12 Mb • RAM (DDR3) : 512 MB • ROM (RAW HAND) : 512 MB • MAC table : 16K • VLAN table : 4k • Link aggregation Group (LAG) : 16, upto 8 ports per LAG • Maximum size of ECMP group : 8 • Maximum Jumbo – frames size : 10240 B • Stacking : 08 devices • Max power consumption : 400W (PoE)	No.	2			
9	**24 Core Fiber Optic Cable** Standard G652-D, • Cable type Single Mode • Cable construction Loose tube • Layer of Aramid Yarn 5mm • Wavelength 1300/1550 nm • Max attenuation 0.36 db/km Excavation duct price with all accessories shall be included	Meter	60			
10	**CAT-6**, 23AWG Cable including termination and tagging at both ends. Complete in all respects.	Meter	165			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
11	**Stainless Steel NEMA 4X 6U Outdoor Enclosure** suitable for installation of standard switches and patch panels and etc. Complete with floor base, vertical cable managers. Rack shall be equipped with power distribution units (PDUs). Complete in all respects. • IP55 • 02 no. or more cooling fans • Pole mount or Wall Mount • Door lock	No.	2			
12	**Indoor Communication Rack 12U (For Monitoring Room)** suitable for installation of standard switches and patch panels and etc. Complete with floor base, vertical cable managers. Rack shall be equipped with power distribution units (PDUs. Complete in all respects. • IP30 • 19 inch standard; • Removable Side Panels, side locks are optional; • Knock-off holes for entering cables • Turning angle of front door is over 180 degrees • Fans, shelf and PDU	No.	1			
13	**2 kVA UPS Pure Sine Wave** • Pure sine wave • Power factors 0.7 lag to 0.9 lead • Efficiency at full load shall be 88% with • Power factor :0.8 • load crest factor : 3: 1 • remote monitoring and diagnostics system Rack , Cables, Power DB , Complete in all respect	No.	1			
14	**VRLA Battery 160 AH Backup** • GEL VRLA Battery • High temperature tolerance • Excellent for deep discharge • Hugh resistance to water loss • Battries Racks • Maintenance free operation • Spill proof construction • 10 Years Life	No.	2			
15	**50 mm Class D - PVC Conduit**	Lot	1			
16	**HDPE pipe** • size 40mm • outer dia 40mm • wall thickness 3.5mm • standard length: 125m/250m/1000m	Meter	145			
17	Installation, Programming, Testing and Commissioning of complete system.	Job	1			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT

BILL OF QUANTITIES

BILL NO. 1: IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty	Unit Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Allow for **any other item** required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in this item but complete description, item rates, quantity required and brands shall be mentioned separately and to be attached with the BOQ.					
	Note: 1) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant. 2) Contractor is advised to confirm the cable running lengths as per site conditions before commencement of work. The Payment of cable shall be paid as per Running meter. 3) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor					
	Total Price					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

SOLARIZATION

No.	ITEM(s)	Description	Unit	Quantity	Amount (PKR) In Figures	Amount (PKR) in Words
1	PV module	Tier 1 Manufacturer according to bloomberg Q1 or Q2 issued rankings, IEC Standard 61215 Compliant, not less than 600 W N-Type and Half Cut PV modules or better, Monofacial or Bifacial	Sum	10 kW		
2	String Inverter	3 phase Hybrid Inverter with Remote Monitoring Devices	Sum	9 kW		
3	Battery Backup	Technology: Lithium Ferrophosphate Protection Class: IP20 or higher for indoor installation Operating and Nominal Voltage: Compliant with Hybrid Inverter and Battery Storage Charge/Discharge Rate: Upto 0.5C DoD: 90% or higher No. of cycles: 2,000 at 70% DoD Operation Humidity: 5%~95% (No Condensing) Operating Temperature: -5 to +45 C Standard Compliance: UL 1642 and other International Standards Battery Management System: Temperature and Discharge Control Service Life: More than 07 years	kWh	25		
4	Communication Box	Data Logger	No.	As per inverter configuration		
5	PV Mount Structure for Elevated	Wind speed = 150km/h, azimuth as per site. (UV resistant, 85 micron of zinc coating), 12AWG or as per drawing given in Employer's Design.	Sum	10 kW		
6	Lightning Arrester	Copper rod height 2 m to be fixed on Parking Shed Top	Nos.	1		
7	0.4kV LV DB	Details of breakers and SPD to be in housed in cabinet: As given in AC BoQ and drawings attached	Nos.	1		
8	DC Distribution Box	IP65 GI DB for each inverter for placing DC strings Expected size but not limited to W*H*D = 3*1*0.75 wall mount, single door with lock and with complete fitting scheme/ railing for DC breakers	Nos.	As per no. of inverters		
9	DC Breakers	As per string configuration and PV Module fuse ratings	Nos.	As per inverter string configuration		
10	DC wire for PV	6 mm Sq. DC flexible wire 1500V DC Copper conductor, Cu XLPO	m	100		
11	AC wire from LV panel to Inverter	Cu/PVC/PVC 0.6/1 kV, 4*10 mm Sq. AC stranded	m	10		
12	AC wire for inverter grounding	Cu/PVC 450/750V, 1*10 mm Sq. (ECC/CPC)	m	10		
13	DC wire for frame-frame grounding	PVC 1*6 mm Sq. AC standard Wire	m	20		

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT (ANAEROBIC FILTER) AT CHAK 191, BHAWANA CHINIOT
BILL OF QUANTITIES

SOLARIZATION

No.	ITEM(s)	Description	Unit	Quantity	Amount (PKR) In Figures	Amount (PKR) in Words
14	DC wire for PV frames to grounding point	PVC 1*16 mm Sq. AC standard Wire	m	20		
15	Copper Bare Conductor	25 mm sq.	m	30		
16	Cable Tray	16 AWG Galvanized iron with flat cover, perforated downside, complete fitting accessories i.e nut bolts, supporting angle iron etc, size (W*D)inch 8*4 for laying string wires	m	As per requirement		
17	UPVC pipe	50mm dia pipe for laying string wires PV area to inverters including sockets	m	As per requirement		
18	UPVC pipe	25mm including bends and sockets	m	As per requirement		
19	MC4 connectors	IP67/IP68 for PV stringing	Nos.	As per requirement		
20	Bi-directional Meter & Net Metering Services	Net metering services complete in all aspects along with bidirectional meters and NEPRA license		1		
21	DC Earthing	Bore Type Earthing for DC Components		1		
22	AC Earthing	Bore Type Earthing for AC Components		1		
23	MISC ITEMS	· Cable ties, rawal bolts, pvc tapes, steel and PVC clamps, pvc pipes, glands different sizes, thimbles, connectors, warning labels etc. · 2 x insulated glove pairs, shoe pairs, hats for site inspection and maintenance activities · PV module O&M kit · Manual Panel Cleaner	As per requirement			
		Subtotal A (inclusive of all applicable taxes on items listed at Sr. No. 1 to 23) =				
B. Installation, Testing, Commissioning, O&M Training						
24	Installation, Testing and Commissioning	Complete project installation and commissioning till handover of the Project to Employer (inclusive of 16% PST)		Job.		
25	O&M Training	1 week O & M training of 3 personnel of the Employer (inclusive of 16% PST)		Job.		
		Total Amount				

WSP AT CHAK 2KB

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

ABSTRACT OF COST

Sr. No	Description	Amount (Rs.)
1	ANAEROBIC AND FACULTATIVE PONDS	
2	STAFF BUILDING	
3	CHEMICAL ROOM	
4	DISINFECTION TANK & COLLECTION CHAMBERS	
5	FISH POND	
6	TREE PLANTATION	
7	ELECTRIFICATION	
8	MAIN GATE & BOUNDARY WALL	
9	CCTV CAMERA (SCADA)	
10	MONITORING PROBS	
11	SOLAR SYSTEM	
	TOTAL COST (Rs.)	
	Rs. in Million	

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

BILL NO. 1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	MRS, 1st BI-ANNUAL-2025 (01.01.2025 to 30.06.2025)					
1	Jungle clearance and removing within 100ft. (30m).					
	a) Ordinary	1000 Sft.	732.00			
	b) Heavy	1000 Sft.	488.00			
2	Earthwork in excavation of drains, irrigation channels through excavator / drag lines in all kind of soil and conditions(dry,wet slush,daldal and under water) including its disposal and preparation of working pad for operation of machinery. (Rates includes 100 ft lead)	1000Cft	56.00			
3	b) Dressing of earthwork (done by machinery and left undressed) to designed section.	100Sft.	200.00			
4	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:-					
	i) 95% to 100% maximum modified AASHO dry density..	1000Cft	57.00			
	(Qunatity of compaction includes embankments and in bed of ponds from excavated earth within site. (Contractor will stack the excavated earth from site at suitable places and then will use it for embankments. Quantity of excavated material may increase or decrease.)					
5	Providing and laying Tuff Pavers, having 7000 PSI, crushing strength of approved manufacturer, over 2" to 3" sand cushion i/c grouting with sand in joints i/c finishing to require slope complete in all respect. (50% Grey / 50% Coloured)					
	c) 80-mm thick	Per Sft	19,635.00			
6	Providing, laying, watering and ramming brick or stone ballast 1½" to 2"(40 mm to 50 mm) gauge mixed with 25% sand, for floor foundation, complete in all respects.	100 Cft	106.00			

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BILL OF QUANTITIES

BILL NO. 1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
7	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)					
	a) upto ¼ mile (400 m).	1000 Cft.	53.00			
	b) for every 330 ft. (100 m) additional lead or part thereof, beyond ¼ mile (400 m) upto one mile. (1.6 Km.) (for 1200m)	1000 Cft.	1.00			
	c) for every ¼ mile (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km).	1000 Cft.	1.00			
	d) for every ½ mile (800 m) additional lead or part thereof , beyond 5 mi les (8 Km). (lead 15 Km)	1000 Cft.	1.00			
Total MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

BILL NO. 1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	NON MRS TTEMS					
1	Providing, laying to designed section and compacting (to at least 95% of the maximum modified Proctor dry density) good earth as Embankments (source to be approved by the Engineer) complete in all respects (both in bed & slope). (Item rate include lead from any source within district up to WWTP)	Cft	470,453			
2	Providing, laying to designed section and compacting (to at least 90% of the maximum modified Proctor dry density) clay as liner (source to be approved by the Engineer),complete in all respects., Liner material should be compected in layers not exceeding 6"(150mm). Liner material should be compacted slightly wet of optimum. Scarify the top of already compected liner layer to a minimum depth of 1.0 inch before placing the next layer. Clods more then 5.0 mm size must be present in liner material, these must be pulverized before placing. (both in bed & slope) The material suitable to be used for compacted soil liner shall meet the following specifications: Vertical in-situ hydraulic conductivity in compacted state ≤ 1 x 10-7 cm/sec Fines (particles passing 0.075 mm sieve) ≥ 30 % Plasticity index = 8 – 30 % Gravels (particles passing 75 mm sieve and retaining 4.75 mm sieve) ≤ 20 % Maximum particle size ≤ 10 mm (Item rate include lead from any source within district up to WWTP)	Cft	48,921			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

BILL NO. 1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
3	Providing, testing, commissioning and training of wastewater sampling and testing equipment for measuring wastewater pollution parameters like temperature, pH, BOD, COD, TSS, TDS, VSS, Oil & Grease, Turbidity and Alkalinity including all relevant instruments, meters and glass wares complete in all respects as per satisfaction of the Engineer	LS				
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) lift upto 5 ft (1.5m)..					
	(ii) in ordinary soil	1000 Cft.	4.260			
2	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent at specified suspension concenterate (SC), Mixing Ability-HEXTAR with Ratio (1:250) = 540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 1 - years complete in all respect as approved by the Engineer Incharge.	Sft	2182.13			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(f) Nominal mix Ratio 1: 2: 4	100 Cft.	1.54			
	(i) Nominal mix Ratio 1: 3: 6	100 Cft.	3.70			
4	Pacca brick work in foundation and plinth					
	i) Cement, sand mortar Ratio 1 : 3	100 Cft.	8.17			
5	Providing and laying damp proof course of cement concrete 1:2:4 (cement, sand, shingle), including bitumen coating.					
	(b) with 2 coats of bitumen:					
	i) 1½" thick (40 mm)	100 Sft.	1.79			
6	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:-					
	(a) with one coat of bitumen and one coat of polythene sheet 500 gauge:					
	ii) Ratio 1:3					
	b) ¾" thick (20 mm)	100 Sft.	1.40			
7	Pacca brick work in ground floor:-					
	i) cement, sand mortar Ratio 1:4	100 Cft.	8.74			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
8	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	386.38			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 6(a)&(i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	304.38			
9	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	('c) Deformed bars (Grade-60)	100 kg	14.31			
10	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From Sargodha quarry	100Cft.	11.00			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
11	Cement plaster 1:4 upto 20' (6.00 m) height:-					
	a) 3/8" (10 mm) thick	100 Sft.	27.62			
12	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height.					
	c) 1:4	100 Sft.	12.00			
13	Filling, watering and ramming earth under floors:-					
	(i) with surplus earth from foundation, et	1000 Cft.	0.97			
	(ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft.	1.74			
14	Extra for every 50 ft. (15 m) additional lead or part thereof					
	i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft.	34.80			
15	Supplying and filling sand under floor; or plugging in wells. (Provisional as Slect Fill)	100 Cft.	13.36			
16	Dry rammed brick or stone ballast, 1½" to 2"(40 mm to 50 mm) gauge.	100 Cft.	2.26			
17	Providing and laying superb quality Porcelain glazed tiles flooring of MASTER brand of specified size in approved design,Color and Shade with adhesive/bondover 3/4" thick (1:3) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respect as approved and directed by the Engineer Incharge. a) Full body Glazed tiles (i) 400 mm x 400 mm	Sft	581.47			
18	Tile skirting laid in 1:2 cement mortar, over ¾"(20 mm) thick cement mortar, 1:2 including cement washing and filling joints complete:-					
	(b) mosaic tiles	100 Sft.	0.89			

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
19	Providing and laying 3/8" thick Prepolished Marble skirting/ risers having uniform texture (spotless) of size 24" x 6" of approved quality and shade with adhesive bond over 3/4" thick (1:2) cement sand mortor complete in all respect i/c the cost of matching sealer to finish the joints as approved and directed by the Engineer Incharge. **i) China Verona**	Sft	143.36			
20	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft.	6.85			
21	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc. (i) 300 gauge (0.003" thick)	Per Sft.	685			
22	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm)	Each	1			
23	Bottom Khuras of brick masonry in cement mortar 1:6, 4'x2'x4½" (1200x600x113 mm) over 3" (75 mm) cement concrete 1:4:8.	Each	1			
24	Providing and fixing M.S. sheet hollow pressed frame of doors, windows, C. windows, etc. (chowkat only) of 20 SWG welded with M.S. flat 6"x 1¼" x 1/8" (150 mmx30mmx3mm) M.S. holdfast 9"x1"x1/8" (225mmx25mmx3mm) welded/screwed 4" (100 mm) long iron hinges, including filling chowkat with cement sand mortar 1:8 and embedding holdfast in cement concrete 1:2:4, complete in all respects:					
	a) single rebate	Per Sft.	66.50			
	b) double rebate	Per Sft.	21.00			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
25	P/F 1-1/2" thick solid flush door comprising of 2.5 mm thick Deodar/ Ash/ Oak ply with grooves, compressed over 2.5 mm thick commercial ply over 1" thick packing wood in style and rails under proper pressure i/c the cost of nails, tower bolt, handles, glue, sawing charges and lacquar polishing to show the grains of ply properly, sand papering and 3/8" thick matching wooden lipping as approved and directed by the Engineer Incharge.	Per Sft.	87.50			
26	Dry brick on edge paving, sand grouted, including preparation of bed by watering, ramming & bringing the same to proper camber, by ½ " (13 mm) thick mud plaster.	100 Sft.	2.94			
27	Grouting 4½" (113 mm) dry brick work with cement mortar ratio 1: 5	100 Sft.	2.94			
28	Providing and fixing sliding bolt to doors:- iii) brass sliding bolt, 10" (250 mm) long	Each	4			
29	Painting new surface:- c) Preparing surface and painting of doors and windows any type (including edges):- i) priming coat. ii) each subsequent coat of paint. (2 coats)	100 Sft.	1.75			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
30	Providing and fitting all types of glazed aluminium windows of anodised bronze colour partly fixed and partly sliding using delux sections of approved manufacturer having frame size of 100 x 20 mm (4"x¾") and leaf frame sections of 50 x 20 mm (2"x¾"), all of 1.6mm thickness including 5 mm thick imported tinted glass with rubber gasket using pproved standard latches, hardware etc., as approved by the Engineer in-charge.	Per Sft.	84.00			
31	Providing and fixing M.S. flat ½"x1/8" (13mm x 3mm) grill including ¾" x 1/8" (20 mmx3 mm) M.S. flat f rame, in windows of approved design, including painting three coats, complete in all respects.	Per Sft.	84.00			
32	Priming coat of chalk under distemper.	100 Sft.	22.82			
33	Distempering (a) new surface ii) two coats	100 Sft.	22.82			
34	Cement pointing struck joints, on walls, upto 20' (6.00 m) hiehgt:- (external wall) a) ratio 1:2	100 Sft.	21.20			
	PLUMBING WORKS					
35	Providing and fitting glazed earthen ware wash hand basin 56x40cm, including bracket set, waste pipe and waste coupling, etc. ii) coloured, with pedestal	Each	1			
36	Providing and fixing stainless steel sink with drain board, size 120x60 cm (48"x24") including bracket set, waste pipe and waste coupling.	Each	1			
37	Providing and fixing chromium plated shower rose:- ii) 2x15 cm (¾"x6")	Each	1			
38	Providing and fixing, chromium plated mixing valve, for wash hand basin, sink or shower.	Each	3			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
39	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipe line in trenches, with socket joints, using G.I pipes of B.S.S. 1387-1967complete in all respects with specials and valves:- ii) Medium Quality (Provisional)					
	b) ¾" i/d (20 mm) 2.65mm thick	Per Rft.	27.60			
	c) 1" i/d (25 mm) 3.25mm thick	Per Rft.	20.00			
40	Providing and fitting glazed earthen ware water closet, squatter type, combined with foot rest.					
	ii) coloured	Each	1			
41	Providing and fitting plastic made low down flushing cistern 1363 liters (3 gallons) capacity, including bracket set, copper connection etc., complete.					
	ii) coloured	Each	1			
42	Providing and fixing looking glass 55x40 cm size and 5mm thick, first quality	Each	1			
43	Providing and fitting					
	i) Plastic Soap Dish	Each	1			
	ii) Plastic toilet paper holder	Each	1			
	iii) Plastic towel rail	Each	1			
	iv) Plastic shelf 60X13cm with bracket and railing	Each	1			
44	Providing and fixing chromium plated bib cock					
	i) 2 cm (¾")	Each	4			
45	Providing and fixing floor trap of cast iron, including concrete chamber all round, and C.I grating:					
	ii) 10x7.5 cm (4"x3")	Each	2.00			
46	Providing and fitting gully trap, including cement concrete, cost of PVC grating 15x15cm and masonry chamber 30x30cm.	Each	2.00			

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
47	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe (Dadex/ Popular/ Beta or approved equivalent manufacturer, with specified pressure rating PN (PRESSURE NOMINAL) and conforming to DIN 8077-8078 code i/c cost of solvent, specials, making jharries complete in all respect as approved and directed by Engineer Incharge. (Internal/ External Diameters mentioned). **b) PN-20 pipe**					
	(ii) (3/4") 25 mm	Rft	69.00			
	(iii) (1") 32 mm	Rft	20.00			
48	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized Polyvinyl Chloride) Nikasi/ SWV pipe, Dadex/ Popular/ Beta or approved equivalent manufacturer, plain/ Bell Ended/ Z-Joints conforming to BS 4514/ BS5255 - EN 1329 including the cost of specials and Solvents complete in all respects, as per drawings & specifications and/ or as approved and directed by the Engineer Incharge.					
	(iv)3"(82mm)	Rft	442.20			
	(v)4"(110 mm)	Rft	15.00			
	(vi)6"(160 mm)	Rft	40.00			
49	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized polyvinyl Chloride) Nikasi/ waste pipe Fittings make of Dadex/ Popular/ Beta or approved equivalent manufacturer, conforming to code EN-1329 including the cost of Solvents complete in all respect as approved and directed by the Engineer Incharge. **a) P-Trap**					
	(i) 4" dia	Each	4.00			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 2; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
50	Providing and hoisting vertical/ horizontal type storage tank of required capacity made of rotationally molded from (HDPE), double ply polyethelene of approved manufacturer i/c cost of making connection for inlet/ outlet pipe, float valve i/c all cost of specials & labour complete in all respect as approved and directed by the Engineer Incharge.	Per gallon	200.00			
51	Providing and fixing almirah shutter comprising of 3/4" thick both side Laminated/ Glossy MDF (Karachi) sheet with 1" x 3/4" deodar wood golla all around the leaf fixed on (3"x1" Kail wood frame i/c the cost of 1/2" full brass hinges, C.P. handles, catchers, screws, and rawal plugs, polishing/ painting 3 coat to gola & frame i/c the cost of locking arrangement complete	Sft	60.00			
Total MRS Items						
	NON MRS TTEMS					
52	Providing and installing domestic pump and motor including boring, pipe, strainer, fittings etc. Compete in all respect.	Each	1.00			
Total Non - MRS Items						
Total Amount						

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	1 (ii) in ordinary soil	1000 Cft	0.45			
2	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent @ specified suspension concenterate (SC), Mixing Ability- HEXTAR with Ratio (1:250) =540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10- years complete in all respect as approved by the Engineer Incharge.	Per Sft	494.20			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(f) Nominal mix Ratio 1: 2: 4	100 Cft	0.55			
	(c) Nominal mix Ratio 1: 1½: 3	100 Cft	0.35			
	(h) Nominal mix Ratio 1: 3: 6	100 Cft	0.85			
4	Pacca brick work in foundation and plinth in:-					
	i) Cement, sand mortar:- Ratio 1:4	100 Cft	4.14			
5	Providing and laying damp proof course of cement concrete 1:2: 4(using cement, sand and shingle), including bitumen coating.					
	(b) with 2 coats of bitumen:					
	ii) 2" thick (50 mm)	100 Sft	0.90			
6	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:-					
	(b) with 2 coats of bitumen:-					
	i) Ratio 1: 4					
	a) ½" thick (13 mm)	100 Sft	1.15			
7	Pacca brick work in ground floor:-					
	i) Cement, sand mortar:- Ratio 1:4	100 Cft	3.95			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
8	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	204.60			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and footing beams, other structural members other than those mentioned in 6(a)&(b) above not requiring form work (i.e. horizontal shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	50.25			
9	Fabrication of mild steel reinforcement for cement concrete, including providing and site, cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	(ii) Deformed bars (Grade-60)	100 kg	10.00			
10	Cement plaster 1:4 upto 20' (6.00 m) height:-					
	b) ½" (13 mm) thick	100 Sft	15.05			
11	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height.					
	c) 1:4	100 Sft	2.65			
12	Filling, watering and ramming earth under floors:-					
	(i) with surplus earth from foundation, etc.	1000 Cft	0.30			
	(ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft	0.45			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
13	Extra for every 50 ft. (15 m) additional lead or part thereo i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft	9.00			
14	Supplying and filling sand under floor; or plugging in wells.	100 Cft	1.00			
15	1½"(40 mm) thick mosaic flooring, consisting of ½ "(13 mm) mosaic topping of one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over 1"(25 mm) thick floor of 1:2:4 cement concrete, including rubbing and polishing complete with finishing :- (b) using white cement	100 Sft	1.60			
16	Mosaic dado or skirting with one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over ½"(13 mm) thick cement plaster 1:3, including rubbing and polishing, complete with finishing: (b) using white cement : ii) ½"(13 mm) thick	100 Sft	0.30			
17	Providing and fixing marble strip of any shade for dividing the mosaic flooring into panels a) Size 1½" x3/8" (40 x 10 mm)	Rft	15.00			
18	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft	3.10			
19	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc. (i) 300 gauge (0.003" thick)	Sft	3.10			
20	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm)	Each	1.00			
21	Bottom Khuras of brick masonry in cement mortar 1:6, 4'x2'x4½" (1200x600x113 mm) over 3" (75 mm) cement concrete 1:4:8.	Each	1.00			
22	Providing and fixing sliding bolt to doors:- i) brass sliding bolt, 10" (250 mm) long	Each	1.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
23	Priming coat of chalk under distemper.	100 Sft	6.80			
24	Distempering (a) new surface ii) two coats	100 Sft	6.80			
25	Providing and applying weather shield paint of approved quality on external surface of building including preparation of surface, application of primer complete in all respect: (external wall)					
	i) 1st coat	100 Sft	8.10			
	ii) 2nd coat	100 Sft	8.10			
26	P/F Iron door comprising of specified leaves made of 1-1/4" x1-1/4" x3/16" MS angle iron for leaf frame, diagonal and horizontal braces duly welded with MS. sheet 18-SWG i/c the cost of sliding bolt, tower bolt and painting 3-coats but excluding the cost of Chowkat complete in all respect as approved and directed by the Engineer incharge.					
	(ii) Double Leaf	Per Sft	28.00			
27	Providing and fixing 2" wide MS/ GI Chowkat singel/double rebate made of 16 SWG MS sheet pressed/ welded/ supported with M.S. flat 1- 1/4"x1/8" i/c 6"long M.S. Flat 1"x1/8"hold fasts (6-Nos) welded/ screwed, punching of lock hole covered with MS Box,coating with antirust paint including filling with cement sand mortar (1:8) and embedding hold fast in cement concrete (1:2:4) ,complete in all respect as approved and directed by Engineer Incharge.					
	(ii) 10.50 " wide	Per Sft	28.00			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
28	Providing and fixing steel windows using M.S. sheet (16 SWG) moulded tubular pipe 1½"x1½" (40x40mm) for frame and 1¼"x1¼" (30x30mm) for leaves including M.S. square bars ¼"x¼" (6x6 mm) welded around each panel of frame, 5 mm thick glass panes fixed with double M.S. square tubular pipe 3/8"x3/8" (10x10mm) (22 SWG) beading with U' shaped rubber lining, brass fitting, holdfast, including painting three coats complete in all respects. a) For openable panels fixed with wire gauze 24 SWG, 12x12 mesh and glass panes ¼" (6 mm) thick.	Per Sft	16.00			
29	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized Polyvinyl Chloride)Nikasi/ SWV pipe, Dadex / Popular/ Beta or approved equivalent manufacturer, plain/ Bell Ended/ Z-Joints conforming to BS 4514/ BS 5255- EN 1329 including the cost of specials and Solvents complete in all respects, as per drawings & specifications and / or as approved and directed by the Engineer Incharge. (v) 4"(110 mm)	Rft	13			
30	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From Sargodha quarry	100 Cft	3.42374			
31	Brick on edge flooring, laid in 1:6 cement mortar, over a bed of ¾" (20 mm) thick cement mortar 1:6.	100 Sft	2.20			
Total MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 3: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
B	**NON MRS**					
32	Providing, fixing, commissioning & testing of Hypo Chlorinator (make Europe/USA or equivalent) consisting of multifunction dosing pump with a microcontroller (RX controller) make Europe/USA complying to EU directives 2006/95/EC and 2004/108/EC, having capacity of 8-10 Liter/hour and maximum pressure of 10 bar, having standard power supply of 230V A.C ± 10%, 50 Hz single phase, Insulation protection rating of IP65, complete with all accessories like injection valve, suction hose, discharge hose, valves, RX probe, level switch, dosing tank complete in all respect.	Job	1			
33	Electricity Connection including all appurtenances.	Job	1			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill NO. 4; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m). **2 (b) By Excavator** ii) Ordinary soil	1000 Cft.	4.82			
2	Providing and laying sand under and around the sewer pipe, including leveling, manual compaction, complete in all respect.	100Cft	3.58			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate): **(h) Ratio 1: 3: 6**	100 Cft.	1.09			
4	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):- (a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- (1) Type A (nominal mix 1:1:2) (c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 6 (a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:-	Cft.	803.02			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill NO. 4; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	1) Type A (nominal mix 1: 1: 2)	Cft.	314.96			
5	Fabrication of mild steel reinforcement for cement concrete, including providing at site, cutting, bending, laying in position, making joints and steel chairs, etc. complete in all respect. and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also Includes removal of rust from bars):- (ii) Deformed bars (Grade-60)	100 Kg	44.27			
6	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or equivalent including the cost of specials, in trenches, as approved & directed by the engineer incharge, complete in all respects.					
	b) PN-8 (SDR-21)					
	8) 110 mm	P.Rft	90.00			
	10) 160 mm	P.Rft	280.00			
7	Providing and fixing heavy duty Gate valve of specified diameter and material for pressure rating PN-16 mde of Crane (USA), Hatersly (UK) or Scon (Pakistan) i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge.					
	(b) Flange Ended Ductile Iron Valve					
	(ix) 4" dia	Each	1.00			
	(xi) 6" dia	Each	3.00			
8	Providing and fixing heavy duty Check valve of specified diameter and material for pressure rating PN-16 made of Crane (USA), Hatersly (UK), Scon (Pakistan) or approved equivalent manufacturer i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge.					
	(b) Flange Ended Ductile Iron Valve					
	(xi) 6" dia	Each	2.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill NO. 4; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
9	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect.					
	i) 10"wide 6 mm thick	Rft	56.33			
10	Rehandling of earthwork:					
	a) Lead upto a single throw of Kassi, phaorah or shovel	1000Cft	1.45			
11	Fabrication of heavy steel work, with angle, tees, flat iron round iron and sheet iron for making trusses, girders, tanks, etc., including cutting, drilling, revitting, handling, assembling and fixing, but including erection in position.	100 kg	0.62			
12	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From Sargodha quarry	100 Cft	10.42			
13	Preparing surface and painting with Matt/ Glossy high chemical resistant/hard wearing Polyurethane paint (Epoxy Paint) by sprayer/ Brush i/c the cost of Primer coat , all material and labour complete in all respects as approved and directed by the Engineer Incharge.					
	(i)Priming Coat	Per Sft	1,225.21			
	(ii) Each and subsequent Coat	Per Sft	2,450.42			
Total MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill NO. 4; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
B	**NON MRS**					
14	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification and as directed by the engineer.	Per Cft.	674.00			
15	Providing and fixing GI cover (size 2'-0" x 2'-0") with angle iron frame 2"x2"x1/4". Angle iron 1-1/2"x1-1/2"x1/4" for cover thickness of cover will be 1/5"thick GI sheet with hooks, hinges etc complete in all respect as per drawing, specifications and as directed by the engineer.	Nos	4.00			
16	Providing and fixing malleable iron rungs with outer dimensions 12"x15"x3" and weight not less than 7.5kg including carriage and setting the same in work, to correct lines and levelsas per drawing, specification and as directed by the engineer.	Nos	23.00			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 5 : FISH PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Chamber & Fish Pond					
1	Compaction of earthwork (soft, ordinary or hard soil) :-					
	c) Ramming earthwork (all types of soil).	1000 Cft	0.15			
2	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	1) By Manual					
	ii) in ordinary soil.	1000 Cft.	32.85			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(h) Nominal mix Ratio 1: 3: 6	100 Cft	0.75			
4	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	51.47			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 6(a)& (b) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	99.40			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 5 : FISH PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5	Fabrication of mild steel reinforcement for cement concrete, including providing and site, cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	(ii) Deformed bars (Grade-60)	100 kg	3.45			
6	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or equivalent including the cost of specials, in trenches, as approved & directed by the engineer incharge, complete in all respects.					
	b) PN-8 (SDR-21)					
	1) 25 mm	Rft	510.00			
	6) 75 mm	Rft	745.00			
7	Providing and fixing sluice valve of B.S.S. quality and weight, Class `B', for cast iron pipe line, and Asbestos cement pipe line (including cost of jointing material):-					
	a) 3" i/d (75 mm)	Each	2.00			
8	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipeline in trenches, with socket joints, using G.I. pipes of B.S.S. 1387-1967 complete in all respects, with specials and valves.					
	g) 2"½ i/d (65 mm) 3.65mm thick	Rft	134.00			
Total MRS Items						
	Non-Mrs Items					
9	Providing and fixing Sp air pump Lp-100, 100 watt including nano bubble diffuser with piping.	Each	1.00			
10	Providing and fixing green tarpal at top of Fish Pond including all accessories complete in all respect as per drawing and as directed by the engineer.	Sft	289.00			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 6: TREE PLANTATION

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	NON MRS					
1	**Native trees**					
a.	Populus (Poplar)	Each	50			
b.	Bombax ceiba (Simal)	Each	50			
c.	Ficus religiosa (Pipal)	Each	25			
d.	Salix (Willow)	Each	25			
	Mortaility 20% (during 1 year of operation)	Each	30			
2	**Input Requirements**					
2	Providing and laying at site the following items as per direction of the engineer.					
a.	Fertilizer (NPK)	Bags	2			
b.	FYM	Kg	1,000			
3	Development (For 12 Months)					
a.	Gardner	Month	12			
b.	Miscellaneous (Vehicle expenditures, wear & tear of tools etc)	L/S				
Total Amount						

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1.0	**WIRING AND ACCESSORIES**					
1.1	Wiring of light or fan point from switch board/dimmer to the point with 3x1.5 mm^2 (P+N+E) PVC insulated single core stranded cables in 25 mm PVC conduit/pipe concealed in walls, columns and slabs including accessories, PVC box, 10 Amp. gang switch 1 or 2 way as required, one for each light or fan and installed as in specifications complete in all respects.	Each	15			
1.2	Circuit wiring from DB/ MCBs to gang switches board and from switch board to another switch board with 3x2.5 mm^2 (P+N+E) PVC insulated single core stranded cables in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	8			
1.3	The same as item No. 1.1 but from one light point to another light point.	Each	15			
1.4	10/13 Amp 3 pin universal flush mounting switch socket outlet wired from DB/MCBs to first outlet with 3x4 mm^2 (P+N+E) single core cable stranded (away from switch board) in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	5			
1.5	The same as item No.1.4 but wiring from one socket outlet to another socket outlet with 3x2.5 mm^2 (P+N+E) single core stranded cable in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	6			
1.6	15/20 Amp 3 pin mounting switch socket outlet wired from DB MCBs to independent socket outlet with 3x6 mm^2 (P+N+E) single core stranded cable (away from switchboard) in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	7			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
2.0	**CONDUIT/PIPE**					
2.1	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables in walls/barriers/structure.	Rft.	400			
2.2	PVC pipe/conduit Class-B 200 mm dia with accessories suitable for laying multi-core cables in walls/barriers/structure.	Rft.	300			
2.3	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables from pole to pole in trenches/directly burried including excavation.	Rft.	1,800			
2.4	PVC pipe/conduit Class-D 100 mm dia with accessories suitable for laying multi-core cables in trenches/directly burried on road crossings including excavation.	Rft.	400			
3.0	**Power Cables**					
3.1	Supply and erection of copper conductor cables for service connection, in prelaid pipe/G.I. wire/trenches, etc. (rate for cable only) PVC insulated, PVC sheathed 4 core, 600/1000 volt non armoured cable					
(a)	10 mm (7/0.052")	Rft.	3,000			
(b)	16 mm (7/0.064")	Rft.	500			
3.2	Supply and erection of single core PVC insulated copper conductor cables, in prelaid PVC pipe/M.S. conduit/G.I pipe/wooden strip batten/wooden casing an capping/G.I. wire/trenches (rate for cables only) 450/750 volts, PVC insulated:					
(a)	10 mm sq (7/0.052")	Rft.	3,000			
(b)	16 mm sq. (7/0.064")	Rft.	650			

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
3.3	3 Nos. 1 core 2.5 mm^2 Cu/PVC 450/750 Voltage grade cable (stranded conductor) (Imported copper shall be used. Verified documentary evidence for source of copper & PVC shall be furnished prior to manufacturing) from junction box to the fitting through the hollow of pole.					
-	For 10m Pole	Each	6			
4.0	**EXHAUST FAN**					
4.1	Providing and fixing Copper winded Exhaust fan with louver and shutter made of Pak/Younas/G.F.C. i/c the cost of necessary cable and hardware for connection from ceiling rose complete as approved and directed by Engineer Incharge.					
	Plastic Body (12" dia)	Each	4			
4.2	Providing and fixing Copper winded wall bracket fan made of Pak/ Younas/G.F.C or NEECA approved equivalent i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer.					
	18" Sweep dia	Each	2			
4.3	Providing and fixing Copper winded ceiling fan made of Pak/ Younas/G.F.C or NEECA approved equivalent i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer.					
	56" dia	Each	1			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5.0	**Road / Street Lighting Poles and Foundations**					
5.1	10m high single arm octagonal shape electric street light pole, made of hot dipped 4.5 mm thick (7 SWG) galvanized steel, tappered from 225 mm at bottom to 100 mm at top, with 1500 mmx60 mmx4mm thick dia. arm for luminaire installation, duly G.I.welded with 470x470x20 mm base plate with the help of 4 no triangular stiffeners 100x350x20 mm of GI sheet, with built in junction box with shutter & one (01) no. 2A SP MCB 10kA breaker, i/c the cost of nuts & J-rag bolts, duly fixed in prelaid concrete foundation, foundation will be paid additionally as approved and directed by the Engineer Incharge	Each	6			
5.2	Road/Street Lighting Pole Foundations including 04 nos. of dia 25mm J-Bolts, PVC long Bends Class (3000 Psi- cylinder strength) concrete, 60 grade reinforced steel, Excavation, Blinding Concrete, Common Backfilling & Pitchmen Coating etc. as shown on drawing. Complete in all respect.	Each	6			
6.0	**LED Road Light Fixtures**					
6.1	Road Lighting LED Cobra-head Luminaries of 90 Watt with 10800 Lumens conforming to IP 66 & IK 08 or above Philips/Osram/Thorn or equivalent with corrosion resistant die casted Aluminium housing, silicon gasket in special groove, UV stable & scratch resistant synthetic materials, thermally hardened glass complete with LED Chip (Philips Lumiled/Cree/Nichia/Osram make or equivalent), programmable LED driver (Harvard/ TCI/ Lumotech/ Philips/VOSSLOHSchwabe/ Lightech make or equivalent), minimum 10kV surge protection rating i/c the cost of all accessories/ components required for proper operation, fully flexible for future upgradation and easy replacements for maintenance purposes, bucket elevator charges as approved and directed by the Engineer Incharge.	Each	6			

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WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
7.0	**<u>Rod Type Earthing</u>**					
7.1	Providing, making & testing / commissioning of Rod type Earth point comprising of 5/8" dia. (16mm dia) 10ft long copper coated M.S.rod driven inground duly fixed with clamp with Tinned earth test link copper plate (300 x 50 x 10mm), i/c the cost of brass nuts, spacers, bolts washers lugs etc but excluding the cost of copper strand & manhole. as approved and directed by Engineer Incharge.	Each	4			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Supply, stroage, installation, testing and commissioning of the following items of work (unless specifically stated otherwise) including all material, labour, tools, accessories, etc. required for proper completion of each item as per specification, drawings and as directed by the Engineer.					
1	**LIGHT FITTINGS AND FANS**					
	Following LED Luminaries of suitable wattage make suitable for the project requirements. Contractor to submit lighting design calculation to determine the adequacy of the wattage and should adjust the number of LEDs/wattage as per project lighting requirements. The fitting shall be approved by the Engineer.					
1.1	Light Fixture Type LED Batten Ceiling/surface mounted, 18W complete in all respect with allied accessories . The fitting shall be approved by the Engineer.	Each	12			
1.2	Light Fixture Type LED Batten Ceiling/surface mounted, 10W above mirror in toilets complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	4			
1.3	Light Fixture Type LED surface mounted down lighter, 12W complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	12			
1.4	20W LED Water tight light fixture IP 65 complete in all respect with all allied accessories. The fitting shall be approved by the Engineer.	Each	4			
2.0	**DISTRIBUTION BOARDS**					
	D.Bs with TP incoming adjustable moulded case circuit breaker and SP miniature outgoing circuit breakers, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories. alongwith all installation and operational accessories as per specification or as shown on the drawings.					
2.1	**DB- Pump Room**	Each	1			
-	1 No. 16 Amps (Adj.) MCCB TP, RC=18kA, Icu=100%Ics					
-	3 Nos. outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
2.2	**DB- Chemical Room**	Each	1			
-	1 No. 16 Amps (Adj.) MCCB TP, RC=18kA, Icu=100%Ics					
-	2 Nos. outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
-	4 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
2.3	**D B- Staff Building**	Each	1			
-	1 No. 63 Amps (Adj.) MCCB TP, RC=25kA, Icu=100%Ics					
-	04 Nos.outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	05 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
	01 No. 16 Amp MCCB TP, (Adj.) RC=18kA, Icu=100%Ics (For DB Chemical Room) 01 No. 16 Amp MCCB TP, (Adj.) RC=18kA, Icu=100%Ics (For DB Pump Room)					
	02 No. 16 Amps (Adj.) MCCB TP, RC= 18 kA, Icu=Ics 100%, 02 No. 26 Amps (Adj.), Megnatic Contactor (AC-3), 2 Nos. Push Button (ON/OFF), 5 Nos. indication lights (ON, OFF) (R,Y,B), Brass cable glands/ accessories, 1 No. Auto-Manual-OFF (3 position switches for operation in auto (with photocell) and normal (manual mode- photocell overide), 3 Nos. photo-electric switches- (For External Lighting)					
-	03 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
3.0	**EARTHING**					
3.1	Bore type, earthing up to permanent water level/moist soil by arrangement of earth pit/point comprising of concrete/ brickwork housing with lifting cover 50mm perforated GI pipe, appropriate bare copper stranded conductor as per details in drawing. The earthing and bonding shall be complete with fixing clamps etc. & all metal works shall be bonded to the proposed earthing network.	No.	2			
	MATERIAL					
-	Drilling of earth bore 3" dia 100 ft. deep or up to permanent water level.					
-	Supply and installation of G.I pipe 2" dia 14 SWG to be installed in pre-made bore including all accessories like tees, bends, sockets etc. Pipe shall be connected to tinned copper spike as per detail shown on drawing, complete in all respects.					
-	Supply and installation of tinned copper spike to be manufactured as per detail shown on drawing. Spike shall be connected/screwed at bottom of G.I pipe including all accessories like nuts and bolts complete in all respect.					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

Bill No. 7: Electrical work

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
-	Supply and installation of 70 mm^2 bare stranded electrolytic copper conductor lead in prelaid G.I pipe and connected to tinned copper spike as shown on drawing. 2 Nos. of leads to be installed including all accessories like brass nuts, bolts, washers etc complete in all respect.					
-	Supply and installation of tinned earth test link in earthing pit consisting of copper plate (12"x2"x1/2") with fixing arrangement on the wall of man hole including brass nuts, bolts washers lugs etc. complete in all respect.					
-	Construction of earthing pit (manhole) of internal size 18"x18"x24" deep with 9" thick brick wall with cement mortar, internal plaster 1:4, RCC 4" thick cover with lifting hooks including all accessories complete in all respect.					
-	Testing and commissioning of the earthing system alongwith all testing accessories complete in all respect.					
	TOTAL COST					

Note:

- The cost of materials are inclusive of General Sales Tax (G.S.T)
- The cost of the security deposit and obtaining of 11 kV electrical connection with installation material from DESCO/WAPDA shall be finalized as per site requirement and the cost for the same is not included in the above.
- The above referred cost is for estimation purposes only and are based on budgetary quotations from the different manufacturers/suppliers. The final cost for the referred items shall be decided/finalized by the Client as per method of procurement i.e. open tendering, limited quotations from prequalified manufacturers/suppliers or any other.

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 8; Main Gate & Boundary wall

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m). **(By excavator)**					
	ii) in ordinary soil.	1000 Cft	19.55			
2	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(h) Ratio 1:3:6	100 Cft	14.20			
3	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	805.05			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 6(a)&(b) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	1268.70			
4	Fabrication of mild steel reinforcement for cement concrete, including cutting, laying in position making joints and fastenings including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars)					
	ii) Deformed bars (Grade 60)	100 Kg	72.58			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

BILL NO. 8; Main Gate & Boundary wall

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From sargodha quarry	100 Cft	32.05			
6	Pacca brick work in foundation and plinth in:-					
	i) Cement, sand mortar:-					
	Ratio 1:3	100 Cft	148.05			
7	Providing and laying damp proof course of cement concrete 1:2: 4(using cement, sand and shingle), including bi tumen coating :-					
	(b) with 2 coats of bitumen:					
	ii) 2" thick (50 mm)	100 Sft	15.90			
8	Pacca brick work other than building upto 10ft. (3 m) height.					
	Ratio 1:3	100 Cft	79.20			
9	Cement plaster 1:3 upto 20' (6.00 m) height:-					
	b) ½" (13 mm) thick	100 Sft	110.10			
10	Cement pointing struck joints, on walls, upto 20' (6.00 m) hiehgt:-					
	a) Ratio 1:2	100 Sft	110.10			
11	Rehandling of earthwork, lead upto a single throw of kassi, phaorah or shovel, including Ramming earthwork (all types of soil).	1000 Cft	9.80			
12	Making and fixing steel grated door with 1/16" thick (1.5mm) sheeting, including angle iron frame 2"x2"x3/8" (50x50x10 mm) and ¾" (20 mm) square bars 4" (100 mm) centre to centre, with locking arrangement .	Sft	101.75			
13	Painting new surface:-					
	d) Preparing surface and painting guard bars, gates of iron bars, gratings, railing (including standards, braces, etc.) and in similar open work:-					
	i) priming coat.	100 Sft	1.02			
	ii) each subsequent coat of paint.(2 Coats)	100 Sft	2.04			
Total Amount						
Total for (1 Nos) Boundary Walls						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty.	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Supply, wiring, tagging, termination, design, installation, testing and commissioning of following system complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards and technical specifications attached herewith					
1	**Fixed Bullet IP Camera 8MP** • 08 MPX Sony Starvis 4K Sensor 1/2.8” • Lens Type : Motorized with auto-iris and auto-focus functions, f=2.7 ~ 13.5 mm/F1.4 • Resolution: 3840 x 2160 pixels • Frame Rate: 20 fps (4K) • Min. Illumination: 0.1 lux (0 lx, IR on) • IR LED, range up to 50 m •Video Intelligent Analytics: Perimeter Intrusion Detection, Line Crossing Detection, Stationary Object Detection, Pedestrian Detection, Face Detection, Cross Counting and Face Recognition. • Operating Temperature -40°C ~ 60°C	No.	9			
2	**IP Based Outdoor PTZ Camera 5MP** • Resolution: 5MP • 30X Optical Zoom • Lens Type motorized, auto-iris function, f=4.7 ~ 141 mm/F1.5 ~ F4 • Edge Analytics • facial recognition. • Deep learning algorithm having People and Vehicle Counting technology • Detect, track, capture vehicle, non-motor vehicle and people	No.	6			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty.	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
3	**PTZ Controller**	No.	1			
4	**32 channels NVR Network Video Recorder (NVR)** • Video and audio channels: 32 • Supported protocols: ONVIF, RTSP • Supports resolution 3840 x 2160 • Recorded stream size: 320 Mb/s in total from all cameras • Internal HDDs mount: 8 • Internal storage for recording mount: 2 x HDD 3.5” 6 TB SATA • Minimum storage12 TB • Monitor outputs: 3 (HDMI (4K UltraHD), HDMI, VGA) • RAID protects recordings • Intelligent image analysis •Video Intelligence Analytics • Facial Recognition Advanced Analytics • Compatible with all Onvif IP cameras • Power Supply 100 ~ 240 VAC with 140 W PoE • Operating Temperature -10°C ~ 50°C	No.	1			
5	**Video Management Server with 24" VDU** Management & Client Software, • Intel Xeon gold Processor (16 Core with 32 threads) latest version • 32 GB DDR 4 RAM • 8TB Internal Hard disk drive SATA • HDMI port for connection to the High quality monitor • DVD/RW drive • 24” LED monitor FHD with HDMI and VGA • 10G optical connectivity • Keyboard, Mouse and Peripheral Interface Cards • 2U Rack mount chassis including redundant power supply (Minimum 500W) • Latest MS WINDOWS software 64 bit pre-installed Operating System and associated software.	No.	1			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty.	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
6	**55" LED Display**	No.	1			
7	**16-port Access Switches layer 3 with SFP Managed** • 1000 Base –T (RJ-45) Ports(PoE / PoE+) : 16 Ports • 1000 Base-X (SFP) : 2 Ports • Console Port RS-232/RJ-45 • Switching Capacity Bandwidth 128 Gbps • Packet forwarding rate (64B) : 92.1Mpps • Buffer memory 12 Mb • RAM (DDR3) : 512 MB • ROM (RAW HAND) : 512 MB • MAC table : 16K • VLAN table : 4k • Link aggregation Group (LAG) : 16, upto 8 ports per LAG • Maximum size of ECMP group : 8 • Maximum Jumbo – frames size : 10240 B • Stacking : 08 devices • Max power consumption : 400W (PoE)	No.	2			
8	**24-Port PoE+ SFP Managed Switch (For Monitoring Room)** • 1000 Base –T (RJ-45) Ports(PoE / PoE+) : 24 Ports • 1000 Base-X (SFP) : 4 Ports • Console Port RS-232/RJ-45 • Switching Capacity Bandwidth 128 Gbps • Packet forwarding rate (64B) : 92.1Mpps • Buffer memory 12 Mb • RAM (DDR3) : 512 MB • ROM (RAW HAND) : 512 MB • MAC table : 16K • VLAN table : 4k • Link aggregation Group (LAG) : 16, upto 8 ports per LAG • Maximum size of ECMP group : 8 • Maximum Jumbo – frames size : 10240 B • Stacking : 08 devices • Max power consumption : 400W (PoE)	No.	2			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty.	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
9	**24 Core Fiber Optic Cable** Standard G652-D, • Cable type Single Mode • Cable construction Loose tube • Layer of Aramid Yarn 5mm • Wavelength 1300/1550 nm • Max attenuation 0.36 db/km Excavation duct price with all accessories shall be included	Meter	210			
10	**CAT-6**, 23AWG Cable including termination and tagging at both ends. Complete in all respects.	Meter	620			
11	**Stainless Steel NEMA 4X 6U Outdoor Enclosure** suitable for installation of standard switches and patch panels and etc. Complete with floor base, vertical cable managers. Rack shall be equipped with power distribution units (PDUs). Complete in all respects. • IP55 • 02 no. or more cooling fans • Pole mount or Wall Mount • Door lock	No.	2			
12	**Indoor Communication Rack 12U (For Monitoring Room)** suitable for installation of standard switches and patch panels and etc. Complete with floor base, vertical cable managers. Rack shall be equipped with power distribution units (PDUs. Complete in all respects. • IP30 • 19 inch standard; • Removable Side Panels, side locks are optional; • Knock-off holes for entering cables • Turning angle of front door is over 180 degrees • Fans, shelf and PDU	No.	1			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty.	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
13	**2 kVA UPS Pure Sine Wave** • Pure sine wave • Power factors 0.7 lag to 0.9 lead • Efficiency at full load shall be 88% with • Power factor :0.8 • load crest factor : 3: 1 • remote monitoring and diagnostics system Rack , Cables, Power DB , Complete in all respect	No.	1			
14	**VRLA Battery 160 AH Backup** • GEL VRLA Battery • High temperature tolerance • Excellent for deep discharge • Hugh resistance to water loss • Battries Racks • Maintenance free operation • Spill proof construction • 10 Years Life	No.	2			
15	**50 mm Class D - PVC Conduit HDPE pipe** • size 50mm • outer dia 50mm • wall thickness 3.5mm • standard length: 125m/250m/1000m	Lot	1			
16		Meter	580			
17	Installation, Programming, Testing and Commissioning of complete system.	Job	1			
	Allow for **any other item** required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in this item but complete description, item rates, quantity required and brands shall be mentioned separately and to be attached with the BOQ.					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN

BILL OF QUANTITIES

IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Qty.	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Note: 1) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant. 2) Contractor is advised to confirm the cable running lengths as per site conditions before commencement of work. The Payment of cable shall be paid as per Running meter. 3) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor					
	Total Price					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING
WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

SOLARIZATION

No.	ITEM(s)	Description	Unit	Quantity	Amount	
					In Figures	In Words
1	PV module	Tier 1 Manufacturer according to bloomberg Q1 or Q2 issued rankings, IEC Standard 61215 Compliant, not less than 600 W N-Type and Half Cut PV modules or better, Monofacial or Bifacial	Sum	10 kW		
2	String Inverter	3 phase Hybrid Inverter with Remote Monitoring Devices	Sum	9 kW		
3	Battery Backup	Technology: Lithium Ferrophosphate Protection Class: IP20 or higher for indoor installation Operating and Nominal Voltage: Compliant with Hybrid Inverter and Battery Storage Charge/Discharge Rate: Upto 0.5C DoD: 90% or higher No. of cycles: 2,000 at 70% DoD Operation Humidity: 5%~95% (No Condensing) Operating Temperature: -5 to +45 C Standard Compliance: UL 1642 and other International Standards Battery Management System: Temperature and Discharge Control Service Life: More than 07 years	kWh	25		
4	Communication Box	Data Logger	No.	As per inverter configuration		
5	PV Mount Structure for Elevated	Wind speed = 150km/h, azimuth as per site. (UV resistant, 85 micron of zinc coating), 12AWG or as per drawing given in Employer's Design.	Sum	10 kW		
6	Lightning Arrester	Copper rod height 2 m to be fixed on Parking Shed Top	Nos.	1		
7	0.4kV LV DB	Details of breakers and SPD to be in housed in cabinet: As given in AC BoQ and drawings attached	Nos.	1		
8	DC Distribution Box	IP65 GI DB for each inverter for placing DC strings Expected size but not limited to W*H*D = 3*1*0.75 wall mount, single door with lock and with complete fitting scheme/ railing for DC breakers	Nos.	As per no. of inverters		
9	DC Breakers	As per string configuration and PV Module fuse ratings	Nos.	As per inverter string configuration		
10	DC wire for PV	6 mm Sq. DC flexible wire 1500V DC Copper conductor, Cu XLPO	m	100		
11	AC wire from LV panel to Inverter	Cu/PVC/PVC 0.6/1 kV, 4*10 mm Sq. AC stranded	m	10		
12	AC wire for inverter grounding	Cu/PVC 450/750V, 1*10 mm Sq. (ECC/CPC)	m	10		
13	DC wire for frame-frame grounding	PVC 1*6 mm Sq. AC standard Wire	m	20		

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING
WASTEWATER TREATMENT PLANT AT CHAK 2KB, PAKPATTAN
BILL OF QUANTITIES

SOLARIZATION

No.	ITEM(s)	Description	Unit	Quantity	Amount	
					In Figures	In Words
14	DC wire for PV frames to grounding point	PVC 1*16 mm Sq. AC standard Wire	m	20		
15	Copper Bare Conductor	25 mm sq.	m	30		
16	Cable Tray	16 AWG Galvanized iron with flat cover, perforated downside, complete fitting accessories i.e nut bolts, supporting angle iron etc, size (W*D)inch 8*4 for laying string wires	m	As per requirement		
17	UPVC pipe	50mm dia pipe for laying string wires PV area to inverters including sockets	m	As per requirement		
18	UPVC pipe	25mm including bends and sockets	m	As per requirement		
19	MC4 connectors	IP67/IP68 for PV stringing	Nos.	As per requirement		
20	Bi-directional Meter & Net Metering Services	Net metering services complete in all aspects along with bidirectional meters and NEPRA license		1		
21	DC Earthing	Bore Type Earthing for DC Components		1		
22	AC Earthing	Bore Type Earthing for AC Components		1		
23	MISC ITEMS	· Cable ties, rawal bolts, pvc tapes, steel and PVC clamps, pvc pipes, glands different sizes, thimbles, connectors, warning labels etc. · 2 x insulated glove pairs, shoe pairs, hats for site inspection and maintenance activities · PV module O&M kit · Manual Panel Cleaner		As per requirement		
Subtotal A (inclusive of all applicable taxes on items listed at Sr. No. 1 to 23)						
B. Installation, Testing, Commissioning, O&M Training						
24	Installation, Testing and Commissioning	Complete project installation and commissioning till handover of the Project to Employer		Job.		
25	O&M Training	1 week O & M training of 3 personnel of the Employer		Job.		
Subtotal B (inclusive of 16% PST on Services at Sr. No. 24 to 25)						
26	D. Total Price (C = A + B) =					

TRICKLING FILTER AT SARKALAN

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

SUMMARY OF COST

Bill No.	Description	Amount (Rs.)
1	PRIMARY SEDIMENTATION TANK (PST) (01 Nos)	
2	TRICKLING FILTER (01 Nos)	
3	SECONDARY SEDIMENTATION TANK (SST) (01 Nos)	
4	SLUDGE THICKENER (ST) (1 Nos)	
5	PUMPING PIT (01 Nos)	
6	SLUDGE PUMPING STATION (SPS) (03 Nos)	
7	INTERNAL/YARD PIPING	
8	SLUDGE DRYING BED	
9	ACCESS AND INTERNAL ROADS	
10	STAFF BUILDING	
11	DISINFECTION TANK & VALVE CHAMBERS	
12	CHEMICAL BUILDING	
13	FISH POND	
14	TREE PLANTATION	
15	MAIN GATE AND BOUNDARY WALL	
16	RCC DRAIN	
17	ELECTRICAL WORK	
18	CCTV CAMERA (SCADA)	
19	MONITORING PROBS	
20	SOLAR SYSTEM	
	TOTAL COST (Rs.)	
	Rs. in Million	

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.1.0 PRIMARY SEDIMENTATION TANK (PST) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m).					
	2) a) By Excavator					
	ii) Ordinary soil	1000 Cft.	2.50			
	iii) Hard soil or Soft murum	1000 Cft.	2.50			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	5.00			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	5.00			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(f) Ratio 1: 2: 4	100 Cft.	5.00			
	(h) Ratio 1: 3: 6	100 Cft.	5.00			
5	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(1) Type A (nominal mix 1:1:2)	Per Cft	1,800.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	65.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.1.0 PRIMARY SEDIMENTATION TANK (PST) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and footing beams, other structural members other than those mentioned in 6(a) (i)& (ii) above not requiring form work (i.e. horizontal shuttering) complete in all respects:-					
	(1) Type A (nominal mix 1: 1: 2)	Per Cft	1,205.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	10.00			
6	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From approved querry	100Cft.	35.00			
7	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	b) Deformed bars (Grade 60)	100 Kg	125.66			
8	Providing and fixing G.I. pipe railing, as per standard drawing. (2" i/d G.I Pipes)	Per Rft. of 3 rows of Pipes	135.00			
9	Providing and fixing 1¼"x1¼"x3/16" (31x31x5 mm) angle iron step, in manhole chambers, including carriage and setting the same in work to correct lines and levels.	Each	10.00			
10	Bitumen coating to plastered or cement concrete surface:- (2 Coats)					
	i) 20 lbs. per 100 Sft. (9.07 Kg per Sq.m)	100 Sft.	560.00			
11	Rehandling of earthwork:					
	a) Lead upto a single throw of Kassi, phaorah or shovel.	1000Cft	5.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.1.0 PRIMARY SEDIMENTATION TANK (PST) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
12	Extra for every 50 ft. (15 m) additional lead or part thereof :-- i) for earhtwork soft, ordinary, hard and very hard. (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)	1000 Cft.	90.00			
13	Compaction of earthwork (soft, ordinary or hard soil) :- (Backfilling) a) Mixing, moistening earth to optimum moisture content in layers for compaction, etc. complete.	1000Cft	5.00			
	c) Ramming earthwork (all types of soil).	1000Cft	5.00			
14	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:- (bed compaction) i) 95% to 100% maximum modified AASHO dry density..	1000Cft	5.00			
15	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)					
	a) upto ¼ mile (400 m).	1000Cft	5.00			
	b) for every 330 ft. (100 m) additional lead or part thereof, beyond ¼ mile (400 m) upto one mile. (1.6 Km.)	1000Cft	5.00			
	c) for every ¼ mile (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km)	1000Cft	5.00			
16	Preparing surface and painting with Matt/ Glossy high chemical resistant/ hard wearing Polyurethane paint (Epoxy Paint)by sprayer/ Brush i/c the cost of Primer coat, all material and labour complete in all respects as approved and directed by the Engineer Incharge (including priming each and subsequent coat)	Per Sft	780.00			
17	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect. (6mm)	Rft	250.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.1.0 PRIMARY SEDIMENTATION TANK (PST) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
18	Providing and mixing super plasticizer (water reducing admixture) as defined in ASTM C-94 in order to achieve the required consistancy / workablility measured by the slump, used in the ratio of (0.05% to 1.00%) by weight of cement as proposed by the designer etc complete in all respect. (Pervisional Qty to be excuted after the approval by the Engineer)	Per Gal.	4			
Total - MRS Items						
	Non-Mrs Items					
19	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification or directed by the engineer.	100Cft	5			
20	Providing and fabricating, fixing Stainless Steel (316L) Weir plate, Scum plate, Tie angle, Nuts and bolts,inlet etc. complete in all respect as per drawings, specification and as directed by the engineer.	Kg	690			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.2.0 TRICKLING FILTER TANK (TFT) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m).					
	2) a) By Excavator					
	ii) Ordinary soil	1000 Cft.	2.50			
	iii) Hard soil or Soft murum	1000 Cft.	2.50			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	5.00			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	5.00			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(f) Ratio 1: 2: 4	100 Cft.	5.00			
	(h) Ratio 1: 3: 6	100 Cft.	5.00			
5	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(1) Type A (nominal mix 1:1:2)	Per Cft	2,420.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	295.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.2.0 TRICKLING FILTER TANK (TFT) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and footing beams, other structural members other than those mentioned in 6(a) (i)& (ii) above not requiring form work (i.e. horizontal shuttering) complete in all respects:-					
	(1) Type A (nominal mix 1: 1: 2)	Per Cft	1,540.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	10.00			
6	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From approved querry	100Cft.	45.00			
7	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	b) Deformed bars (Grade 60)	100 Kg	232.02			
8	Providing and fixing G.I. pipe railing, as per standard drawing. (2" i/d G.I Pipes)	Per Rft. of 3 rows of Pipes	95.00			
9	Providing and fixing stair railing of 2½" (63 mm) i/d G.I. pipe, welded with 5/8"x5/8" (16x16 mm) square M.S. bars 2'-9" (838 mm) high, fixed in each step, complete in all respects, including painting, polishing three coats.	Per Rft.	30.00			
10	Bitumen coating to plastered or cement concrete surface:- (2 Coats)					
	i) 20 lbs. per 100 Sft. (9.07 Kg per Sq.m)	100 Sft.	410.00			
11	Rehandling of earthwork:					
	a) Lead upto a single throw of Kassi, phaorah or shovel.	1000Cft	5.00			
12	Extra for every 50 ft. (15 m) additional lead or part thereof :--					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.2.0 TRICKLING FILTER TANK (TFT) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	i) for earhtwork soft, ordinary, hard and very hard. (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)	1000 Cft.	90.00			
13	Compaction of earthwork (soft, ordinary or hard soil) :- (Backfilling)					
	a) Mixing, moistening earth to optimum moisture content in layers for compaction, etc. complete.	1000Cft	5.00			
	c) Ramming earthwork (all types of soil).	1000Cft	5.00			
14	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:- (bed compaction)					
	i) 95% to 100% maximum modified AASHO dry density..	1000Cft	5.00			
15	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)					
	a) upto ¼ mile (400 m).	1000Cft	5.00			
	b) for every 330 ft. (100 m) additional lead or part thereof, beyond ¼ mile (400 m) upto one mile. (1.6 Km.)	1000Cft	5.00			
	c) for every ¼ mile (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km)	1000Cft	5.00			
16	Preparing surface and painting with Matt/ Glossy high chemical resistant/ hard wearing Polyurethane paint (Epoxy Paint)by sprayer/ Brush i/c the cost of Primer coat, all material and labour complete in all respects as approved and directed by the Engineer Incharge (including priming each and subsequent coat)	Per Sft	1,235.00			
17	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect. (6mm)	Rft	360.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.2.0 TRICKLING FILTER TANK (TFT) (01 No)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
18	Providing and installing P.V.C. strainer B.S.S. Class `D' , in tubewell bore hole, including sockets and solvent, etc. complete:- (Perforated Pipe)					
	a) 1¼" i/d (30 mm)	Per Rft.	3,430.00			
19	Providing and mixing super plasticizer (water reducing admixture) as defined in ASTM C-94 in order to achieve the required consistancy / workablility measured by the slump, used in the ratio of (0.05% to 1.00%) by weight of cement as proposed by the designer etc complete in all respect. (Pervisional Qty to be excuted after the approval by the Engineer)	Per Gal.	4			
	TF Showering Mechanism Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or approved equivalent manufacturer, including the cost of specials, in trenches, as approved & directed by the engineer incharge,complete in all respects. b) PN-8 (SDR-21)					
	4) 50 mm (Perforated for Shower)	Per Rft	200			
	8) 110 mm	Per Rft	50			
Total Amount (MRS)						
	Non-Mrs Items					
20	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification or directed by the engineer.	100Cft	10			
21	Providing and laying filter media of graded gravels above 10 mm as per drawings, specifications and as directed by the engineer.	Per Cft.	2,360.00			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.3.0 SECONDARY SEDIMENTATION TANK (SST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m).					
	2) a) By Excavator					
	ii) Ordinary soil	1000 Cft.	2.50			
	iii) Hard soil or Soft murum	1000 Cft.	2.50			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	5.00			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring	1000 Cft.	5.00			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(f) Ratio 1: 2: 4	100 Cft.	5.00			
	(h) Ratio 1: 3: 6	100 Cft.	5.00			
5	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(1) Type A (nominal mix 1:1:2)	Per Cft	2,260.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	65.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.3.0 SECONDARY SEDIMENTATION TANK (SST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 5(a)(i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(1) Type A (nominal mix 1: 1: 2)	Per Cft	1,450.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	10.00			
6	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From approved querry	100Cft.	40.00			
7	Providing and Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position making joints and fastenings including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars)					
	b) Deformed bars (Grade 60)	100 Kg	154.43			
8	Providing and fixing G.I. pipe railing, as per standard drawing. (2" i/d G.I Pipes)	Per Rft. of 3 rows of Pipes	150.00			
9	Providing and fixing 1¼"x1¼"x3/16" (31x31x5 mm) angle iron step, in manhole chambers, including carriage and setting the same in work to correct lines and levels.	Each	10.00			
10	Bitumen coating to plastered or cement concrete surface:- (2 Coats)					
	i) 20 lbs. per 100 Sft. (9.07 Kg per Sq.m)	100 Sft.	625.00			
11	Rehandling of earthwork:					
	a) Lead upto a single throw of Kassi, phaorah or shovel.	1000Cft	5.00			
12	Extra for every 50 ft. (15 m) additional lead or part thereof :--					
	i) for earhtwork soft, ordinary, hard and very hard. (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)	1000 Cft.	90.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.3.0 SECONDARY SEDIMENTATION TANK (SST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
13	Compaction of earthwork (soft, ordinary or hard soil) :- (Backfilling)					
	a) Mixing, moistening earth to optimum moisture content in layers for compaction, etc. complete.	1000Cft	5.00			
	c) Ramming earthwork (all types of soil).	1000Cft	5.00			
14	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:- (bed compaction)					
	i) 95% to 100% maximum modified AASHO dry density..	1000Cft	5.00			
15	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)					
	a) upto ¼ mile (400 m).	1000Cft	5.00			
	b) for every 330 ft. (100 m) additional lead or part thereof, beyond ¼ mile (400 m) upto one mile. (1.6 Km.)	1000Cft	5.00			
	c) for every ¼ mile (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km)	1000Cft	5.00			
16	Preparing surface and painting with Matt/ Glossy high chemical resistant/ hard wearing Polyurethane paint (Epoxy Paint)by sprayer/ Brush i/c the cost of Primer coat, all material and labour complete in all respects as approved and directed by the Engineer Incharge (including priming each and subsequent coat)	Per Sft	920.00			
17	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect. (6mm)	Rft	285.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.3.0 SECONDARY SEDIMENTATION TANK (SST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
18	Providing and mixing super plasticizer (water reducing admixture) as defined in ASTM C-94 in order to achieve the required consistancy / workablility measured by the slump, used in the ratio of (0.05% to 1.00%) by weight of cement as proposed by the designer etc complete in all respect. (Pervisional Qty to be excuted after the approval by the Engineer)	Per Gal	4			
Total Amount MRS Items						
	Non-Mrs Items					
18	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification or directed by the engineer.	100Cft	5			
19	Providing and fabricating, fixing Stainless Steel (316L) Weir plate, Scum plate, Tie angle, Nuts and bolts,inlet etc. complete in all respect as per drawings, specification and as directed by the engineer.	Kg	900.00			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO.4.0 SLUDGE THICKENER (ST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m).					
	2) a) By Excavator					
	ii) Ordinary soil	1000 Cft.	2.50			
	iii) Hard soil or Soft murum	1000 Cft.	2.50			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	5.00			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring	1000 Cft.	5.00			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(f) Ratio 1: 2: 4	100 Cft.	5.00			
	(h) Ratio 1: 3: 6	100 Cft.	5.00			
5	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(1) Type A (nominal mix 1:1:2)	Per Cft	960.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	65.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO.4.0 SLUDGE THICKENER (ST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 5(a)(i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(1) Type A (nominal mix 1: 1: 2)	Per Cft	875.00			
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	10.00			
6	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From approved querry	100Cft.	25.00			
7	Providing and Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position making joints and fastenings including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars) b) Deformed bars (Grade 60)	100 Kg	77.93			
8	Providing and fixing G.I. pipe railing, as per standard drawing. (2" i/d G.I Pipes)	Per Rft. of 3 rows of Pipes	150.00			
9	Providing and fixing stair railing of 2½" (63 mm) i/d G.I. pipe, welded with 5/8"x5/8" (16x16 mm) square M.S. bars 2'-9" (838 mm) high, fixed in each step, complete in all respects, including painting, polishing three coats.	Per Rft.	25.00			
10	Bitumen coating to plastered or cement concrete surface:- (2 Coats) i) 20 lbs. per 100 Sft. (9.07 Kg per Sq.m)	100 Sft.	450.00			
11	Rehandling of earthwork: a) Lead upto a single throw of Kassi, phaorah or shovel.	1000Cft	5.00			
12	Extra for every 50 ft. (15 m) additional lead or part thereof :--					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO.4.0 SLUDGE THICKENER (ST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	i) for earhtwork soft, ordinary, hard and very hard. (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)	1000 Cft.	90.00			
13	Compaction of earthwork (soft, ordinary or hard soil) :- (Backfilling)					
	a) Mixing, moistening earth to optimum moisture content in layers for compaction, etc. complete.	1000Cft	5.00			
	c) Ramming earthwork (all types of soil).	1000Cft	5.00			
14	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:- (bed compaction)					
	i) 95% to 100% maximum modified AASHO dry density..	1000Cft	5.00			
15	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)					
	a) upto ¼ mile (400 m).	1000Cft	5.00			
	b) for every 330 ft. (100 m) additional lead or part thereof, beyond ¼ mile (400 m) upto one mile. (1.6 Km.)	1000Cft	5.00			
	c) for every ¼ mile (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km)	1000Cft	5.00			
16	Preparing surface and painting with Matt/ Glossy high chemical resistant/ hard wearing Polyurethane paint (Epoxy Paint)by sprayer/ Brush i/c the cost of Primer coat, all material and labour complete in all respects as approved and directed by the Engineer Incharge (including priming each and subsequent coat)	Per Sft	545.00			
17	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect. (6mm)	Rft	195.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO.4.0 SLUDGE THICKENER (ST) (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
18	Providing and mixing super plasticizer (water reducing admixture) as defined in ASTM C-94 in order to achieve the required consistancy / workablility measured by the slump, used in the ratio of (0.05% to 1.00%) by weight of cement as proposed by the designer etc complete in all respect. (Pervisional Qty to be excuted after the approval by the Engineer)	Per Gal	3			
Total Amount MRS Items						
	Non-Mrs Items					
19	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification or directed by the engineer.	100Cft	5			
20	Providing and fabricating, fixing Stainless Steel (316L) Weir plate, Scum plate, Tie angle, Nuts and bolts,inlet etc. complete in all respect as per drawings, specification and as directed by the engineer.	Kg	485			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 5; PUMPING PIT

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	2 (b) By Excavator					
	ii) Ordinary soil	1000 Cft.	0.23			
	iii) Hard soil or Soft murum	1000 Cft.	0.23			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	0.46			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	0.46			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(h) Ratio 1: 3: 6	100 Cft.	0.37			
5	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(1) Type A (nominal mix 1:1:2)	Cft.	308.62			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 5; PUMPING PIT

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 6 (a) (i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	1) Type A (nominal mix 1: 1: 2)	Cft.	99.10			
6	Fabrication of mild steel reinforcement for cement concrete, including providing at site, cutting, bending, laying in position, making joints and steel chairs, etc. complete in all respect. and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also Includes removal of rust from bars):- (b) Deformed bars (Grade-60)	100 Kg	15.60			
7	Rehandling of earthwork: a) Lead upto a single throw of Kassi, phaorah or shovel	1000Cft	0.28			
8	Fabrication of heavy steel work, with angle, tees, flat iron round iron and sheet iron for making trusses, girders, tanks, etc., including cutting, drilling, revitting, handling, assembling and fixing, but including erection in position.	100 kg	0.76			
9	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From Sargodha quarry	100 Cft	3.77			
Total MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 5; PUMPING PIT

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
B	**NON MRS**					
10	**PST TO TF Pump** Designing, manufacturing, testing at manufacturer's workshop, supplying at site, installation, testing, commissioning, guarantee and maintenance for one year during defect Liability Period of each item of following equipment: Close coupled, non-clogging, vertical shaft, centrifugal type Submersible Pump, sewage cum strom water pumps of following discharge and rated head with suitable AC induction, totally enclosed, 4 pole, 3-Ph, 400 V, 50 Hz, insulation class F, ingress protection IP 68 motors to be installed in wet well, alongwith electrical cable upto 15 m and control cable upto 15m, motor control unit, pressure gauge at discharge side, 01 Nos. sluice valve, 01 No non-return valve including factory inspection during casting of pumps and final inspection at test bed, erection & maintenance tools and spare parts as per Specifications. All equipment shall be from internationally reputed approved manufacturers **a) Pump** Capacity = 25 m3/h (0.25 cusecs) Head = 30 ft (10 m) Min. Free Particle Size = 80 mm Min. Efficiency = 60% Maximum speed = 1500 rpm Casing: Cast iron ASTM A 48 Class 35, EN GJL 250 or better Impeller: Ductile Cast iron (A536 GR 65-45-12) or better Shaft:Stainless Steel AISI 431 or better Shaft Sleeve:Stainless Steel AISI 304 or better Mechanical Seal: Two mechanical seals with oil resevoir and Moisture in Oil sensors Primary Seal : Silicon Carbide-Silicon Carbide Secondary Seal: Silicon Carbide-Carbon. **b) Motor With Cooling Jacket** Rated power suitable for Pump described in "a)" Insulation Class = H Ingress Protection = IP 68					

Bill NO. 5; PUMPING PIT

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Min. Efficiency = as per IE-2 **c) Motor Control Unit (MCU)** MCU with painted metallic box, auto star delta starter, circuit breaker, magnetic contactor, on/off switch, control fuse, auto level control with ultrasonic level sensor, control wire, under/over voltage relay, electronic over current relay, indication lamps, digital ampere meter, volt meter, hour run meter, dry running protection, high temperature protection, phase reversal protection, alongwith wiring and necessary items for moisture in oil monitoring for mechanical seals and level switches for dry running protection, temperature and vibration monitoring of pump units, controller for alternate operation of pumps at predetermined time, complete in all respects. All the equipment shall be from internationally reputed approved manufacturers. d) 2 No's Sluice valve (rising type) and 1 No. Non return valve of B.S.S. 5163 quality and weight with each pumping set.	No	2			
11	**TF TO SST Pump**					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 5; PUMPING PIT

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Designing, manufacturing, testing at manufacturer's workshop, supplying at site, installation, testing, commissioning, guarantee and maintenance for one year during defect Liability Period of each item of following equipment: Close coupled, non-clogging, vertical shaft, centrifugal type Submersible Pump, sewage cum strom water pumps of following discharge and rated head with suitable AC induction, totally enclosed, 4 pole, 3-Ph, 400 V, 50 Hz, insulation class F, ingress protection IP 68 motors to be installed in wet well, alongwith electrical cable upto 15 m and control cable upto 15m, motor control unit, pressure gauge at discharge side, 01 Nos. sluice valve, 01 No non-return valve including factory inspection during casting of pumps and final inspection at test bed, erection & maintenance tools and spare parts as per Specifications. All equipment shall be from internationally reputed approved manufacturers **a) Pump** Capacity = 25 m3/h (0.25 cusecs) Head = 30 ft (10 m) Min. Free Particle Size = 80 mm Min. Efficiency = 60% Maximum speed = 1500 rpm Casing: Cast iron ASTM A 48 Class 35, EN GJL 250 or better Impeller: Ductile Cast iron (A536 GR 65-45-12) or better Shaft:Stainless Steel AISI 431 or better Shaft Sleeve:Stainless Steel AISI 304 or better Mechanical Seal: Two mechanical seals with oil resevoir and Moisture in Oil sensors Primary Seal : Silicon Carbide-Silicon Carbide Secondary Seal: Silicon Carbide-Carbon. **b) Motor With Cooling Jacket** Rated power suitable for Pump described in "a)" Insulation Class = H Ingress Protection = IP 68 Min. Efficiency = as per IE-2 **c) Motor Control Unit (MCU)**					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 5; PUMPING PIT

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	MCU with painted metallic box, auto star delta starter, circuit breaker, magnetic contactor, on/off switch, control fuse, auto level control with ultrasonic level sensor, control wire, under/over voltage relay, electronic over current relay, indication lamps, digital ampere meter, volt meter, hour run meter, dry running protection, high temperature protection, phase reversal protection, alongwith wiring and necessary items for moisture in oil monitoring for mechanical seals and level switches for dry running protection, temperature and vibration monitoring of pump units, controller for alternate operation of pumps at predetermined time, complete in all respects. All the equipment shall be from internationally reputed approved manufacturers. d) 2 No's Sluice valve (rising type) and 1 No. Non return valve of B.S.S. 5163 quality and weight with each pumping set.	No	2			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.06 SLUDGE PUMPING STATION (SPS)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	ii) in ordinary soil.	1000 Cft.	1.25			
	iii) Hard soil or Soft murum	1000 Cft.	1.25			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	2.50			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	2.50			
4	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent @ specified suspension concenterate (SC), Mixing Ability- HEXTAR with Ratio (1:250) =540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10- years complete in all respect as approved by the Engineer Incharge.	Sft	296.75			
5	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(i) Ratio 1: 4: 8	100 Cft.	5.00			
6	Pacca brick work in ground floor:-					
	i) cement, sand mortar Ratio 1:4	100 Cft.	3.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.06 SLUDGE PUMPING STATION (SPS)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
7	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	124.00			
	(c) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	105.00			
8	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	('b) Deformed bars (Grade-60)	100 kg	10.00			
9	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From approved querry	100Cft.	7.00			
10	Cement plaster 1:4 upto 20' (6.00 m) height:-					
	b) ½" (13 mm) thick	100 Sft.	9.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.06 SLUDGE PUMPING STATION (SPS)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
11	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height. c) 1:4	100 Sft.	5.00			
12	Filling, watering and ramming earth under floors:- (i) with surplus earth from foundation, etc.	1000 Cft.	5.00			
	(ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft.	1.00			
13	Extra for every 50 ft. (15 m) additional lead or part thereo i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft.	20.00			
14	Dry rammed brick or stone ballast, 1½" to 2"(40 mm to 50 mm) gauge.	100 Cft.	5.00			
15	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft.	5.00			
16	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc. (i) 300 gauge (0.003" thick)	Per Sft.	500			
17	Providing and fixing windows consisting of M.S. box section frame 2"x1½", (50x40mm) leaves frame 1½"x1" 40x25mm) box section frame for glazing 3/8"x3/8" 10x10mm) using 16 SWG sheet 'U' shaped rubber supported with 1"x1/8" (25x3mm) M.S. flat for fixing 3/16" 5 mm) thick glass panes M.S. box section ½"x½" 13x13mm) of 16 SWG for fixing 24 SWG wire gauze on outer side by means of ¾"x1/8" (20x3mm) M.S. flat and screws including grill of M.S. flat ½"x1/8" (13x3mm) or ¼"x¼" (6x6mm) square bar with independent frame of ½"x½" (13x13mm) box section of 16 SWG i/c all C.P. fitting and painting 3 coats complete in all respect.	Per Sft.	110.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.06 SLUDGE PUMPING STATION (SPS)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
18	Small iron work, such as gusset plates, knees, bends, stirrups, straps, rings, etc. including cutting, drilling, riveting, handling, assembling and fixing; but excluding erection in position (for Louver Doors the design will be finalized by the Engineer).	100Kg	2.00			
19	Erection and fitting in position iron trusses, staging of water tanks, etc.	100Kg	2.00			
20	Painting new surface:- c) Preparing surface and painting of doors and windows any type (including edges):- i) priming coat. ii) each subsequent coat of paint.	 100 Sft. 100 Sft.	 28.00 56.00			
21	Priming coat of chalk under distemper.	100 Sft.	10.00			
22	Distempering (a) new surface ii) two coats	 100 Sft.	 10.00			
23	Providing and applying weather shield paint of approved quality on external surface of building including preparation of surface, application of primer complete in all respect: a) new surface : i) 1st coat ii) 2nd coat	 100 Sft. 100 Sft.	 5.00 5.00			
24	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized Polyvinyl Chloride) Nikasi/ SWV pipe, Dadex / Popular / Beta or approved equivalent manufacturer, plain / Bell Ended / Z - Joints conforming to BS 4514 / BS 5255 - EN 1329 including the cost of specials and Solvents complete in all respects, as per drawings & specifications and / or as approved and directed by the Engineer Incharge. **(v) 110 mm**	Rft	162.00			
Total Amount MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.06 SLUDGE PUMPING STATION (SPS)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Non-Mrs Items					
25	**Primary, Secondary & thickened Sludge Pump** Designing, manufacturing, testing at manufacturer's workshop, supplying at site, installation, testing, commissioning, guarantee and maintenance for one year during defect Liability Period of each item of following equipment: Non-clogging,horizontal centrifugal type, sludge pumps of 10 m3/h (0.10 cusecs) capacity,8 m (26 ft) rated head with suitable AC induction, totally enclosed, 6 pole, 3-Ph, 400 V, 50 Hz, insulation class F, ingress protection IP 55, including factory inspection during casting of pumps and final inspection at test bed, erection & maintenance tools and spare parts as per Specifications. All equipment shall be from internationally reputed approved manufacturers. **a) Pump** Capacity = 10 m3/h (0.1 cusecs) Head = 8 m (26 ft) Min. Free Particle Size = 50 mm Min. Efficiency = Above 40% Maximum speed = 1000 rpm Casing: Cast Iron ASTM A 48 Class 35 (EN-GJL-250) Impeller: Stainless Steel or better Shaft and Sleeve: Stainless Steel ASTM A 276 Type 316 or better **b) Motor** Ratied power suitable for Pump described Insulation Class = F Ingress Protection = IP 55 Min. Efficiency = as per the IE -02 Class					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO.06 SLUDGE PUMPING STATION (SPS)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	c) Motor Control Unit (MCU) MCU with painted metallic box, auto star delta starter, circuit breaker, magnetic contactor, on/off switch, control fuse, auto level control with ultrasonic level sensor, control wire, under/over voltage relay, electronic over current relay, indication lamps, digital ampere meter, volt meter, hour run meter, dry running protection controller for alternate operation of pumps at predetermined time, complete in all respects. All the equipment shall be from internationally reputed approved manufacturers.		2			
Total Non - MRS Items						
Total Amount						
Total Amount MRS Items for 3 Nos						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 07 INTERNAL/YARD PIPING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation of trenches in all kinds of soil, except cutting rock, for watersupply pipelines/electric cables upto 5 ft. (1.5 m) depth from ground level, including backfilling, trimming, dressing sides, leveling the beds of trenches to correct grade and cutting pits for joints, etc. complete in all respects.	1000 Cft.	7.50			
2	Excavation in rock dressed to designed section, grades and profiles, excavated material disposed off within 100 ft. (30 m) and lift upto 5'-0" (1.5 m). a) Soft rock, slate, shale, schist laterite work, with pick and crow bar.	1000 Cft.	7.50			
3	Dressing and levelling of earhtwork to designed section, etc. complete:- c) Gravel work or soft rock not requiring blasting.	1000 Cft.	7.50			
4	Supplying and filling sand under floor; or plugging in wells. (Provisional Qty)	100Cft.	5.00			
5	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or equivalent including the cost of specials, in trenches, as approved & directed by the engineer incharge, complete in all respects					
	b) PN-8 (SDR-21)					
	6) 75 mm	P.Rft	240.00			
	8) 110 mm	P.Rft	410.00			
	10) 160 mm	P.Rft	500.00			
6	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate): (Thrust Blocks pervisional Qty) (f) Nominal mix Ratio 1: 2: 4	100Cft	5.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 07 INTERNAL/YARD PIPING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
7	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From approved querry	100Cft.	4.40			
8	Compaction of earthwork (soft, ordinary or hard soil) :-					
	c) Ramming earthwork (all types of soil).	1000 Cft.	15.00			
9	Transportation of earth all types when the total distance, including the lead covered in the i tem of work, is more than 1000 ft. (300 m) (Transportation will be paid as per actual lead chart to be approved by the Engineer)					
	a) upto ¼ mi le (400 m).	1000 Cft.	5.00			
	b) for every 330 ft. (100 m) addi tional lead or part thereof, beyond ¼ mi le (400 m) upto one mi le. (1.6 Km.)	1000 Cft.	5.00			
	c) for every ¼ mil e (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km).	1000 Cft.	5.00			
10	Providing and laying crushed stone aggregate of 1/4" to 1-1/2" guage under and around the sewer pipe, including leveling, manual compaction, complete in all respects.	100 Cft.	16.20			
11	Providing and fixing sluice valve of B.S.S. quality and weight, Class `B', for cast iron pipe line, and Asbestos cement pipe line (including cost of jointing material):-					
	a) 3" i/d (75 mm)	Each	10.00			
	b) 4" i/d (100 mm)	Each	10.00			
	d) 6" i/d (150 mm)	Each	2.00			
12	Providing and fixing heavy duty Check valve of specified diameter and material for pressure rating PN-16 made of Crane (USA), Hatersly (UK) or Scon (Pakistan) i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge.					
	(b) Flange Ended Ductile Iron Valve					
	(viii) 3" dia	Each	2.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 07 INTERNAL/YARD PIPING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(ix) 4" dia	Each	2.00			
	(xi) 6" dia	Each	2.00			
13	Providing and fixing cast iron special of B.S.S. Class `B' (such as bend, tee cross collar, reducer, tail piece, flanged spigot, cap, flanged socket, taper, angle branch, plug etc.) for cast iron pipe line , complete:- b) C.I. flanged specials, with flanged and flanged joints:-					
	i) 3" to 6" (75 to 150 mm) i/d	Per Kg	100			
Total Amount MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 8: SLUDGE DRYING BED

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	ii) in ordinary soil.	1000 Cft.	0.53			
	iii) Hard soil or Soft murum	1000 Cft.	0.53			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	1.05			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	1.05			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(h) Ratio 1: 3: 6	100 Cft.	2.15			
5	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(1) Type A (nominal mix 1:1:2)	Per Cft	945.00			

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 8: SLUDGE DRYING BED

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 5(a)(i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(1) Type A (nominal mix 1: 1: 2)	Per Cft	245.00			
6	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position making joints and fastenings including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars)					
	b) Deformed bars (Grade 60)	100 Kg	47.60			
7	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From nearest quarry	100Cft.	12.00			
8	Providing and installing, P.V.C. strainer B.S.S. Class 'B', in tubewell bore hole, including sockets and solvents, etc. complete:- (Perforated Pipe)					
	d) 6" i/d (150 mm)	Per Rft.	50.00			
9	Supplying and filling sand under floor; or plugging in wells (Filter media)	100Cft.	2.20			
10	Shrouding with graded pea gravel 3/8" to 1/8" (10 to 3 mm), around tube well in bore hole.(Filter media will be graded as per drawings for beds)	Per Cft.	110.00			
11	Rehandling of earthwork:					
	a) Lead upto a single throw of Kassi, phaorah or shovel.	1000Cft	0.30			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 8: SLUDGE DRYING BED

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
12	Extra for every 50 ft. (15 m) additional lead or part thereof :-- i) for earhtwork soft, ordinary, hard and very hard. (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)	1000 Cft.	5.00			
13	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:- (bed compaction) i) 95% to 100% maximum modified AASHO dry density..	1000Cft	5.00			
14	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)					
	a) upto ¼ mile (400 m).	1000Cft	1.80			
	b) for every 330 ft. (100 m) additional lead or part thereof, beyond ¼ mile (400 m) upto one mile. (1.6 Km.)	1000Cft	1.80			
	c) for every ¼ mile (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km)	1000Cft	1.80			
15	Preparing surface and painting with Matt/ Glossy high chemical resistant/ hard wearing Polyurethane paint (Epoxy Paint)by sprayer/ Brush i/c the cost of Primer coat, all material and labour complete in all respects as approved and directed by the Engineer Incharge (including priming each and subsequent coat)	Per Sft	705.00			
16	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect. (6mm)	Rft	90.00			

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 8: SLUDGE DRYING BED

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
17	Providing and mixing super plasticizer (water reducing admixture) as defined in ASTM C-94 in order to achieve the required consistancy / workablility measured by the slump, used in the ratio of (0.05% to 1.00%) by weight of cement as proposed by the designer etc complete in all respect. (Pervisional Qty to be excuted after the approval by the Engineer)	Per Ltr.	5			
Total Amount MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB
WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 8: SLUDGE DRYING BED

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Non-MRS Items					
18	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification or directed by the engineer.	100Cft	5			
19	Providing and laying filter media of graded gravels above 10 mm as per drawings, specifications and as directed by the engineer.	Per Cft.	110.00			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill No. 9 Access and Internal roads

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m).					
	2) a) By Excavator					
	ii) Ordinary soil	1000 Cft	1.83			
	iii) Hard soil or Soft murum	1000 Cft.	1.83			
2	Excavation in rock dressed to designed section, grades and profiles, excavated material disposed off within 100 ft. (30 m) and lift upto 5'-0" (1.5 m).					
	a) Soft rock, slate, shale, schist laterite work, with pick and crow bar.	1000 Cft.	3.66			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring	1000 Cft.	3.66			
4	Compaction of earthwork with power road roller, including ploughing, mixing, moistening earth to optimum moisture content in layers, etc. complete:					
	ii) 90% maximum modified AASHO dry density.	1000 Cft	1.83			
5	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(f) Ratio 1: 2: 4	100 Cft	33			
6	Providing and laying Tuff pavers, having 7000 PSI, crushing strength of approved manufacturer, over 2" to 3" sand cushion i/c grouting with sand in joints i/c finishing to require slope . complete in all respect.					
	(50% Grey / 50% Coloured)					
	c) 80-mm thick	P.Sft	6025			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill No. 9 Access and Internal roads

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
7	Providing and fixing precast Edge Kerb Stone (4" to 6" thick), of 3500 PSI Compressive Strength, embeded in PCC 1:2:4 over lean concrete 1:4:8 etc complete in all respect.					
	b) With Painting					
	(i) 14" high	Per Rft	350			
8	Carriage of 100 Cf t. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.	100 Cft	29.37			
Total Amount MRS						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m).					
	2) a) By Excavator					
	ii) Ordinary soil	1000 Cft.	1.07			
	iii) Hard soil or Soft murum	1000 Cft.	1.07			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	2.13			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	2.13			
3	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/Ms Hextar or equivalent @specified suspension concenterate (SC), Mixing Ability-HEXTAR with Ratio (1:250) = 540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10- years complete in all respect as approved by the Engineer Incharge.	Sft	2024.51			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(f) Nominal mix Ratio 1: 2: 4	100 Cft.	1.15			
	(i) Nominal mix Ratio 1: 3: 6	100 Cft.	3.28			
5	Precast cement concrete solid or face blocks (1:2:4), including cost of templates.	Cft.	817.40			
6	Providing and laying damp proof course of cement concrete 1:2:4 (cement, sand, shingle), including bitumen coating.					
	(b) with 2 coats of bitumen:					
	i) 1½" thick (40 mm)	100 Sft.	1.59			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
7	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:- (a) with one coat of bitumen and one coat of polythene sheet 500 gauge: ii) Ratio 1:3 b) ¾" thick (20 mm)	100 Sft.	1.40			
8	Precast cement concrete hollow blocks (1: 2: 4) , including cost of templates and constructing walls thereof.	Cft.	776.79			
9	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):- (a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- (2) Type B (nominal mix 1: 1½: 3)	Per Cft	406.98			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizental shuttering) complete in all respects:- (2) Type B (nominal mix 1: 1½: 3)	Per Cft	304.38			
10	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- ('b) Deformed bars (Grade-60)	100 kg	14.78			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
11	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From Sargodha quarry	100Cft.	11.00			
12	Cement plaster 1:4 upto 20' (6.00 m) height:- a) 3/8" (10 mm) thick	100 Sft.	27.62			
13	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height. c) 1:4	100 Sft.	12.00			
14	Filling, watering and ramming earth under floors:- (i) with surplus earth from foundation, etc.	1000 Cft.	0.94			
	(ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft.	1.31			
15	Extra for every 50 ft. (15 m) additional lead or part thereof i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft.	26.20			
16	Supplying and filling sand under floor; or plugging in wells. (Provisional as Slect Fill)	100 Cft.	13.36			
17	Dry rammed brick or stone ballast, 1½" to 2"(40 mm to 50 mm) gauge.	100 Cft.	1.87			
18	Providing and laying superb quality Porcelain glazed tiles flooring of MASTER brand of specified size in approved design,Color and Shade with adhesive/bondover 3/4" thick (1:3) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respect as approved and directed by the Engineer Incharge. a) Full body Glazed tiles (i) 400 mm x 400 mm	Sft	423.85			

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
19	Tile skirting laid in 1:2 cement mortar, over ¾"(20 mm) thick cement mortar, 1:2 including cement washing and filling joints complete:-					
	(b) mosaic tiles	100 Sft.	0.89			
20	Providing and laying 3/8" thick Prepolished Marble skirting/ risers having uniform texture (spotless) of size 24" x 6" of approved quality and shade with adhesive bond over 3/4" thick (1:2) cement sand mortor complete in all respect i/c the cost of matching sealer to finish the joints as approved and directed by the Engineer Incharge. **i) China Verona**	Sft	143.36			
21	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft.	7.27			
22	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc.					
	(i) 300 gauge (0.003" thick)	Per Sft.	727			
23	Providing and fixing M.S. sheet hollow pressed frame of doors, windows, C. windows, etc. (chowkat only) of 20 SWG welded with M.S. flat 6"x 1¼" x 1/8" (150 mmx30mmx3mm) M.S. holdfast 9"x1"x1/8" (225mmx25mmx3mm) welded/screwed 4" (100 mm) long iron hinges, including filling chowkat with cement sand mortar 1:8 and embedding holdfast in cement concrete 1:2:4, complete in all respects:					
	a) single rebate	Per Sft.	66.50			
	b) double rebate	Per Sft.	21.00			

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
24	P/F 1-1/2" thick solid flush door comprising of 2.5 mm thick Deodar/ Ash/ Oak ply with grooves, compressed over 2.5 mm thick commercial ply over 1" thick packing wood in style and rails under proper pressure i/c the cost of nails, tower bolt, handles, glue, sawing charges and lacquar polishing to show the grains of ply properly, sand papering and 3/8" thick matching wooden lipping as approved and directed by the Engineer Incharge.	Per Sft.	87.50			
25	Providing and fixing sliding bolt to doors:- iii) brass sliding bolt, 10" (250 mm) long	Each	4			
26	Painting new surface:- c) Preparing surface and painting of doors and windows any type (including edges):- i) priming coat. ii) each subsequent coat of paint. (2 coats)	100 Sft.	1.75			
27	Providing and fitting all types of glazed aluminium windows of anodised bronze colour partly fixed and partly sliding using delux sections of approved manufacturer having frame size of 100 x 20 mm (4"x¾") and leaf frame sections of 50 x 20 mm (2"x¾"), all of 1.6mm thickness including 5 mm thick imported tinted glass with rubber gasket using pproved standard latches, hardware etc., as approved by the Engineer in-charge.	Per Sft.	126.00			
28	Providing and fixing M.S. flat ½"x1/8" (13mm x 3mm) grill including ¾" x 1/8" (20 mmx3 mm) M.S. flat f rame, in windows of approved design, including painting three coats, complete in all respects.	Per Sft.	126.00			
29	Priming coat of chalk under distemper.	100 Sft.	20.83			
30	Distempering (a) new surface ii) two coats	100 Sft.	20.83			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
31	Cement pointing struck joints, on walls, upto 20' (6.00 m) hiehgt:- (external wall) a) ratio 1:2	100 Sft.	20.99			
	PLUMBING WORKS					
32	Providing and fitting glazed earthen ware wash hand basin 56x40cm, including bracket set, waste pipe and waste coupling, etc. ii) coloured, with pedestal	Each	1			
33	Providing and fixing stainless steel sink with drain board, size 120x60 cm (48"x24") including bracket set, waste pipe and waste coupling.	Each	1			
34	Providing and fixing chromium plated shower rose:- ii) 2x15 cm (¾"x6")	Each	1			
35	Providing and fixing, chromium plated mixing valve, for wash hand basin, sink or shower.	Each	3			
36	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipe line in trenches, with socket joints, using G.I pipes of B.S.S. 1387-1967complete in all respects with specials and valves:- ii) Medium Quality (Provisional)					
	b) ¾" i/d (20 mm) 2.65mm thick	Per Rft.	27.60			
	c) 1" i/d (25 mm) 3.25mm thick	Per Rft.	20.00			
37	Providing and fitting glazed earthen ware water closet, squatter type, combined with foot rest. ii) coloured	Each	1			
38	Providing and fitting plastic made low down flushing cistern 1363 liters (3 gallons) capacity, including bracket set, copper connection etc., complete. ii) coloured	Each	1			
39	Providing and fixing looking glass 55x40 cm size and 5mm thick, first quality	Each	1			
40	Providing and fitting					
	i) Plastic Soap Dish	Each	1			
	ii) Plastic toilet paper holder	Each	1			
	iii) Plastic towel rail	Each	1			
	iv) Plastic shelf 60X13cm with bracket and railing	Each	1			

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
41	Providing and fixing chromium plated bib cock					
	i) 2 cm (¾")	Each	4			
42	Providing and fixing floor trap of cast iron, including concrete chamber all round, and C.I grating:					
	ii) 10x7.5 cm (4"x3")	Each	2.00			
43	Providing and fitting gully trap, including cement concrete, cost of PVC grating 15x15cm and masonry chamber 30x30cm.	Each	2.00			
44	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe (Dadex/ Popular/ Beta or approved equivalent manufacturer, with specified pressure rating PN (PRESSURE NOMINAL) and conforming to DIN 8077-8078 code i/c cost of solvent, specials, making jharries complete in all respect as approved and directed by Engineer Incharge. (Internal/ External Diameters mentioned). **b) PN-20 pipe**					
	(ii) (3/4") 25 mm	Rft	69.00			
	(iii) (1") 32 mm	Rft	20.00			
45	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized Polyvinyl Chloride) Nikasi/ SWV pipe, Dadex/ Popular/ Beta or approved equivalent manufacturer, plain/ Bell Ended/ Z-Joints conforming to BS 4514/ BS5255 - EN 1329 including the cost of specials and Solvents complete in all respects, as per drawings & specifications and/ or as approved and directed by the Engineer Incharge.					
	(iv)3"(85 mm)	Rft	147.00			
	(v)4"(110 mm)	Rft	15.00			
	(vi)6"(160 mm)	Rft	40.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 10; STAFF BUILDING (01 Nos)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
46	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized polyvinyl Chloride) Nikasi/ waste pipe Fittings make of Dadex/ Popular/ Beta or approved equivalent manufacturer, conforming to code EN-1329 including the cost of Solvents complete in all respect as approved and directed by the Engineer Incharge. **a) P-Trap** (i) 4" dia	Each	4.00			
47	Providing and hoisting vertical/ horizontal type storage tank of required capacity made of rotationally molded from (HDPE), double ply polyethelene of approved manufacturer i/c cost of making connection for inlet/ outlet pipe, float valve i/c all cost of specials & labour complete in all respect as approved and directed by the Engineer Incharge.	Per gallon	200.00			
48	Providing and fixing almirah shutter comprising of 3/4" thick both side Laminated/ Glossy MDF (Karachi) sheet with 1" x 3/4" deodar wood golla all around the leaf fixed on (3"x1" Kail wood frame i/c the cost of 1/2" full brass hinges, C.P. handles, catchers, screws, and rawal plugs, polishing/ painting 3 coat to gola & frame i/c the cost of locking arrangement complete in all respect as approved and	Sft	60.00			
Total MRS Items						
	NON MRS TTEMS					
49	Providing and installing domestic pump and motor including boring, pipe, strainer, fittings etc. Compete in all respect.	Each	1.00			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 11; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	2 (b) By Excavator					
	ii) Ordinary soil	1000 Cft.	1.02			
	iii) Hard soil or Soft murum	1000 Cft.	1.02			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	2.04			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	2.04			
4	Providing and laying sand under and around the sewer pipe, including leveling, manual compaction, complete in all respect.	100Cft	0.77			
5	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(h) Ratio 1: 3: 6	100 Cft.	1.04			
6	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(1) Type A (nominal mix 1:1:2)	Cft.	795.80			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 11; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 6 (a) (i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	1) Type A (nominal mix 1: 1: 2)	Cft.	352.19			
7	Fabrication of mild steel reinforcement for cement concrete, including providing at site, cutting, bending, laying in position, making joints and steel chairs, etc. complete in all respect. and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also Includes removal of rust from bars):-					
	(b) Deformed bars (Grade-60)	100 Kg	44.38			
8	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or equivalent including the cost of specials, in trenches, as approved & directed by the engineer incharge, complete in all respects.					
	b) PN-8 (SDR-21)					
	160 mm	P.Rft	85.00			
9	Providing and fixing heavy duty Gate valve of specified diameter and material for pressure rating PN-16 mde of Crane (USA), Hatersly (UK) or Scon (Pakistan) i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge.					
	(b) Flange Ended Ductile Iron Valve					
	(xi) 6" dia	Each	2.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 11; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
10	Providing and fixing heavy duty Check valve of specified diameter and material for pressure rating PN-16 made of Crane (USA), Hatersly (UK), Scon (Pakistan) or approved equivalent manufacturer i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge.					
	(b) Flange Ended Ductile Iron Valve (xi) 6" dia	Each	2.00			
11	Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect. i) 10"wide 6 mm thick	Rft	60.33			
12	Rehandling of earthwork: a) Lead upto a single throw of Kassi, phaorah or shovel	1000Cft	1.22			
13	Fabrication of heavy steel work, with angle, tees, flat iron round iron and sheet iron for making trusses, girders, tanks, etc., including cutting, drilling, revitting, handling, assembling and fixing, but including erection in position.	100 kg	0.33			
14	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From Sargodha quarry	100 Cft	10.62			
15	Preparing surface and painting with Matt/ Glossy high chemical resistant/hard wearing Polyurethane paint (Epoxy Paint) by sprayer/ Brush i/c the cost of Primer coat , all material and labour complete in all respects as approved and directed by the Engineer Incharge.					
	(i)Priming Coat	Per Sft	1,361.61			
	(ii) Each and subsequent Coat	Per Sft	2,723.22			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill NO. 11; DISINFECTION TANK & COLLECTION CHAMBERS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
Total MRS Items						
B	**NON MRS**					
16	Providing, laying and compacting (95% modified dry density) slectfill material, should be well graded granular fill with fine not more than 20% the aggregate 1/2" to 1-1/2" size complete in all respect as per drawings and specification and as directed by the engineer.	100 Cft.	7.57			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 12: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	ii) in ordinary soil.	1000 Cft.	0.10			
	iii) Hard soil or Soft murum	1000 Cft.	0.10			
2	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	0.20			
3	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	0.20			
3	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent @ specified suspension concenterate (SC), Mixing Ability- HEXTAR with Ratio (1:250) =540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10- years complete in all respect as approved by the Engineer Incharge.	Per Sft	483.05			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(f) Nominal mix Ratio 1: 2: 4	100 Cft	0.55			
	(c) Nominal mix Ratio 1: 1½: 3	100 Cft	0.35			
	(h) Nominal mix Ratio 1: 3: 6	100 Cft	0.80			
5	Precast cement concrete solid or face blocks (1:2:4), including cost of templates.	Cft	397.40			
6	Providing and laying damp proof course of cement concrete 1:2: 4(using cement, sand and shingle), including bitumen coating.					
	(b) with 2 coats of bitumen: ii) 2" thick (50 mm)	100 Sft	0.75			
7	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:-					
	(b) with 2 coats of bitumen:- i) Ratio 1: 4 a) ½" thick (13 mm)	100 Sft	1.15			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 12: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
8	Precast cement concrete hollow blocks (1: 2: 4) , including cost of templates and constructing walls thereof.	Cft.	342.25			
9	Providing and laying reinforced cement concrete (including prestressed concrete), using coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	198.10			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	49.30			
10	Fabrication of mild steel reinforcement for cement concrete, including providing and site, cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	(b) Deformed bars (Grade-60)	100 kg	9.70			
11	Cement plaster 1:4 upto 20' (6.00 m) height:-					
	b) ½" (13 mm) thick	100 Sft	14.75			
12	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height.					
	c) 1:4	100 Sft	2.65			
13	Filling, watering and ramming earth under floors:-					
	(i) with surplus earth from foundation, etc.	1000 Cft	0.30			
	(ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft	0.45			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 12: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
14	Extra for every 50 ft. (15 m) additional lead or part thereo i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft	9.00			
15	Supplying and filling sand under floor; or plugging in wells.	100 Cft	1.00			
16	1½"(40 mm) thick mosaic flooring, consisting of ½ "(13 mm) mosaic topping of one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over 1"(25 mm) thick floor of 1:2:4 cement concrete, including rubbing and polishing complete with finishing :- (b) using white cement	100 Sft	1.60			
17	Mosaic dado or skirting with one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over ½"(13 mm) thick cement plaster 1:3, including rubbing and polishing, complete with finishing: (b) using white cement : ii) ½"(13 mm) thick	100 Sft	0.30			
18	Providing and fixing marble strip of any shade for dividing the mosaic flooring into panels a) Size 1½" x3/8" (40 x 10 mm)	Rft	15.00			
19	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft	3.00			
20	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc. (i) 300 gauge (0.003" thick)	Sft	3.00			
21	Providing and fixing sliding bolt to doors:- i) brass sliding bolt, 10" (250 mm) long	Each	1.00			
22	Priming coat of chalk under distemper.	100 Sft	6.70			
23	Distempering (a) new surface ii) two coats	100 Sft	6.70			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 12: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
24	Providing and applying weather shield paint of approved quality on external surface of building including preparation of surface, application of primer complete in all respect: (external wall)					
	i) 1st coat	100 Sft	7.95			
	ii) 2nd coat	100 Sft	7.95			
25	P/F Iron door comprising of specified leaves made of 1-1/4" x1-1/4" x3/16" MS angle iron for leaf frame, diagonal and horizontal braces duly welded with MS. sheet 18-SWG i/c the cost of sliding bolt, tower bolt and painting 3-coats but excluding the cost of Chowkat complete in all respect as approved and directed by the Engineer incharge.					
	(ii) Double Leaf	Per Sft	28.00			
26	Providing and fixing 2" wide MS/ GI Chowkat singel/double rebate made of 16 SWG MS sheet pressed/ welded/ supported with M.S. flat 1- 1/4"x1/8" i/c 6"long M.S. Flat 1"x1/8"hold fasts (6-Nos) welded/ screwed, punching of lock hole covered with MS Box,coating with antirust paint including filling with cement sand mortar (1:8) and embedding hold fast in cement concrete (1:2:4) ,complete in all respect as approved and directed by Engineer Incharge.					
	(ii) 10.50 " wide	Per Sft	28.00			
27	Providing and fixing steel windows using M.S. sheet (16 SWG) moulded tubular pipe 1½"x1½" (40x40mm) for frame and 1¼"x1¼" (30x30mm) for leaves including M.S. square bars ¼"x¼" (6x6 mm) welded around each panel of frame, 5 mm thick glass panes fixed with double M.S. square tubular pipe 3/8"x3/8" (10x10mm) (22 SWG) beading with U' shaped rubber lining, brass fitting, holdfast, including painting three coats complete in all respects.					
	a) For openable panels fixed with wire gauze 24 SWG, 12x12 mesh and glass panes ¼" (6 mm) thick.	Per Sft	12.00			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 12: CHEMICAL ROOM

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
28	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized Polyvinyl Chloride)Nikasi/ SWV pipe, Dadex / Popular/ Beta or approved equivalent manufacturer, plain/ Bell Ended/ Z-Joints conforming to BS 4514/ BS 5255- EN 1329 including the cost of specials and Solvents complete in all respects, as per drawings & specifications and / or as approved and directed by the Engineer Incharge.					
	(v) 4"(110 mm)	Rft	13			
29	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From Sargodha quarry	100 Cft	3.31416			
	Total MRS Items					
B	**NON MRS**					
30	Providing, fixing, commissioning & testing of Hypo Chlorinator (make Europe/USA or equivalent) consisting of multifunction dosing pump with a microcontroller (RX controller) make Europe/USA complying to EU directives 2006/95/EC and 2004/108/EC, having capacity of 8-10 Liter/hour and maximum pressure of 10 bar, having standard power supply of 230V A.C ± 10%, 50 Hz single phase, Insulation protection rating of IP65, complete with all accessories like injection valve, suction hose, discharge hose, valves, RX probe, level switch, dosing tank complete in all respect.	Job	1			
31	Electricity Connection including all appurtenances.	Job	1			
	Total Non - MRS Items					
	Total Amount					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 13 : FISH PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Chamber & Fish pond					
1	Compaction of earthwork (soft, ordinary or hard soil) :-					
	c) Ramming earthwork (all types of soil).	1000 Cft	0.10			
2	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	1) By Manual					
	ii) in ordinary soil.	1000 Cft.	0.79			
	iii) Hard soil or Soft murum	1000 Cft.	0.79			
3	Excavation in shingle or gravel formation and rock, not requiring blasting, undressed lead upto 100 ft (30 m).					
	i) Dry	1000 Cft.	1.58			
4	Dressing and levelling of earhtwork to designed section, etc. complete:-					
	c) Gravel work or soft rock not requiring blasting.	1000 Cft.	1.58			
4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate).					
	(h) Nominal mix Ratio 1: 3: 6	100 Cft	0.70			
5	Providing and laying reinforced cement concrete (including prestressed concrete), using coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	181.89			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 13 : FISH PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- (2) Type B (nominal mix 1: 1½: 3)	Cft	99.40			
6	Fabrication of mild steel reinforcement for cement concrete, including providing and site, cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (b) Deformed bars (Grade-60)	100 kg	6.40			
7	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working presure pipe, Beta/ Dadex/ Popular/ IIL or equivalent including the cost of specials, in trenches, as approved & directed by the engineer incharge, complete in all respects. **b) PN-8 (SDR-21)** 7) 90 mm	Rft	70.00			
8	Providing and fixing sluice valve of B.S.S. quality and weight, Class `B', for cast iron pipe line, and Asbestos cement pipe line (including cost of jointing material):- a) 3" i/d (75 mm)	Each	2.00			
9	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipeline in trenches, with socket joints, using G.I. pipes of B.S.S. 1387-1967 complete in all respects, with specials and valves. g) 2"½ i/d (65 mm) 3.65mm thick	Rft	134.00			
10	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From sargodha quarry	100 Cft	3.01			
	Total MRS Items					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 13 : FISH PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Non-Mrs Items					
11	Providing and fixing Sp air pump Lp-100, 100 watt including nano bubble diffuser with piping.	Each	1.00			
12	Providing and fixing green tarpal at top of Fish Pond including all accessories complete in all respect as per drawing and as directed by the engineer.	Sft	176.72			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

Bill No. 14: TREE PLANTATION

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	NON MRS					
1	**Native trees**					
a.	Albizia Lebbeck (Siris Tree)	Each	20			
b.	Morus Alba (White Mulberry)	Each	20			
c.	Ficus religiosa (Pipal)	Each	15			
d.	Acacia Nilotica (Kikar)	Each	20			
e.	Mortaility 20% (during 1 year of operation)		15			
2	**Input Requirements**					
2	Providing and laying at site the following items as per direction of the engineer.					
a.	Fertilizer (NPK)	Bags	2			
b.	FYM	Kg	1,000			
3	Development (For 12 Months)					
a.	Gardner	Month	12			
b.	Miscellaneous (Vehicle expenditures, wear & tear of tools etc)	L/S	1			
	Total Amount					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 15 Boundary wall & Main Gate

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m).					
	1) By Manual					
	ii) in ordinary soil.	1000 Cft.	2.00			
	iii) Hard soil or Soft murum	1000 Cft.	2.00			
2	Excavation in rock dressed to designed section, grades and profiles, excavated material disposed off within 100 ft. (30 m) and lift upto 5'-0" (1.5 m).					
	a) Soft rock, slate, shale, schist laterite work, with pick and					
	crow bar.	1000 Cft.	4.00			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(h) Ratio 1:3:6	100 Cft	5.20			
4	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	301.15			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining wal ls; etc and other structural members other than those mentioned in 5(a)(i) above not requiring form work (i.e. horizental shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Cft	474.90			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 15 Boundary wall & Main Gate

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5	Fabrication of mild steel reinforcement for cement concrete, including cutting, laying in position making joints and fastenings including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars)					
	b) Deformed bars (Grade 60)	100 Kg	27.16			
6	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.					
	Lead From sargodha quarry	100 Cft	11.90			
7	Precast cement concrete solid or face blocks (1:2:4), including cost of templates.	Cft.	5400.50			
8	Providing and laying damp proof course of cement concrete 1:2: 4(using cement, sand and shingle), including bi tumen coating :- (b) with 2 coats of bitumen:					
	ii) 2" thick (50 mm)	100 Sft	5.85			
9	Precast cement concrete hollow blocks (1: 2: 4) , including cost of templates and constructing walls thereof.	Cft.	2684.15			
10	Cement plaster 1:3 upto 20' (6.00 m) height:-					
	b) ½" (13 mm) thick	100 Sft	40.50			
11	Cement pointing struck joints, on walls, upto 20' (6.00 m) hiehgt:-					
	a) Ratio 1:2	100 Sft	40.50			
12	Rehandling of earthwork, lead upto a single throw of kassi, phaorah or shovel, including Ramming earthwork (all types of soil).	1000 Cft	3.60			
13	Making and fixing steel grated door with 1/16" thick (1.5mm) sheeting, including angle iron frame 2"x2"x3/8" (50x50x10 mm) and ¾" (20 mm) square bars 4" (100 mm) centre to centre, with locking arrangement .	Sft	101.75			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 15 Boundary wall & Main Gate

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
14	Painting new surface:- d) Preparing surface and painting guard bars, gates of iron bars, gratings, railing (including standards, braces, etc.) and in similar open work:- i) priming coat. ii) each subsequent coat of paint.(2 Coats)	 100 Sft 100 Sft	 1.02 2.04			
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 16; RCC DRAIN

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	Earthwork excavation in irrigation channels, drains, etc. to designed section, grades and profiles, excavated material disposed off and dressed within 100 ft. (30 m) lead:-					
	ii) Hard	1000 Cft.	0.74			
	iv) Gravel & shingle	1004 Cft.	0.08			
2	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):					
	(i) Ratio 1: 3: 6 (Lean Concrete)	100 Cft.	1.82			
3	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					
	a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	225			
	(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and footing beams, other structural members other than those mentioned in 6(a)&(b) above not requiring form work (i.e. horizontal shuttering) complete in all respects:-					
	(2) Type B (nominal mix 1: 1½: 3)	Per Cft	250			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 16; RCC DRAIN

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
4	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-					
	(ii) (Grade-60)	100 Kg	22			
5	Providing and embedding 10"(250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls,water tanks, Slabs) complete in all respect.					
	i) 6 mm thick	Per Rft.	238			
6	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor (crushed stone aggregate and bajri used in concrete items)					
	Lead From nearest quarry (Sargodha Quarry)	100 Cft.	5.68			
7	Bitumen coating to plastered or cement concrete surface:-					
	i) 20 lbs. per 100 Sft. (9.07 Kg per Sq.m)	100 Sft	8.00			
8	Preparing surface and painting with Matt / Glossy high chemical resistant/ hard wearing Polyurethane paint (EpoxyPaint)by sprayer /Brush i/c the cost of Primer coat, all material and labour complete in all respects as approved and directed by the Engineer Incharge.					
	(i) Priming Coat	Per Sft	300			
	(ii) Each and subsequent Coat	Per Sft	300			
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1.0	**WIRING AND ACCESSORIES**					
1.1	Wiring of light or fan point from switch board/dimmer to the point with 3x1.5 mm^2 (P+N+E) PVC insulated single core stranded cables in 25 mm PVC conduit/pipe concealed in walls, columns and slabs including accessories, PVC box, 10 Amp. gang switch 1 or 2 way as required, one for each light or fan and installed as in specifications complete in all respects.	Each	15			
1.2	Circuit wiring from DB/ MCBs to gang switches board and from switch board to another switch board with 3x2.5 mm^2 (P+N+E) PVC insulated single core stranded cables in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	8			
1.3	The same as item No. 1.1 but from one light point to another light point.	Each	15			
1.4	10/13 Amp 3 pin universal flush mounting switch socket outlet wired from DB/MCBs to first outlet with 3x4 mm^2 (P+N+E) single core cable stranded (away from switch board) in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	5			
1.5	The same as item No.1.4 but wiring from one socket outlet to another socket outlet with 3x2.5 mm^2 (P+N+E) single core stranded cable in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	6			
1.6	15/20 Amp 3 pin mounting switch socket outlet wired from DB MCBs to independent socket outlet with 3x6 mm^2 (P+N+E) single core stranded cable (away from switchboard) in 25mm PVC pipe/conduit concealed in walls, columns and slabs as required complete in all respects.	Each	7			
2.0	**CONDUIT/PIPE**					

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
2.1	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables in walls/barriers/structure.	Rft.	350			
2.2	PVC pipe/conduit Class-B 200 mm dia with accessories suitable for laying multi-core cables in walls/barriers/structure.	Rft.	400			
2.3	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables from pole to pole in trenches/directly burried including excavation.	Rft.	1800			
2.4	PVC pipe/conduit Class-D 100 mm dia with accessories suitable for laying multi-core cables in trenches/directly burried on road crossings including excavation.	Rft.	400			
3.0	**Power Cables**					
3.1	Supply and erection of copper conductor cables for service connection, in prelaid pipe/G.I. wire/trenches, etc. (rate for cable only) PVC insulated, PVC sheathed 4 core, 600/1000 volt non armoured cable					
(a)	10 mm (7/0.052")	Rft.	1800			
(b)	16 mm (7/0.064")	Rft.	200			
(c)	25 mm (19/0.052")	Rft.	800			
3.2	Supply and erection of single core PVC insulated copper conductor cables, in prelaid PVC pipe/M.S. conduit/G.I pipe/wooden strip batten/wooden casing an capping/G.I. wire/trenches (rate for cables only) 450/750 volts, PVC insulated:					
(a)	10 mm sq (7/0.052")	Rft.	1950			
(b)	16 mm sq. (7/0.064")	Rft.	1200			
3.3	3 Nos. 1 core 2.5 mm^2 Cu/PVC 450/750 Voltage grade cable (stranded conductor) (Imported copper shall be used. Verified documentary evidence for source of copper & PVC shall be furnished prior to manufacturing) from junction box to the fitting through the hollow of pole.					

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
-	For 10m Pole	Each	6			
4.0	**EXHAUST FAN**					
4.1	Providing and fixing Copper winded Exhaust fan with louver and shutter made of Pak/Younas/G.F.C. i/c the cost of necessary cable and hardware for connection from ceiling rose complete as approved and directed by Engineer Incharge.					
	Plastic Body (12" dia)	Each	4			
4.2	Providing and fixing Copper winded wall bracket fan made of Pak/ Younas/G.F.C or NEECA approved equivalent i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer.					
	18" Sweep dia	Each	2			
4.3	Providing and fixing Copper winded ceiling fan made of Pak/ Younas/G.F.C or NEECA approved equivalent i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer.					
	56" dia	Each	2			
5.0	**Road / Street Lighting Poles and Foundations**					
5.1	10m high single arm octagonal shape electric street light pole, made of hot dipped 4.5 mm thick (7 SWG) galvanized steel, tappered from 225 mm at bottom to 100 mm at top, with 1500 mmx60 mmx4mm thick dia. arm for luminaire installation, duly G.I.welded with 470x470x20 mm base plate with the help of 4 no triangular stiffeners 100x350x20 mm of GI sheet, with built in junction box with shutter & one (01) no. 2A SP MCB 10kA breaker, i/c the cost of nuts & J-rag bolts, duly fixed in prelaid concrete foundation, foundation will be paid additionally as approved and directed by the Engineer Incharge.	Each	6			

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5.2	Road/Street Lighting Pole Foundations including 04 nos. of dia 25mm J-Bolts, PVC long Bends Class (3000 Psi- cylinder strength) concrete, 60 grade reinforced steel, Excavation, Blinding Concrete, Common Backfilling & Pitchmen Coating etc. as shown on drawing. Complete in all respect.	Each	6			
6.0	**<u>LED Road Light Fixtures</u>**					
6.1	Road Lighting LED Cobra-head Luminaries of 90 Watt with 10800 Lumens conforming to IP 66 & IK 08 or above Philips/Osram/Thorn or equivalent with corrosion resistant die casted Aluminium housing, silicon gasket in special groove, UV stable & scratch resistant synthetic materials, thermally hardened glass complete with LED Chip (Philips Lumiled/Cree/Nichia/Osram make or equivalent), programmable LED driver (Harvard/ TCI/ Lumotech/ Philips/VOSSLOHSchwabe/ Lightech make or equivalent), minimum 10kV surge protection rating i/c the cost of all accessories/ components required for proper operation, fully flexible for future upgradation and easy replacements for maintenance purposes, bucket elevator charges as approved and directed by the Engineer Incharge.	Each	6			
Total Amount MRS Items						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Non-MRS Items Supply, stroage, installation, testing and commissioning of the following items of work (unless specifically stated otherwise) including all material, labour, tools, accessories, etc. required for proper completion of each item as per specification, drawings and as directed by the Engineer.					
1.0	**<u>POWER CABLE</u>**					
1.1	Copper conductor PVC/PVC 600/1000V cables including sockets and connections at both ends with Cu/Brass glands, lugs ets alongwith all accessories. The cable shall be drawn in cable trench or clipped on the wall or pulled in cable tray/PVC pipes or as required or as shown on drawings. **(Imported copper shall be used. Verified documentary evidence for source of copper & PVC shall be furnished prior to manufacturing).**					
a)	2 core 10 mm^2	Rft.	120			
2.0	**<u>LIGHT FITTINGS AND FANS</u>**					

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	Following LED Luminaries of suitable wattage make suitable for the project requirements. Contractor to submit lighting design calculation to determine the adequacy of the wattage and should adjust the number of LEDs/wattage as per project lighting requirements. The fitting shall be approved by the Engineer.					
2.1	Light Fixture Type LED Batten Ceiling/surface mounted, 18W complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	12			
2.2	Light Fixture Type LED Batten Ceiling/surface mounted, 10W above mirror in toilets complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	4			
2.3	Light Fixture Type LED surface mounted down lighter, 12W complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	12			
2.4	20W LED Water tight light fixture IP 65 complete in all respect with all allied accessories. The fitting shall be approved by the Engineer.	Each	4			
3.0	**<u>DISTRIBUTION BOARDS</u>**					

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	D.Bs with TP incoming adjustable moulded case circuit breaker and SP miniature outgoing circuit breakers, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories. alongwith all installation and operational accessories as per specification or as shown on the drawings.					
3.1	**DB- Pump Room**	Each	1			
-	1 No. 16 Amps (Adj.) MCCB TP, RC=18kA, Icu=100%Ics					
-	3 Nos. outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
3.2	**DB- Chemical Room**	Each	1			
-	1 No. 16 Amps (Adj.) MCCB TP, RC=18kA, Icu=100%Ics					
-	2 Nos. outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	4 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	3 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
3.3	**D B- Staff Building**	Each	1			
-	1 No. 25 Amps (Adj.) MCCB TP, RC=25kA, Icu=100%Ics					
-	04 Nos.outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	05 Nos. outgoing 10A, MCB, SP, RC=10 kA, Icu=100%Ics					
-	03 Nos. Spare 10/20A, MCB, SP, RC=10 kA, Icu=100%Ics					

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	- Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.					
4.0	**LV SWITCHGEAR PANEL/MAIN PANEL BOARD (MPB)**					
	LV Switchgear Panel/Main Panel Board of 14 SWG, IP class 54/44 & RAL 7032 including I/C and O/G following electrical items, foundation/base frame with all installation and operational accessories as per site requirements, as per tender specifications and drawings and as directed by the Engineer.					
4.1	**MPB**	No.	1			
	INCOMING					
	- 01 No. 80 Amps TP (Adj.) MCCB, RC= 25 kA, Icu=100%Ics					
	- 01 No. VSS (07 position)					
	- 01 No. 0-600 Volts AC DIGITAL Voltmeter					
	- 03 Nos. 100/5 Amps Current Transformers					
	- 01 No. ASS (R-Y-B-OFF)					
	- 01 No. 0-100 Amps AC DIGITAL Ammeter					
	- 06 Nos. RYB and ON OFF TRIP LED indication lights					
	- 14 SWG steel sheet Panel RAL 7032, IP= 54/44 and all other accessories,					
	OUTGOING					
	- 02 Nos. outgoing 16 Amp MCCB TP, (Adj.) RC=18kA , Icu=100%Ics (For 7.5 HP Running Motor)					

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
-	02 Nos. outgoing 16 Amp MCCB TP, (Adj.) RC=18kA , Icu=100%Ics (For 7.5 HP Standby Motor)					
-	3 Nos.outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics (For 2 HP Running Motor)					
-	3 Nos.outgoing 20A, MCB, SP, RC=10 kA, Icu=100%Ics (For 2 HP Standby Motor)					
-	01 No. 25 Amp MCCB TP, (Adj.) RC=25kA, Icu=100%Ics (For DB Sub Station Building)					
-	01 No. 16 Amp MCCB TP, (Adj.) RC=18kA, Icu=100%Ics (For DB Chemical Room)					
-	01 No. 16 Amp MCCB TP, (Adj.) RC=18kA, Icu=100%Ics (For DB Pump Room)					
-	01 No. 63 Amp MCCB TP, (Adj.) RC=25kA, Icu=100%Ics (For PFI)					
-	02 No. 16 Amps (Adj.) MCCB TP, RC= 18 kA, Icu=Ics 100%, 02 No. 26 Amps (Adj.), Megnatic Contactor (AC-3), 2 Nos. Push Button (ON/OFF), 5 Nos. indication lights (ON, OFF) (R,Y,B), Brass cable glands/ accessories, 1 No. Auto-Manual-OFF (3 position switches for operation in auto (with photocell) and normal (manual mode-photocell overide), 3 Nos. photo-electric switches- (For External Lighting)					
-	01 No. Spare 25 Amp MCCB TP, (Adj.), RC=25kA, Icu=100%Ics					
-	01 No. Spare 16 Amp MCCB TP, (Adj.), RC=18kA, Icu=100%Ics					
-	01 No. Space MCCB TP, (Adj.)					
-	01 No. Panel light with limit switch					

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
-	02 Nos. Exhaust fan 6" (copper) & Louver 8" sweep with thermosttae relay and all accessories etc.					
-	Electrolytic copper bus bar with electrical grade PVC mountings 3 for each, nuts, bolts and washers, control MCB etc. (160 Amps. R+Y+B N, 50 Hz, 415 V, AC)					
-	All other accessories required for completion of the qulaity works					
-	Contractor shall submit the genuine certificate from the manufacturer/authorized agent clear by indicating the project name make/model/rating of MCCB, MCB, magnetic contactors, terminal blocks and voltmeters/ ammeter alongwith warranties.					
5.0	**POWER FACTOR IMPROVEMENT PANEL (PFI)**					
	14 SWG steel sheet clad IP 54 colour RAL 7032 powder coated power factor improvement panel (PFI) including Cu busbar, heavy duty incoming and outgoing circuit breaker to capacitor, magnetic contactors, continuous digital p.f controller, on & off pushbuttons etc. complete with all components/ accessories as per specifications and drawings.					
5.1	**PFI - 20 kVAR**	No.	1			
-	06 steps with continuous digital power factor and capacitor controller with all accessories etc.					
-	01 No. Neutral/OFF/Auto selector switch					
-	04 Nos. 5 kVAR capacitor					
-	04 Nos. 32 A Magnetic contactor (AC-3)					

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WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

BILL NO. 17; ELECTRICAL WORK

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
	04 Nos. 25A MCCB, TP (Adj.) RC= 25 kA Circuit breaker, Icu=100%Ics					
-	06 Nos. Indication light - (for magnetic contactor and phase)					
-	06 Nos. Push Buttons (ON/OFF)					
-	06 Nos. Auxiliary contractor (NO/NC)					
-	01 No. Panel light with limit switch					
-	01 No. Exhaust fan 6" & Louver 8" sweep with thermosttae relay and all accessories etc.					
-	14 SWG steel sheet Panel RAL 7032, IP= 54/44 and all other accessories,					
-	Electrolytic copper bus bar with electrical grade PVC mountings 3 for each, nuts, bolts and washers, control MCB etc. (200 Amps. R+Y+B N, 50 Hz, 415 V, AC)					
-	All other accessories required for completion of the qulaity works including Cable gland and lugs etc.					
-	Contractor shall submit the genuine certificate from the manufacturer/authorized agent clear by indicating the project name make/model/rating of MCCB, MCB, magnetic contactors, terminal blocks and voltmeters/ ammeter alongwith warranties.					
6.0	**EARTHING**					
6.1	Earth point comprising of 10 ft. 5/8" dia. (16 mm dia) copper coated M.S. rods driven in ground near each lighting control panel. The earthing rods shall be completed with fixing clamps etc.	No.	6			
Total Non - MRS Items						
Total Amount						

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill No. 18; IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
1	**Supply, wiring, tagging, termination, design, installation, testing and commissioning of following system complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards and technical specifications attached herewith** **Fixed Bullet IP Camera 8MP** • 08 MPX Sony Starvis 4K Sensor 1/2.8” • Lens Type : Motorized with auto-iris and auto-focus functions, f=2.7 ~ 13.5 mm/F1.4 • Resolution: 3840 x 2160 pixels • Frame Rate: 20 fps (4K) • Min. Illumination: 0.1 lux (0 lx, IR on) • IR LED, range up to 50 m •Video Intelligent Analytics: Perimeter Intrusion Detection, Line Crossing Detection, Stationary Object Detection, Pedestrian Detection, Face Detection, Cross Counting and Face Recognition. • Operating Temperature -40°C ~ 60°C	No.	9			
2	**IP Based Outdoor PTZ Camera 5MP** • Resolution: 5MP • 30X Optical Zoom • Lens Type motorized, auto-iris function, f=4.7 ~ 141 mm/F1.5 ~ F4 • Edge Analytics • facial recognition. • Deep learning algorithm having People and Vehicle Counting technology • Detect, track, capture vehicle, non-motor vehicle and people	No.	3			
3	**PTZ Controller**	No.	1			
4	**32 channels NVR Network Video Recorder (NVR)** • Video and audio channels: 32 • Supported protocols: ONVIF, RTSP • Supports resolution 3840 x 2160 • Recorded stream size: 320 Mb/s in total from all cameras • Internal HDDs mount: 8 • Internal storage for recording mount: 2 x HDD 3.5” 6 TB SATA • Minimum storage12 TB • Monitor outputs: 3 (HDMI (4K UltraHD), HDMI, VGA) • RAID protects recordings • Intelligent image analysis •Video Intelligence Analytics • Facial Recognition Advanced Analytics • Compatible with all Onvif IP cameras • Power Supply 100 ~ 240 VAC with 140 W PoE • Operating Temperature -10°C ~ 50°C	No.	1			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill No. 18; IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
5	**Video Management Server with 24" VDU** Management & Client Software, • Intel Xeon gold Processor (16 Core with 32 threads) latest version • 32 GB DDR 4 RAM • 8TB Internal Hard disk drive SATA • HDMI port for connection to the High quality monitor • DVD/RW drive • 24" LED monitor FHD with HDMI and VGA • 10G optical connectivity • Keyboard, Mouse and Peripheral Interface Cards • 2U Rack mount chassis including redundant power supply (Minimum 500W) • Latest MS WINDOWS software 64 bit pre-installed Operating System and associated software.	No.	1			
6	**55" LED Display**	No.	1			
7	**16-port Access Switches layer 3 with SFP Managed** • 1000 Base –T (RJ-45) Ports(PoE / PoE+) : 16 Ports • 1000 Base-X (SFP) : 2 Ports • Console Port RS-232/RJ-45 • Switching Capacity Bandwidth 128 Gbps • Packet forwarding rate (64B) : 92.1Mpps • Buffer memory 12 Mb • RAM (DDR3) : 512 MB • ROM (RAW HAND) : 512 MB • MAC table : 16K • VLAN table : 4k • Link aggregation Group (LAG) : 16, upto 8 ports per LAG • Maximum size of ECMP group : 8 • Maximum Jumbo – frames size : 10240 B • Stacking : 08 devices • Max power consumption : 400W (PoE)	No.	2			
8	**24-Port PoE+ SFP Managed Switch (For Monitoring Room)** • 1000 Base –T (RJ-45) Ports(PoE / PoE+) : 24 Ports • 1000 Base-X (SFP) : 4 Ports • Console Port RS-232/RJ-45 • Switching Capacity Bandwidth 128 Gbps • Packet forwarding rate (64B) : 92.1Mpps • Buffer memory 12 Mb • RAM (DDR3) : 512 MB • ROM (RAW HAND) : 512 MB • MAC table : 16K • VLAN table : 4k • Link aggregation Group (LAG) : 16, upto 8 ports per LAG • Maximum size of ECMP group : 8 • Maximum Jumbo – frames size : 10240 B • Stacking : 08 devices • Max power consumption : 400W (PoE)	No.	2			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill No. 18; IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
9	**24 Core Fiber Optic Cable** Standard G652-D, • Cable type Single Mode • Cable construction Loose tube • Layer of Aramid Yarn 5mm • Wavelength 1300/1550 nm • Max attenuation 0.36 db/km Excavation duct price with all accessories shall be included	Meter	92			
10	**CAT-6**, 23AWG Cable including termination and tagging at both ends. Complete in all respects.	Meter	351			
11	**Stainless Steel NEMA 4X 6U Outdoor Enclosure** suitable for installation of standard switches and patch panels and etc. Complete with floor base, vertical cable managers. Rack shall be equipped with power distribution units (PDUs). Complete in all respects. • IP55 • 02 no. or more cooling fans • Pole mount or Wall Mount • Door lock	No.	2			
12	**Indoor Communication Rack 12U (For Monitoring Room)** suitable for installation of standard switches and patch panels and etc. Complete with floor base, vertical cable managers. Rack shall be equipped with power distribution units (PDUs. Complete in all respects. • IP30 • 19 inch standard; • Removable Side Panels, side locks are optional; • Knock-off holes for entering cables • Turning angle of front door is over 180 degrees • Fans, shelf and PDU	No.	1			
13	**2 kVA UPS Pure Sine Wave** • Pure sine wave • Power factors 0.7 lag to 0.9 lead • Efficiency at full load shall be 88% with • Power factor :0.8 • load crest factor : 3: 1 • remote monitoring and diagnostics system Rack , Cables, Power DB , Complete in all respect	No.	1			
14	**VRLA Battery 160 AH Backup** • GEL VRLA Battery • High temperature tolerance • Excellent for deep discharge • Hugh resistance to water loss • Battries Racks • Maintenance free operation • Spill proof construction • 10 Years Life	No.	2			
15	**50 mm Class D - PVC Conduit**	Lot	1			
16	**HDPE pipe** • size 40mm • outer dia 40mm • wall thickness 3.5mm • standard length: 125m/250m/1000m	Meter	252			

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTE WATER IN PUNJAB

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR

BILL OF QUANTITIES

Bill No. 18; IP Based Video Surveillance System (CCTV System)

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				Rupees in Figures	Rupees in Words	
17	Installation, Programming, Testing and Commissioning of complete system.	Job	1			
18	**8 kVA UPS Pure Sine Wave** ***(This item is Not related to CCTV System, it will be used for Air Pump, Dosing pump & Staff Building & Chemical Room)*** • Pure sine wave • Power factors 0.7 lag to 0.9 lead • Efficiency at full load shall be 88% with • Power factor :0.8 • load crest factor : 3: 1 • remote monitoring and diagnostics system Rack , Cables, Power DB , Complete in all respect	No.	1			
19	**Battery (230 AH) for 6 Hours backup** ***(This item is Not related to CCTV System, it will be used for Air Pump, Dosing pump & Staff Building & Chemical Room)*** • Voltage : 12V • High temperature tolerance • Low electrical resistance PE separators and prevents oxidation • Large head room provided for high acid for longer life • Float Indicators are fitted to determine the level of electrolyte • Designed llife of over 1250 cycles at 80 % DOD	No	12			
	Allow for **any other item** required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in this item but complete description, item rates, quantity required and brands shall be mentioned separately and to be attached with the BOQ. **Note:** 1) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant. 2) Contractor is advised to confirm the cable running lengths as per site conditions before commencement of work. The Payment of cable shall be paid as per Running meter. 3) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor					
Total Amount						

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

BILL NO; 20 SOLARIZATION

No.	ITEM(s)	Description	Unit	Quantity	Rate (Rs)		Amount (PKR)
					Rupees in Figures	Rupees in Words	
1	PV module	Tier 1 Manufacturer according to bloomberg Q1 or Q2 issued rankings, IEC Standard 61215 Compliant, not less than 600 W N-Type and Half Cut PV modules or better, Monofacial or Bifacial	Sum	27 kW			
2	String Inverter	3 phase Ongrid Inverter with Remote Monitoring Devices	Sum	27 kW			
3	Genset Synchronization Module	Genset Auto Synchronization Hybrid Genset Controller/Solar-Diesel integration Controller compatible with Inverter and Generator, factory fabricated as approved by the Engineer.	Nos.	01			
4	Communication Box	Data Logger	No.	As per inverter configuration			
5	PV Mount Structure for Ground Mounted	Wind speed = 150km/h, azimuth as per site. (UV resistant, 85 micron of zinc coating), 12AWG or as per drawing given in Employer's Design.	Sum	30 kW			
6	Lightning Arrester	Copper rod height 2 m to be fixed on Parking Shed Top	Nos.	1			
7	0.4kV LV DB	**Details of breakers and SPD to be in housed in cabinet:** As given in AC BoQ and drawings attached	Nos.	1			
8	DC Distribution Box	IP65 GI DB for each inverter for placing DC strings Expected size but not limited to W*H*D = 3*1*0.75 wall mount, single door with lock and with complete fitting scheme/ railing for DC breakers	Nos.	As per no. of inverters			
9	DC Breakers	As per string configuration and PV Module fuse ratings	Nos.	As per inverter string configuration			
10	DC wire for PV	6 mm Sq. DC flexible wire 1500V DC Copper conductor, Cu XLPO	m	500			
11	AC wire from LV panel to Inverter	Cu/PVC/PVC 0.6/1 kV, 4*16 mm Sq. AC stranded	m	10			
12	AC wire for inverter grounding	Cu/PVC 450/750V, 1*10 mm Sq. (ECC/CPC)	m	10			
13	DC wire for frame- frame grounding	PVC 1*6 mm Sq. AC standard Wire	m	30			
14	DC wire for PV frames to grounding point	PVC 1*16 mm Sq. AC standard Wire	m	30			
15	Copper Bare Conductor	25 mm sq.	m	50			
16	Cable Tray	16 AWG Galvanized iron with flat cover, perforated downside, complete fitting accessories i.e nut bolts, supporting angle iron etc, size (W*D)inch 8*4 for laying string wires	m	30			
17	Cable Trench	Outdoor Excavation and back filling with sand for DC string cable along with bricks,Trench minimum size(ft.) Depth*Width*Length (ft.) =3*1*115.5.	m	35			
18	UPVC pipe	50mm dia pipe for laying string wires PV area to inverters including sockets	m	As per requirement			
19	UPVC pipe	25mm including bends and sockets	m	As per requirement			
20	MC4 connectors	IP67/IP68 for PV stringing	Nos.	As per requirement			
21	Bi-directional Meter & Net Metering Services	Net metering services complete in all aspects along with bidirectional meters and NEPRA license		01			
22	DC Earthing	Bore Type Earthing for DC Components		01			
23	AC Earthing	Bore Type Earthing for AC Components		01			

WASTEWATER TREATMENT PLANT AT VILLAGE SARKALAN, KALAR KAHAR
BILL OF QUANTITIES

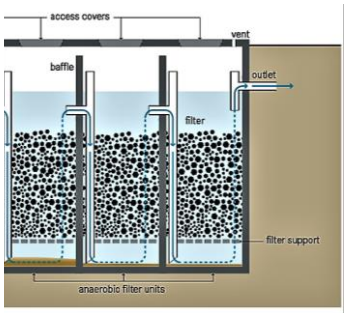
BILL NO; 20 SOLARIZATION

No.	ITEM(s)	Description	Unit	Quantity	Rate (Rs)		Amount (PKR)
					Rupees in Figures	Rupees in Words	
24	MISC ITEMS	• Cable ties, rawal bolts, pvc tapes, steel and PVC clamps, pvc pipes, glands different sizes, thimbles, connectors, warning labels etc. • 2 x insulated glove pairs, shoe pairs, hats for site inspection and maintenance activities • PV module O&M kit • Manual Panel Cleaner	As per requirement				
Subtotal A (inclusive of all applicable taxes on items listed at Sr. No. 1 to 24)							
B. Installation, Testing, Commissioning, O&M Training							
25	Installation, Testing and Commissioning	Complete project installation and commissioning till handover of the Project to Employer	Job.				
26	O&M Training	1 week O & M training of 3 personnel of the Employer	Job.				
Subtotal B (inclusive of 16% PST on Services at Sr. No. 25 to 26)							
	D. Total Price (C = A + B)						

Strategic Planning & Implementation Unit (SP&IU),
PGDP Environment Protection Department (EPD),
Government of Punjab

Surveying, Engineering Design, Technical Specifications and Preparation of Bidding Document For 03 Pilot Plants of Wastewater Treatment in Punjab











Engineer's Estimate
(Technical Specifications)

JUNE 2025

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LIST OF ABBREVIATIONS

Acronyms	Definition
AISI	American Iron and Steel Institute
ASTM	American Society for Testing and Materials
BMS	Battery Management System
BNEF	Bloomberg New Energy Finance
BOQ	Bill of Quantities
CFM	Cubic Feet per Mint
dB(A)	Decibels A-weighted
DIN	Deutsches Institut für Normung
EPDM	Ethylene Propylene Diene Monomer
°F	Fahrenheit
h	Hours
HI	Hydraulic Institute
IEC	International Electrotechnical Commission
in	inches
IP	Ingress Protection
ISO	International Organization for Standardization
KW	Kilowatt
kWh	Kilowatt-hour
LID	Light Induced Degradation
MCC	Motor Control Centre
mm	Millimeter
NEMA	National Electrical Manufacturers Association
NPSH	Net Positive Suction Head
NTU	Nephelometric Turbidity Unit
O&M	Operation and Maintenance
PID	Potential Induced Degradation
ppm	Parts Per Million
psi	Pressure per square inches

1 TECHNICAL SPECIFICATIONS OF SUBMERSIBLE SEWERAGE PUMPS

1.1 Scope

This section outlines the requirements for the design, manufacture, factory testing, supply, delivery, installation, testing, commissioning, and warranty of submersible sewerage pumps. The work includes pumps, motors, discharge piping, non-return and isolation valves, guide rail systems, level sensors, control panels, and all associated appurtenances for a complete and functional pumping system.

1.3 General Requirements

- Type: Submersible non-clog sewage pump suitable for pumping untreated raw sewage and wastewater containing solids.
- Duty: Continuous duty operation submerged in wastewater.
- Motor: Squirrel cage induction motor, insulation class F, IP 68, 400 V, 50 Hz, 3 phase, suitable for submerged conditions.
- Capacity & Head Requirements:

Capacity (m^3/hr)	Head (m)
25	10

- The pumps must be able to handle spherical solids up to 75 mm (minimum).
- Pump and motor shall be integrally close-coupled and designed for fully submerged operation.

1.4 Applicable Standards

- **ISO 9906** – Hydraulic performance testing of centrifugal pumps
- **IEC 60034** – Rotating electrical machines
- **ISO 5199** – Technical specifications for centrifugal pumps
- **HI 9.6.4** – Rotodynamic pumps: vibration measurement and allowable values
- **NEMA MG-1** – Motors and generators
- **DIN EN 12050** – Wastewater lifting plants
- **ASTM A240** – Stainless steel plate, sheet, and strip for pressure vessels
- **AWS D1.1** – Structural Welding Code – Steel
- **ISO 1940** – Balance quality of rotors

1.5 Design Criteria

- Pumps shall have a non-clog impeller, vortex or single-channel type.
- Motor and hydraulic section must be from a single manufacturer.
- Each pump must be suitable for continuous operation without overheating.
- Design shall ensure operation near Best Efficiency Point (BEP).
- Minimum pump efficiency: 65% at rated duty point.

1.6 Manufacturer's Qualifications

- Must have at least 10 years of experience in manufacturing wastewater pumps.
- ISO 9001 certified manufacturing facility.
- Products must have proven track record in municipal/industrial sewage applications.

1.7 Submittals

The following documents must be submitted for approval:

- General arrangement drawings
- Pump and motor performance curves
- Material certificates (ISO 10204 3.1)
- Technical data sheets
- O&M manuals
- List of spare parts
- Shop test reports per ISO 9906

1.8 Pump Construction

- **Pump Casing:** Cast iron EN-GJL-250 or better, with corrosion-resistant coating
- **Impeller:** Vortex, semi-open or channel impeller, made of stainless steel AISI 304 / Duplex SS
- **Shaft:** Stainless steel AISI 431 or better
- **Seal:** Dual mechanical seal (silicon carbide vs. silicon carbide); oil chamber between seals
- **Bearings:** Sealed-for-life deep groove ball bearings, rated L10 life > 50,000 hours
- **Motor:** IP 68, Class F, designed for continuous submerged operation
- **Cooling:** Motor must have adequate cooling via pumped liquid or internal closed-loop system
- **Thermal Protection:** Built-in motor thermal protection with temperature sensors
- **Vibration Monitoring:** Mounting provisions for vibration sensor

1.9 Installation & Accessories

- **Guide Rail System:** Stainless steel or hot dip galvanized guide rails and lifting chain
- **Base Stand:** Cast iron/steel discharge bend with automatic coupling
- **Discharge Piping:** HDPE or Ductile Iron with valves, bends, flanges, supports
- **Non-Return Valve & Isolation Valve:** Provided on each pump discharge
- **Level Control:** Float switches or ultrasonic level transmitter
- **Control Panel:** MCC panel with DOL/Star-Delta/Soft Starter as applicable, including:
    - Motor protection relays
    - Ammeter, Voltmeter
    - Run/Stop pushbuttons
    - Indicator lights
    - Phase failure/reverse protection
    - PLC & telemetry provision (if required)

1.10 Testing

Shop Tests:

- Hydrostatic pressure test (1.5 × design pressure)
- Performance test as per ISO 9906 at minimum 5 points
- Vibration and noise testing per HI/ISO standards

Field Tests:

- Insulation resistance test of motor
- Pump performance at actual site conditions
- Vibration levels at base and motor
- Discharge rate, head, power draw verification
- Two-hour full load operation test

1.11 Operation and Maintenance Manuals

Manuals must include:

- General description of pump system
- Step-by-step start-up and shut-down procedures
- Trouble-shooting guide
- Preventive maintenance schedule
- List of spare parts with part numbers and materials
- Electrical diagrams and control logic
- As-installed layout and color-coded piping drawings

1.12 Warranty

- Minimum one (1) year warranty from date of commissioning.
- Warranty shall cover defects in materials, workmanship, and performance.
- Any defective components shall be replaced at no cost to the Employer.

1.13 Quality Assurance

- Factory certified to ISO 9001
- Material traceability with test certificates
- Shop and field inspection records submitted to the Engineer

1.14 Handling, Delivery, and Storage

- All equipment shall be delivered in factory-packed condition
- Components shall be protected from moisture, physical damage, and sunlight
- Lifting points must be clearly indicated and lifting devices provided

- Temporary covers must be installed on suction/discharge nozzles during transport

1.15 Foundations and Installation

- Concrete sump foundations shall be designed to avoid vibration amplification
- Pumps must be installed per manufacturer's instructions with proper alignment
- Provide adequate clearances for removal of pumps and access for maintenance
- Use thrust blocks or pipe supports as needed to relieve loads on pump

1.16 Tools and Spare Parts

- Supply special tools for pump/motor disassembly
- Minimum recommended spare parts:
    - 2 sets mechanical seals
    - 2 sets of bearings
    - 2 impellers
    - 1 shaft
    - 1 set of O-rings and gaskets

2 TECHNICAL SPECIFICATIONS OF HORIZONTAL NON-CLOGGING SEWAGE PUMP

2.1 Scope

This section specifies the requirements for design, manufacture, factory testing, supply, delivery, installation, testing, commissioning, and warranty of horizontal non-clogging sewage pumps. The scope includes pumps, motors, discharge piping, non-return and isolation valves, base frame, coupling guards, level sensors, control panels, and all associated accessories necessary for a complete and operational pumping system.

2.2 General Requirements

• Type: Horizontal, non-clogging sewage pump with transmission system suitable for raw sewage and wastewater containing solids.
• Duty: Continuous duty operation in sewage pumping stations.
• Motor: TEFC (Totally Enclosed Fan Cooled) squirrel cage induction motor, insulation class F, IP 55, 400 V, 50 Hz, 3 phase, suitable for dry installation and protection against dust and water jets.
• Capacity & Head Requirements:

Capacity (m^3/hr)	Head (m)
10	8

• Pumps shall be capable of handling spherical solids of a minimum 60-100 mm diameter.
• The drive system shall be designed to transmit torque from the motor to the pump with flexible coupling arrangement allowing axial and radial misalignment.

2.3 Applicable Standards

• ISO 9906 – Hydraulic performance testing of centrifugal pumps
• IEC 60034 – Rotating electrical machines
• ISO 5199 – Technical specifications for centrifugal pumps
• HI 9.6.4 – Rotodynamic pumps: vibration measurement and allowable values
• NEMA MG-1 – Motors and generators
• DIN EN 12050 – Wastewater lifting plants
• ASTM A240 – Stainless steel plate, sheet, and strip for pressure vessels
• AWS D1.1 – Structural Welding Code – Steel
• ISO 1940 – Balance quality of rotors

2.4 Design Criteria

• Pumps shall have a non-clog impeller, vortex or semi-open type.
• Coupling with universal joints to accommodate misalignment and reduce vibration.
• Pump and motor shall be provided by a single manufacturer to ensure compatibility.

• Continuous duty operation without overheating.
• Operation near Best Efficiency Point (BEP) is mandatory.
• Minimum pump efficiency: 65% at rated duty point.

2.5 Manufacturer's Qualifications

• Minimum 10 years experience in manufacturing sewage pumps.
• ISO 9001 certified manufacturing facility.
• Proven track record in municipal and industrial sewage applications.

2.6 Submittals

• General arrangement drawings showing pump, motor, base frame, and coupling details.
• Pump and motor performance curves.
• Material certificates as per ISO 10204 3.1.
• Technical data sheets.
• Operation & Maintenance manuals.
• Spare parts list.
• Shop test reports per ISO 9906.

2.7 Pump Construction

• Pump Casing: Cast iron EN-GJL-250 or higher with corrosion-resistant coating.
• Impeller: Non-clog vortex or semi-open type, stainless steel AISI 304 / Duplex SS.
• Shaft: Stainless steel AISI 431 or better.
• Seal: Dual mechanical seals (silicon carbide vs. silicon carbide) with oil chamber.
• Bearings: Heavy-duty, sealed-for-life deep groove ball bearings, L10 life > 50,000 hours.
• Motor: TEFC, IP 55, Class F insulation, suitable for continuous dry operation and protection against dust and water jets.
• Cooling: Motor fan cooled externally; pump bearings lubricated and sealed for life.
• Coupling: with universal joints, protective guards as per safety standards.
• Vibration Monitoring: Provision for vibration sensor mounting on pump and motor

2.8 Installation & Accessories

• Base Frame: Heavy-duty fabricated steel frame with anti-vibration pads.
• Discharge Piping: Ductile iron or HDPE piping with valves, bends, flanges, and supports.
• Non-Return Valve & Isolation Valve on discharge line.
• Level Control: Float switches or ultrasonic level transmitter for pump start/stop.
• Control Panel: MCC with DOL/Star-Delta/Soft Starter options, including:
o Motor protection relays
o Ammeter, Voltmeter
o Run/Stop pushbuttons
o Indicator lights
o Phase failure and reverse phase protection
o PLC and telemetry provisions if required.

2.9 Testing

Shop Tests:

• Hydrostatic pressure test at 1.5 × design pressure.
• Performance test per ISO 9906 at minimum five points.
• Vibration and noise test as per HI/ISO standards.

Field Tests:

• Insulation resistance test of motor.
• Pump performance verification at site conditions.
• Vibration level measurement at base and motor.
• Discharge rate, head, and power consumption verification.
• Two-hour continuous full-load operation test.

2.10 Operation and Maintenance Manuals

Must Include:

• Detailed description of pump system and arrangement.
• Stepwise startup and shutdown procedures.
• Troubleshooting guide.
• Preventive maintenance schedule.
• Spare parts list with part numbers and materials.
• Electrical diagrams and control logic.
• As-installed layout and piping drawings with color coding.

2.11 Warranty

• Minimum one (1) year warranty from commissioning date.
• Warranty covers material defects, workmanship, and performance.
• Defective components to be replaced free of cost.

2.12 Quality Assurance

• ISO 9001 certified manufacturing.
• Material traceability and test certificates provided.
• Shop and field inspection reports submitted.

2.13 Handling, Delivery, and Storage

• Equipment delivered in factory-packed condition.
• Protection from moisture, damage, and sunlight during transit.
• Clearly marked lifting points and lifting devices provided.
• Temporary covers on suction and discharge nozzles during transport.

2.14 Foundations and Installation

• Concrete foundation designed to minimize vibration amplification.
• Installation per manufacturer's guidelines with proper alignment.
• Adequate clearances for maintenance and removal.
• Thrust blocks or pipe supports to relieve pipe loads on the pump.

2.15 Tools and Spare Parts

• Special tools supplied for pump,motor maintenance.
• Recommended spare parts:
o 2 sets of mechanical seals
o 2 sets of bearings
o 2 impellers
o 1 shaft

o 1 set O-rings and gaskets

3 LINEAR DIAPHRAGM TYPE AIR BLOWER – TECHNICAL SPECIFICATION REPORT

3.1 Scope

This section outlines the requirements for the design, supply, testing, delivery, installation, commissioning, and one-year warranty of base-mounted, oil-free linear diaphragm-type air blowers. The scope includes air delivery systems used for aeration, pressure supply, or low-pressure air distribution, suitable for continuous duty applications. Equipment shall be sourced from internationally reputed manufacturers and fully comply with the performance and environmental criteria specified herein.

3.2 General Description

The air blower shall be a compact, oil-free, base-mounted linear diaphragm type unit suitable for continuous operation. The unit must be air-cooled, with low vibration, low noise, and energy-efficient performance characteristics. Blower operation must be stable under varying loads and ambient conditions.

Key Parameters:

Parameter	**Specification**
Flow Rate	150 L/min (5.3 CFM)
Operating Pressure	0.15 – 0.25 bar (2.2 – 3.6 psi)
Power Consumption	130 – 150 W
Voltage	220V, 50 Hz (or 110V, 60 Hz options)
Noise Level	< 45 dB(A) at 1 meter
Duty Cycle	Continuous (24/7)
Motor Type	Linear Diaphragm (oil-free)
Cooling Method	Air-cooled
Ingress Protection	IPX4 or higher (splashproof)
Service Life	~20,000 hours (diaphragm ~10,000 h)
Mounting	Base-mounted with anti-vibration feet

3.3 Applicable Standards

The equipment shall comply with the following international standards where applicable:

- **ISO 1217** – Displacement compressors — Acceptance tests
- **ISO 2151** – Acoustics — Noise test code for compressors and vacuum pumps
- **IEC 60034** – Rotating electrical machines
- **ISO 13849** – Safety of machinery — Control system reliability
- **CE/UL Certification** – For electrical safety compliance
- **IPX4/5/6** – Ingress protection levels as per IEC 60529
- **RoHS/REACH** – Environmental compliance (where applicable)

3.4 Design Criteria

- The blower shall operate at a flow of 150 L/min under pressure range 0.15 to 0.25 bar.
- The blower shall be capable of 24/7 continuous duty operation with minimal maintenance.
- Sound level shall not exceed 45 dB(A) at a distance of 1 meter.
- The blower shall not transmit excessive vibration to its base or surrounding structure.
- Power supply options must include both 220V/50Hz and 110V/60Hz variants.

3.5 Materials and Construction

Blower Housing:

- Material: Corrosion-resistant aluminium alloy or impact-resistant ABS/polycarbonate.
- Finish: Powder-coated or anodized for weather resistance.

Diaphragm:

- Material: Synthetic rubber (e.g., EPDM or similar), resistant to fatigue and oxidation.
- Expected diaphragm service life: Minimum 10,000 hours of operation.

Motor:

- Type: Linear diaphragm type, oil-free
- Class: Class B or higher insulation
- Protection: IPX4 minimum
- Cooling: Natural air convection

Mounting Base:

- Anti-vibration rubber feet
- Shock-isolated base to minimize structure-borne noise

3.6 Installation Requirements

- Install the blower on a flat surface using anti-vibration mounts.
- Ensure the area has sufficient ventilation for air cooling.
- Provide a weather-proof or splash-proof cover if installed outdoors.
- Air piping should be designed to minimize backpressure and accommodate flexible couplings.

3.7 Manufacturer Qualifications

Proposed manufacturers shall have a minimum of 10 years of experience in the production of linear diaphragm air blowers and must comply with CE, ISO 9001, or equivalent international quality standards.

3.8 Testing and Quality Assurance

Factory Tests

- Performance test at rated pressure and flow.
- Vibration and sound level test.
- Insulation and dielectric test per IEC 60034.
- Pressure leak test (housing and diaphragm).

On-site Tests

- Verification of flow and pressure.
- Measurement of operating sound and temperature.
- Visual inspection of mounting, cabling, and housing integrity.

3.9 Operation & Maintenance

O&M Manual shall include:

- Installation instructions
- Electrical wiring diagrams
- Operating procedures
- Maintenance schedule
- Troubleshooting guide
- Spare parts list for 5 years of operation

Maintenance Overview:

- Diaphragm replacement every ~10,000 hours.
- Air filter cleaning/replacement every 1,000 hours.
- Inspection of internal valves annually.

3.10 Warranty and Service

- Minimum one (1) year warranty against manufacturing defects.
- Availability of spare parts for 5 years.
- Service manuals and user training if required.

3.11 Safety and Environmental Considerations

- Equipment shall comply with OSHA/ISO noise and electrical safety standards.
- Blowers must be RoHS/REACH compliant.
- The blower must be safe for use in residential or sensitive environments (e.g., schools, hospitals, labs).

4 TECHNICAL DETAILS OF FINE BUBBLE DISC-TYPE AIR DIFFUSER

4.1 Scope

This section specifies the design, manufacturing, testing, supply, installation, commissioning, and performance requirements of fine bubble disc-type air diffusers used for aeration in wastewater and water treatment systems. The diffusers shall be designed to produce nano to ultra-fine bubbles and achieve high oxygen transfer efficiency under low-pressure operation. Diffusers shall be suitable for continuous or intermittent aeration and compatible with standard aeration grid systems. All accessories including piping connectors, support accessories, and installation hardware shall be included in the Bill of Quantities (BOQ).

4.2 Applicable Standards

The design, materials, and testing shall conform to the latest edition of the following standards or equivalent:

- **ISO 9001:** Quality Management Systems
- **ISO 14001:** Environmental Management Systems
- **ASTM D638:** Tensile Properties of Plastics
- **ASTM D543:** Chemical Resistance of Plastics
- **ISO 12239:** Fine Bubble Diffusers – Measurement of Oxygen Transfer in Clean Water
- **DIN EN 12255-15:** Wastewater Treatment Plants – Aeration

4.3 General Description

The air diffusers shall be of disc type with the following characteristics:

Parameter	Specification
Disc Diameter	9 inches (≈ 230 mm)
Material	Ceramic (porous) or EPDM membrane
Bubble Size	Nano to ultra-fine bubbles, approx. 1–2 mm diameter
Operating Air Pressure	0.1 to 0.3 bar (1.5 to 4.5 psi)
Air Flow Rate per Diffuser	2 to 5 m^3/hr
Oxygen Transfer Efficiency (OTE)	Typically, 15–25% in clean water
Maximum Operating Temperature	Up to 60 °C
Connection Type	0.75" to 1.5" threaded or flanged inlet (customizable)
Diffuser Lifespan	1.5–3 years (ceramic), 3–5 years (EPDM)
Weight	Approx. 0.3 – 0.5 kg

Diffusers shall be corrosion-resistant, suitable for submersion in aggressive wastewater environments, and resistant to biological fouling and chemical cleaning.

4.4 Design Criteria

- Diffusers shall ensure uniform air distribution over the membrane surface.
- Diffuser design shall ensure minimal backpressure and high energy efficiency.
- Materials used must be non-toxic, UV-resistant, and compatible with wastewater treatment conditions.
- The diffuser system must be modular and easy to install/remove for maintenance.

4.5 Manufacturer's Qualifications

The manufacturer must:

- Have at least 5 years of experience in aeration system manufacturing.
- Be ISO 9001:2008 or higher certified.
- Provide references for at least three projects using similar diffuser systems.

4.6 Submittals

The Contractor shall submit the following for Engineer's approval:

- Manufacturer’s catalogue and data sheet.
- Material test certificates as per ASTM/ISO.
- Oxygen transfer performance curves.
- Drawing of diffuser assembly with connection details.
- Recommended cleaning and maintenance procedures.
- Lifetime projection based on air quality and operating pressure.

4.7 Inspection and Testing

- Visual inspection for material integrity and defects.
- Factory testing of sample diffusers for:
    - Bubble size verification
    - Air flow capacity
    - Pressure drop
- On-site functional testing under operating conditions.

4.8 Installation and Handling

- All installation shall be per manufacturer’s instructions.
- Diffusers shall be installed using stainless steel or plastic mounting systems.
- Avoid direct contact of diffusers with floor/sediment.
- Handle with care to avoid membrane or ceramic damage.

4.9 Operation & Maintenance Manual

To be submitted by the supplier, including:

- Assembly and installation guide
- Recommended flow rates and pressure range
- Cleaning frequency and approved methods

- Troubleshooting chart
- Spare parts list and ordering information

4.10 Guarantee and Warranty

All supplied diffusers shall be warranted for defects in materials and workmanship for a minimum of **1 year** from the date of commissioning. Performance guarantee (OTE, pressure loss) shall be valid as per specified parameters under clean water test conditions.

4.11 Quality Assurance

- Manufacturer's QA/QC system must be ISO certified.
- Each batch of diffusers shall be traceable to production batch and testing.
- A certificate of compliance to design specifications and standards shall be provided.

5 MINIMUM TECHNICAL SPECIFICATIONS SOLAR PV SYSTEM

The following are the specifications of the equipment being parts of the Solar PV System that shall be installed at the premises.

5.1 Solar PV Modules:

Manufacturer and Material Requirements:

Solar PV modules shall be of Tier-I manufacturer as per latest Bloomberg New Energy Finance (BNEF) list (for Q3 or Q4 of the year 2024). The PV technology shall be half-cut mono-PERC to maximize the yield against the available area and minimize the losses against partial shading. Each module shall have IP 65 rated Junction Boxes which shall be dust and vermin proof having copper bus bar terminals, EPDM rubber gasket, reverse blocking Diodes and IEC 62790 compliant.

5.1.1 Performance and Rating Requirements:

The power rating for each PV module shall be more than 580Wp under STC conditions with positive power tolerance only. Each PV module must have efficiency greater than 22%. The proposed PV module must exhibit efficiency of more than 96% of the STC efficiency at 200W/m^2 (i.e. low lighting conditions). The module Temperature Coefficient at Pmax shall be - 0.37% / ^{0}C or lesser.

5.1.2 Certification Requirements:

The PV Module must be Type Tested based on IEC standard 61215 (Terrestrial PV Modules- Design qualification and type approval) and IEC 61730 (Photovoltaic module safetyqualification) based insulation of Safety Class II. Modules must be free of Potential Induced Degradation (PID) and Light Induced Degradation (LID). The module shall be S.R.O 604 compliant issued by Government of Pakistan. The Flash Test report, module Test report as per IEC standards 61215 and 61730 along with pre-shipment inspection certificate shall be providedat the time of delivery of modules at site.

5.1.3 Warranty and Replacement:

Each module shall have minimum 15 years material and workmanship warranty and 30 years performance warranty. The Power output of each PV module shall be greater than 85% after 25 Years. Warranty shall be insured by third party.

5.1.4 Product Identification:

Each PV module shall have a unique barcode identification tag issued by the manufacturer. The same shall be confirmed from the manufacturer prior to verification of equipment delivery at site by the third party.

5.2 Inverters:

Performance and Rating Requirements:

The inverter shall be three phase hybrids with IP65 protection having CEC efficiency of not less than 94 % and output frequency of 50Hz. The cumulative capacity of inverter shall be

according to the total solar PV capacity to be installed and inverter's minimum input voltageshall be as per array specific design. Under all scenarios, the DC to AC ratio of the inverter shallnot be more than 1.1.

The inverters shall have multiple MPPT inputs for 3-phase inverters and compatibility with Battery type and Voltage. The Total Harmonic Distortion shall be less than 3%. The ambient operating temperature range of Inverter shall be between -25^{o}C to 60^{o}C. Three phase inverters must have Diesel Generator Synchronization module for seamless integration with Generators.

5.2.1 Protection and Safety Requirements:

The inverter shall have AC over current protection, residual current monitoring, DC reverse polarity protection, DC insulation resistance detection, PV array string fault monitoring, anti-islanding protection and Type-2 or better DC and AC SPDs. The inverter must have anti PID module to limit the harmful effects of Potential Induced Degradation of PV Modules. Inverter shall have a built-in data logger; communication interface protections and remote monitoring capability. It shall be compliant with UL 1741, IEC 62109-1/2 for safety design.

5.2.2 Warranty Requirements:

The inverters shall have minimum 10 years of replacement warranty.

5.3 Battery:

The battery should be lithium-ion type with a protection class of IP20 or higher, making it suitable for indoor installations. Battery should operate with a voltage compliant with hybrid inverters and battery storage systems, offering a charge/discharge rate of up to 0.5C, with a depth of discharge (DoD) of 90% or higher, the battery should provide a high usable energy capacity, rated for 4,000 cycles at 90% DoD. It functions within a humidity range of 5% to 95% (without condensation) and can operate in temperatures ranging from -5°C to +45°C. The battery should comply with UL 1642 and other international standards, ensuring safety and reliability. Its integrated battery management system (BMS) controls temperature and discharge processes, enhancing safety and longevity. Designed for a service life of more than 7 years.

5.4 PV Balance of system:

5.4.1 Mounting Structure:

The mounting structure shall be UV resistant and shall have hot dip galvanized steel frame with 100 microns or thicker zinc coating and 100 microns for base plate. Spacing from Parapet wall must be 3 ft. The tilt angle for PTA Quetta (30 KW) Solarization is specified to be 10 Degrees and azimuth angle of the structure shall be 16 Degrees from true South. The structure shall have galvanic isolation and shall withstand wind speed of 150 km/h. Complete civil work for mounting structure installation shall be performed using 3,000 psi concrete.

5.4.2 Design requirements for Mounting Structure:

Any existing roof water drainage must not be disturbed (for example by mounting rails locatedon top of the roof layer).

The existing roof waterproofing shall be protected against damage and horizontal shear forces by a suitable protection mat between the waterproofing system/roof layer and the roof mounting
system. The protection mat shall be made of recycled polyester and polypropylene fibers or recycled shredded rubber, shall have an adequate thickness, size as well as weight and shall becompatible with the materials of the roof layer and the roof mounting system.

Drilling and cutting work of metal parts must not be performed on the roofs during the construction works.

The supporting structure including PV modules shall be capable of handling the maximum 3 sec-gust wind speed of up to 150 km/h. The EPC contractor shall provide a system design that meetsthis requirement as well as any additional requirement related to the site-specific snow load (if applicable). Ballasting/concrete block sizing calculations are typically made by the use of professional design software and shall be made available for the installation and plant documentation.

All components of the roof mounting system and all connecting materials shall be made of corrosion-proof material. All fastening structures shall be verified for durability and resistance to environmental degradation for 25 years, the lifetime requirement of the complete structure. The structural elements shall consist of anodized aluminum, galvanized steel as per ASTM A123/A 123M, or materials with equivalent if not better properties. The applicable building code /construction codes shall be used as well.

The mounting structures shall be earthed for maximum short-circuit current and lightning protection. A racking design that removes the need of PV module to PV module grounding by using the common rail / PV module clips for the grounding is recommended

5.4.3 DC Cables, AC Cables, Earthing wires, Conduits, Connectors, Cable Trays etc.

Copper cables with purity of 99.9% or more with XLPO insulation and rated for 1500 V shall be used. Cables shall be low smoke Halogen free along with compliance with BS 6004, BS 7644 and UL 4703 standards. Minimum size for DC cables shall be 4 mm^2 or as per size of PV Module Output cable (whichever is higher or given in BOQ). Under all conditions, for DC cables, voltage drop shall be less than 1.0% at STC and for AC cables voltage drop shall be less than 1.5% at STC. 6 mm^2 earth wires for equipotential bonding shall be used. Separate DC and AC earthing each with 3 ohm or lesser resistance shall be achieved using the earthing arrangement.

Perforated cable trays of 16 gauge or thicker and UPVC/corrugated PVC pipes shall be installedwith seamless terminations. The cable tray shall not be physically accessible for routine works. Flexible pipes, glands, conduits, cables ducts shall be installed as per site design & requirements. Conduits shall have 30% or higher spare capacity. Labeling of all cables shall be performed in compliance with IEC Standard 62491.

5.4.4 Breakers, Surge Arrester, LV Panel etc.

Circuit breaker, Protection devices and Non-Isolated Lightning Arrestors shall be installed as persite design requirements. MCB/MCCB Circuit breaker for each string shall be rated for morethan 1.5 times the STC current rating of the string. Under all circumstances, circuit breaker ratingmust be less than the fuse rating of PV Module.

In case of installation of LV panel, the panel shall be IP54 rated of galvanized material with

at least 16 gauge. The panel shall have protection scheme compliant with IEC Standard 62548, input and output circuit breakers as per IEC Standards, bus bar current bearing capacity as per requirement, and isolators for bus bars and AC grounding bus bar. The panel shall have digital Ammeter and Voltmeter, RYB indicator with breather vents on both sides of cabinets with RAL Color: 6021. Further details provided under the Employer's design shall be followed as well.

5.4.5 Monitoring and Control System:

Online and real time monitoring shall be provided with following parameters;

1. Energy generation (kWh)
2. Power production (kW)
3. String-level monitoring of voltage and current
4. Monitoring data for at least 3 years

5.4.6 Net Metering Application and Installation of Bidirectional Meter

The EPC Contractor shall comply with all prevailing regulations set forth by NEPRA for net metering purposes including load flow studies on requisite software. Preparation of application for net metering along with requisite clarifications shall be arranged by the EPC contractor in the Project timelines

6 TECHNICAL SPECIFICATIONS FOR ONLINE MONITORING PARAMETERS

Technical specifications for the various monitoring sensors are discussed here under.

6.1 Controller SC1000:

Operating Temperature Range	-20 to 55 °C (-4 to 131 °F),0 to 95% relative humidity, non-condensing
Power Requirements (Voltage)	100 - 240 V AC, 24 V DC
Display	¼ inch Touch screen, high resistance 320 x 240 pixels
Display Viewing Area	11.4 x 8.6 cm (4.5 x 3.4 in)
Alarm	Low alarm point, low alarm point deadband, high alarm point, high alarm point deadband, off delay, and on delay
Relays	Up to four SPDT, user-configurable contacts rated 100 to 230 VAC, 5 Amp resistive maximum per probe module. Additional relays are available with additional probe modules.
Inputs	Up to 12 analogue 0-20 mA.
Output	Up to 12 analogue 0/4-20 mA
Analog Output Functional Mode	PID, off delay, on delay
Communication	Modbus® Profibus® Ethernet service port, RJ45, 10 MB/s
Mounting Configurations	Surface, panel, and pipe (horizontal and vertical) with optional sun shield
Material Enclosures	ABS (display module) and metal (probe module) corrosion resistant finish
Certifications	**North American Certifications:** TUVus to UL 61010A-1 and CSA C22.2 No. 1010.1FCC ID QIPMC56 /IC ID 267W-MC56 **European Certifications:** CE per 73/23/EEC and 89/336/EECTUV-GS to EN 61010-1 EN 61326 Amd's 1 & 2
The Connectivity Options You Need	The Controller is Smart Monitoring enabled and provides local communication to SCADA or a PLC. From analog and advanced digital protocols to Wi-Fi, cellular or LAN, the SC4500 gives you the flexibility to adapt in a rapidly changing world.

6.2 pH DPD1P1:

Compliance	**For non-hazardous and non-maritime applications only**
Operating Temperature Range	-5 - 70 °C (23 - 158 °F) pHD
Range	-2.0 to 14.0 pH
Sensitivity	± 0.01 pH ± 0.5 mV
Pressure Range	Digital: 6.9 bar at 70 ºC (100 psi at 158 ºF)
Temperature Sensor	NTC 300 Ω thermistor for automatic temperature compensation and analyzer temperature readout
Transmission Distance	100 m (328 ft.), maximum
Temperature Accuracy	± 0.5 °C (± 0.9 °F)
Sensor Cable	4 conductor cable with one shield and polyurethane jacket; rated to 105 °C (221 ºF); 10 m (33 ft.) standard length

6.3 Conductivity (non-contacting sensor)

Range	200 - 2,000,000 micro-Siemens/cm
Operating Temperature Range	-10 - 200 °C (14 - 392 °F);
Temperature Sensor	PT1000 RTD

Sensor Cable	Polypropylene and PVDF Sensors PEEK and PFA Sensors
Wetted Materials	Polypropylene, PVDF, PEEK or PFA
Pressure/Temperature Limits	6.9 bar at 100 °C (100 psi at 212 °F)
Principal of Operation	Inductive conductivity sensors induce a low current in a closed loop of solution, then measure the magnitude of this current to determine the solution's conductivity. The conductivity analyzer drives Toroid A, inducing an alternating current in the solution. This current signal flows in a closed loop through the sensor bore and surrounding solution. Toroid B senses the magnitude of the induced current which is proportional to the conductance of the solution. The analyzer processes this signal and displays the corresponding reading

6.4 Solitax/Turbidity

Range	TSS content: 0.001 mg/L - 50 g/L Turbidity: 0.001 - 4000 NTU
Units	Turbidity: User selectable - NTU, FNU, or TE/F Suspended Solids: User selectable - g/L, mg/L, ppm, or % solids
Accuracy	Turbidity up to 1000 NTU: without calibration < 5% of the measured value ±0.01 NTU with calibration < 1% of the measured value ±0.01 NTU
Repeatability	TSS content: < 3 % Turbidity: < 1 %
Response Time T90	1 - 300 s adjustable
Calibration Method	Turbidity: Formazin or STABLCAL Standard (at 800 NTU). Suspended Solids: Sample specific, based on gravimetric TSS analysis with a correction factor procedure
Certifications	CE, MCERTS
Operating Temperature Range	0 - 40 °C
Pressure Range	Stainless steel immersion sensor: <6 bar or <60 m PVC: <1 bar or <10 m
Material	Optics carrier and sleeve: stainless steel 1.4571 or black PVC Wiper arm: stainless steel 1.4581 Wiper blade: silicone (standard) Wiper shaft: stainless steel 1.4571 Threaded cable fitting: stainless steel 1.4305 or white PVC
Cable Length	10 m (optional extension cables available)
Extended pH Sensor Life	Replaceable salt bridge holds higher volumes of buffer which extends pH sensor life and protects the junction reference electrode.
Patented Technology	Electrode Technique for pH measurement in 1970. The pHD sensor series (U.S. Patent Number 6395158B1, dated May 28, 2002) takes this field-proven technology to a new level.
Versatile Mounting Styles	Sensors are available in four mounting styles - convertible, insertion, immersion, and sanitary
Greater accuracy, less maintenance	Hach Solitax sc sensors provide accurate, colour-independent measurement of turbidity and suspended solids in drinking water, wastewater and industrial process applications. A self-cleaning device prevents biological growth and interference of gas bubbles. This system's reliable performance and full data communication capability help improve process control and reduce treatment costs associated with polymer use, digester volume, and sludge handling.
Excellent correlation to laboratory analysis	Solitax sc sensors show an exceptional correlation to laboratory analysis. On-line measurement not only saves time on manual analysis, but also provides critical real-time measurements that can be used to operate the plant more efficiently.

6.5 Dissolved Oxygen

Accuracy	± 0.2 ppm Above 5 ppm, Temperature: ± 0.2 °C, ± 0.1 ppm Below 5 ppm
Cable length	10 m
Communication	Modbus via SC controller
Hazardous location ratings	ETL listed (cETLus marked) to Canadian and US General Safety and Hazardous (Class I, Div. 2) Locations
Housing material	Stainless Steel
Immersion depth	15 m, 1050 kPa, maximum
Interferences	No Interferences from the following: H2S, pH, K+, Na+, Mg2+, Ca2+, NH4+, Al3+, Pb2+, Cd2+, Zn2+, Cr (total), Fe2+, Fe3+, Mn2+, Cu2+, Ni2+, Co2+, CN-, NO3-, SO42-, S2-, PO43-, Cl-, anion active surfactants, crude oils, Cl2 < 4 ppm
Length	254 mm
Measuring range	0.01 - 20.00 mg/L
Operating temperature range	0 - 50 °C
pH range	0 - 12 pH
Pressure range	Max. 3.5 bar
Protection class	IP68
Repeatability	±0.1 mg/L (ppm)
Sensor cable	10 m terminated with quick-disconnect plug
Temperature sensor	PT100 integrated, external sensor
Transmission distance	100 m maximum when used with an extension cable
Warranty	36 months
Wetted materials	Probe body: CPVC, Polyurethane, FKM/FPM, Noryl, 316 Stainless Steel 1.4404 (AISI 316L) Sensor cap: Acrylic

7 TECHNICAL SPECIFICATIONS FOR ELECTRICAL COMPONENTS

Technical Specifications for Electrical Components are Attached as **Annexure-I.**

A. Technical Specification LED

The equipment shall be a 55-inch LED display featuring an ultra-high-definition 8K resolution (7680 × 4320 pixels), delivering exceptional image clarity and vibrant color reproduction. The display must be designed for continuous 24/7 operation, ensuring durability and reliability in demanding environments such as control rooms and conference setups. It shall incorporate advanced display technologies for wide viewing angles, high contrast ratio, and minimal image retention. The unit must include necessary wall-mount accessories, compliant with VESA standards, allowing secure and efficient installation on flat surfaces. Additional features should include multiple input ports (e.g., HDMI 2.1, DisplayPort, USB), integrated speakers or audio-out capability, energy-efficient performance, and remote-control functionality for ease of use and configuration. The display must conform to international quality and safety standards, ensuring long-term performance under continuous use conditions.

ANNEX-I
ELECTRICAL SPECIFICATIONS

SECTION - 1

GENERAL SPECIFICATIONS FOR ELECTRICAL SYSTEMS

1.0 SCOPE OF WORK

The scope of this contract covers all operation and activities required for proper and complete construction of electrification works.

The works related to the Electrical systems that are included in the scope of this Contract are shown on the Tender Drawings, stated in the Bill of Quantities and explained in these Specifications. All the equipment & allied accessories and their installation shall also comply with General Specifications described here-under, with other relevant provisions of Tender Document and WAPDA/other utilities' latest Specifications/Standards.

The scope shall include the continuing of the contractor to remain responsible for removal of defects detected in the works and for achieving satisfactory operation/functioning/service of the works during defect liability period.

The contract shall include furnishing of all construction equipment, tools, labour, supervisory staff, plants, transport, power, testing apparatus/arrangements and all construction materials as shall be required for satisfactory completion of works strictly in accordance with the Technical Specifications and Bill of Quantities forming part of these Tender Documents and as per levels and dimensions as shown on the drawings supplied with these tender documents and in drawings which may be supplied by the Employer from time to time under approved variation orders.

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these Documents but which is necessary for proper operation of the works/ system included in the scope of this Contract. The Contractor shall solely be responsible for ensuring proper functional requirements of various equipments. He shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and/or approved by the Engineer to achieve proper co-ordination with various other equipment's offered in the bid and also with those installed by others.

2.0 RULES & REGULATIONS

The entire Electrical & Communication systems installation/work shall be carried out by licensed Contractor, authorized to undertake such work under the provisions of the Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified upto date by the Government of Pakistan.

All works shall be carried out in accordance with the latest edition of the Regulations of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers-London, 16th edition, NEC 1999, the Contract

Documents, the Electricity Rules 1937 and bye-laws that are in force from time to time.

Any discrepancy between these specifications and the standards/ regulations shall be brought to the notice of Engineer for his instructions and decision of the Engineer shall be final and conclusive.

The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations, and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the utility company WAPDA shall be complied with.

3.0 AMBIENT CONDITIONS

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material/equipment.

Minimum indoor ambient temperature:	Zero Degree Celsius
Maximum indoor ambient temperature:	+ 35 Degree Celsius
Minimum outdoor ambient temperature:	Zero Degree Celsius
Maximum outdoor ambient temperature:	+ 45 Degree Celsius
Maximum Relative Humidity:	70 Percent
Minimum Relative Humidity:	40 Percent

The atmospheric conditions are tropical and arid.

4.0 MARKINGS

The Contractor shall provide "Danger Boards" and "Shock Charts", wherever required, to comply with the requirements of local Electricity Rules and according to normal practice.

5.0 SYSTEM DATA

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate satisfactorily with the following minimum requirements with the specified tolerance without any derating

a.	Voltage rating of equipments	MV15000V Three phase ± 10%
b.	Voltage rating of equipments LT & DG Sets	500V Three phase ± 10% 250V Single phase ± 10%

c.	DC voltages	24V DC ± 10% 12V DC Others
d.	Frequency	50 HZ ± 2 HZ

6.0 STANDARDS

The latest standards and codes of reputable organizations shall be applicable for the material and equipment specified herein and for installation work. Such organizations shall be British Standard Institution (BSS), International Electro technical Commission (IEC), IEEE and NEC. In case the Specifications laid down herein differ from those given in the standards, then the better specifications shall govern. Wherever applicable, the equipment shall also conform to the requirements of Pakistan Standards Institute (PSI) and Pakistan Telecom Authority (PTA).

7.0 MATERIALS & WORKMANSHIP

All materials, equipment, accessories, fixtures and fittings, under the scope of this Contract, shall be brand new and in accordance with the Tender Specifications and the specifications of the British Standards Institute and Pakistan Standards Institute. Samples and detailed manufacturers shop drawings (including dimensional plans, elevation, sections, line and wiring diagrams, foundation details, component characteristics and data etc.), shall be approved by the Engineer before purchase or fabrication. The Engineer shall witness routine tests at the manufacturer's work sites and a test certificate shall be provided to him. Three copies of the test certificates at the manufacturer's works shall be supplied. All workmanship shall be first class and undertaken by workman skilled in the particular type of craft.

8.0 DEVIATIONS

The entire design of the Electrical systems of the project has been carried out to fulfill the Users requirements. The design is based on International standards/norms and practices. Special considerations have been made for ease in operation and maintenance of electrical systems of the project. Deviation may be allowed for the works covered under present scope of work, with the approval of Engineer/Client

9.0 EQUIPMENT AND MATERIALS

The equipment/materials of the Electrical systems of the tender have been designed using the latest editions of International Standards/Codes such as BS, ICE, NFPA, CP as mentioned in article 6.0 above. In these Specifications certain types/makes of equipments/ materials have been specified for the purpose of general reference and guidance of the Bidder. However, names of

certain manufacturers/suppliers of electrical equipments/materials have been recommended for this project.

The names and addresses of these recommended manufacturers/suppliers are given in Annexure "A" of the tender documents. The Contractor is bound to supply and install the required equipments/ materials only from the recommended manufacturers/ suppliers.

In case, if at a later stage in project, the contractor wishes to substitute the specified equipment or materials, he shall furnish complete details of equipment/substitute to materials.

The equipment/substitute equipments/materials will only be considered by the Engineer if he is satisfied that the equipment/substitute material have technically equivalent/better specifications. In case if the Engineer feels that the equivalent/substitute materials are of less cost compared to the specified materials then the contractor shall give comparative discount in the contract value of the BOQ items.

In case the cost of equivalent/substitute item is more the than the cost of BOQ item then no cost adjustment shall be made in the relevant BOQ item. Once the equivalent/substitute materials are recommended for approval by the Engineer the same shall be forwarded to the Employer/Client for their approval. The equivalent/substitute materials shall only be accepted after the Client's final approval.

All materials and equipments being provided by the Contractor & the Sub-contractor shall be interchangeable to the maximum extent with respect to makes, types, model etc.

10.0 DRAWINGS, AND DATA TO BE FURNISHED BY THE CONTRACTOR

Submittal

The contractor, after the award of work, shall submit for approval of the Engineer all drawings and cuts of equipment, appliances, fixtures and accessories that are to be furnished under the contract. After final approval, a sufficient number of copies as desired shall be furnished for distribution. Manuals, cuts, catalogues and drawings shall be clearly marked to indicate, the items furnished. Cuts of all fixtures, and not a few, shall be submitted.

Approval of Drawings and Data

The Contractor shall provide detailed electrical drawings, wiring diagrams, foundation details etc. for all electrical and other systems etc. for the Engineer's review and approval.

The manufacturing of electrical equipment shall be started only after the above mentioned drawings and data are approved.

The time required for review and approval shall be considered included in the total time of completion of job.

Three sets of drawings and data for each equipment shall be furnished by the Contractor for the Engineer's approval before commencement of fabrication and manufacturing. The drawings to be supplied by the Contractor shall be as follows:

- Arrangements
- Dimensional plans, elevations and front view
- Foundation plan, anchors and configuration
- Incoming and outgoing cable termination positions
- Earthing arrangement
- Electrical Drawings showing:

    - Single-Line diagram
    - Detailed wiring diagram
    - All interconnections
    - Other electrical devices including meters, instruments and their wiring diagram.
    - Signal and alarm circuit

Shop Drawings

The locations, routing and installation heights of the equipment etc. which are given on the tender drawings, are approximate. These drawings depict only the position of various fixtures and outlets. All the detailed planning for electrical and communication systems including conduit routes etc. shall be carried out well in advance of the actual execution of work, by the Contractor to the satisfaction of the Engineer. For this purpose the Contractor shall prepare shop drawings and obtain prior approval of the Engineer. Three prints of each shop drawings shall be submitted for obtaining approval. No piece of work shall be allowed to be executed at site without the availability of these approved shop drawings. These shop drawings shall clearly depict the load balancing chart of each distribution board. Time required for the preparation and approval of shop drawings shall be considered to have been included in the total time allowed for the completion of the work.

As-Built Drawings

Clearly annotated "As-Built" electrical drawings and diagrams shall be maintained upto date on site on completion of the Job. One reproducible and three prints of each drawing shall be submitted to the Engineer alongwith a recommended maintenance schedule chart and manuals/operating instructions for equipment supplied. The Contractor shall also provide complete detailed identifications of MV incoming and LV outgoing circuits, in the form of line drawings, for each pad mounted transformer. The line drawings shall be made on 20 SWG sheet metal work. The line drawings shall be clearly identified with permanent colors. The MV and LV circuits shall have

different colors. The sheet metal work shall be of suitable dimensions so as to be fixed on the inside of the door of the LV compartment of the pad mounted transformers. The line drawing shall be fixed with the help of rivets for permanent installation.

11.0 PRODUCT DELIVERY, STORAGE AND HANDLING

All equipment shall be boxed, crated or otherwise enclosed and protected during shipment, handling, storage and after installation until final acceptance of the equipment. Electrical materials shall be delivered in manufacturer's original cartons or containers with seals intact, as applicable. Large multi-component assemblies shall be delivered in sections that facilitate field handling and installation.

Unless designed for outdoor use, all equipment shall be kept dry, off the ground and covered from exposure to weather. Electrical equipment and equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities. Heaters in equipment shall be connected and operated until the equipment is placed in operation. The Contractor shall prevent corrosion, contamination or deterioration of stored equipment.

Equipment and materials shall be handled in accordance with manufacturer's recommendations. Large or heavy items shall only be lifted from the designated points. Padded slings and hooks shall be used for lifting to prevent damage.

All equipment shall be protected until final acceptance and all factory surfaces must be protected from impact, abrasion, discolouration and other damage. All damaged equipment must be repaired or replaced before final acceptance.

12.0 MANUFACTURER'S INSTRUCTIONS

The Contractor shall supply to the Engineer Three (3) copies of manufacturer's instruction manuals in properly bound form for installation, testing, commissioning, operation and maintenance of the specified equipment including manuals of spare parts and tools of the equipment. One copy of the documents shall be submitted in original. The installation instructions shall be submitted four (4) weeks prior to commencement of installation of each equipment and operation & maintenance instructions at least two (2) weeks before the time of commissioning. If the contractor fails to provide the documents, the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

13.0 GUARANTEE

In addition to the Contractor's guarantee and liabilities for satisfactory operation of the works, wherever advised by Engineer, the Contractor shall also furnish written guarantee of the manufacturer or supplier with respect to

satisfactory performance of each equipment. Guarantee shall be given for replacement and repair of part or whole of the equipment that may be found defective in material or workmanship. The guarantee shall as a minimum cover the duration of Maintenance Period as defined in the Conditions of Contract. This guarantee shall not relieve the Contractor of his obligations and he will be fully responsible for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/or replacements.

14.0 INSTALLATION INSTRUCTIONS

The Contractor shall furnish all labor, materials, tools and equipment required to install, connect, test and commission all electrical equipment specified herein, whether or not such equipment is furnished by him or by others.

For all equipment to be installed by the Contractor, the Contractor shall supply and install all erection materials such as foundation bolts, washers, nuts etc. as required and without any additional costs.

The Contractor shall set out the works himself as per Specifications and Drawings and shall properly position the equipment on specified foundation/location. In general, the manufacturer's instructions for installation shall be followed.

Any defect or faulty operation of equipment due to the Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost as per these specification and to the satisfaction of Engineer.

For any deviation from the working drawings that are deemed necessary by the Contractor due to site conditions, he shall submit the details and obtain the Engineer's approval before starting such works.

15.0 PRESHIPMENT INSPECTION AND TESTING

15.1 General

Equipments and materials covered in the scope of this contract are subject to pre-shipment inspection & testing at the manufacturer’s factory/works. The Contractor, in coordination with the manufacturers of relevant materials shall arrange for the pre-shipment inspection & testing by the Engineer or his authorized Representative at the manufacturer’s factory/works. The Contractor shall make all necessary arrangements and cater for all expenses in this regard for the traveling, boarding and lodging of the Engineer or his authorized Representative plus daily allowance @ Rs. 2,000 per day per person within Pakistan and US $ 200 per day per person outside Pakistan for the pre-shipment inspection and to witness the tests at the manufacturer’s factory/works.

15.2 Pre-shipment Factory Tests

15.2.1 MV & LV Switchgear, Generators, Transformers, Maintenance-Bypass Switch & Communication Systems Equipment

All type and routine tests on all equipment, materials and switchgear shall be performed at the manufacturer's works in the presence of the Engineer or his Representative. Type tests may be waived off in case test certificates, certified by an approved standard laboratory of international repute, approved by the Engineer, are submitted. But merely producing the type test certificates shall not relieve the Contractor and the manufacturer to carry out the required tests.

The Contractor shall obtain from the manufacturer and submit to the Engineer for approval, the complete details of tests to be performed describing the procedures, test observations and expected results.

The Contractor shall ensure availability of all tools, instruments, test equipments, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all equipments and materials including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four (4) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams etc.

The Contractor shall inform the Engineer about the place, date and time of test of each equipment at least, two (2) weeks in advance. The witnessing of test by the Engineer or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment, and for furnishing the guarantees referred to

in Clause 8.0. All test results shall be supplied in quadruplicate.

15.2.2 Insulation Resistance Test

Insulation resistance test shall be made on all electrical equipment by using a meggar of 500 volts for circuits upto 250 volts and meggar of 1000 volt for circuits between 250 and 500 volts. The Engineer shall advise the exact testing voltages. The insulation resistance values of cables, switchgear etc. shall be as per BSS, IEC, ICEA and Pakistan Electricity Rules.

15.3 Field Tests

15.3.1 General

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment and system's compliance with Specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the procedure test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials etc. and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of the Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four (4) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment diagrams etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials,

equipment and workmanship or as any other obligations of contract.

15.3.2 Insulation Resistance Test

Before making connections at the ends of each cable run or joint between cables, the insulation resistance test of each cable section shall be made. Each conductor of a multicore cable shall be tested individually with each of the other conductor of the group and also with earth. If insulation resistance test readings are found to be less than the specified minimum in any conductor, the entire cable shall be replaced and tests repeated on new cable. If cable joint is provided, then each cable section shall be tested and joint made only after the tests have been made satisfactorily. Finally the completed cable length including the joints shall be tested.

All switchgear shall be given an insulation resistance test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than the specified value, the cause of the low reading shall be determined and removed. Corrective measures shall include dry out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

15.3.3 Earth Resistance Test

The Contractor shall make Earth resistance tests on the earthing system, separating and reconnecting each earth connection.

If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the ECC together with the resistance of the earthing leads measured from the connection with earth electrode to any other position in the complete installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earth electrodes are installed, the earth resistance test of each electrode shall be measured.

The complete lightning protection system shall be tested for continuity and earth resistance. The combined earth resistance at any point in the lightning protection system shall not exceed ten (10) ohms.

15.4 Completed Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment does not cause any damage to the already tested equipment.

16.0 ASSOCIATED CIVIL WORKS

The cost of all civil works which are associated with any BOQ item are deemed to have been included in the respective items of Bill of Quantities unless specifically stated otherwise. The civil works shall include excavation, backfilling of earth, complication of the earth, foundation pads, grouting, chiseling, making openings etc. Such works will also include repair of any damage to civil works caused by the Contractor during electrical installation.

17.0 EXPENSES TO BE BORNE BY THE CONTRACTOR

All expenses regarding travelling, boarding, lodging and witnessing of tests by the Engineer or his representative and/or the owner or his representative including costs for carrying out the required tests shall be borne by the Contractor and are deemed to have been included in the Tender Bid.

18.0 TEST CERTIFICATES TO BE FURNISHED BY THE CONTRACTOR

After all field tests have been carried at site, the Contractor shall furnish test certificates for the following equipments and materials as supplied and installed by the contractor;

- Lighting fixtures
- MV & LV Switch Boards & Distribution Boards

- MV & LV Power cables
- Diesel Generator Sets
- Power Transformer (11/0.415kV)
- Earthing system

19.0 PAYMENT

No separate payment shall be made for work involved within the scope of this section, unless specifically mentioned in the respective items of Bill of Quantities.

SECTION - 2

SWITCH FITTINGS & ACCESSORIES

1. GENERAL

The work under this section consists of supplying, installing, and commissioning of all material and services of the complete switch fittings and accessories as specified herein, as shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact location and position of all electrical equipments.

The switch fittings and accessories shall also comply with the General Specifications for Electrical & Communications Works Section-8001 and with other relevant provisions of the Tender Documents.

The Light control switches, switch socket units, Fan Controllers, Industrial socket units, etc. shall be of following ratings;

- Light Switches rated for 10A, 250 Volt
- Fan dimmers rated for 100W, 250 Volt
- Shuttered 3 pin rated for 15A, 250 Volt
- Shuttered 3 pin rated for 20A, 250 Volt

The locations of the switch fittings & accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure the exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer.

2. APPLICABLE STANDARDS/CODES

The latest edition of following standards codes shall be applicable for the materials within the scope of this section:

BS 2135	-	Capacitors for radio interference suppression
BS 546	-	3 pin plugs, socket outlets and socket outlet Adapter for circuits up to 250 volts
BS 67	-	Two and three terminal ceiling roses
BS 4934	-	Safety requirements for electric fans and regulators

BS 5060 - Performance of circulating fans and their regulators

3. MATERIAL

3.01 One Way Switches - Indoor type

Switches for controlling light points shall be single pole, rated for 10 Amps, 250 Volt AC. The body of the switches shall be suitable for flush mounting on PVC back box/outlet box. The switches shall have screw contacts and shall operate with snap action.

3.02 Two Way Switches - Indoor Type

Two way switches for control of lights shall be of same make and specifications as for one way switches above, except these shall be of use to control light circuits from two different locations.

3.03 Switched Socket Outlets

Switched Socket units shall be of the following combinations and ratings:

- Shuttered 3 pin rated for 15A, 250 Volt

- Shuttered 3 pin rated for 20A, 250 Volt

Front face plate shall conform to the requirements stated above for switches - indoor type. The outlets shall be heavy duty type suitable for mounting on PVC outlet box. The 3 pin 15 Amps and 3 pin 20 Amps sockets shall have shrouded live contacts and designed such that the earth pin of plug is engaged to socket earth before mating of live contacts.

3.04 Fan Controller

Fan Controller for fan speed regulating shall be suitable for ceiling fans, rated for 10 Amps, 250 Volt AC. The body of the fan controller shall be suitable for flush mounting on PVC back box/ outlet box. The fan controller shall have ON/OFF switch that shall operate with click action.

3.05 Outlet Box

The outlet boxes for installation of switches, dimmers and socket outlets shall be of PVC having appropriate dimensions. The box shall have suitable arrangement for receiving the conduit.

4. INSTALLATION

4.01 General

The mounting heights of all wiring accessories fixtures are stated on the Drawings. In case the mounting height is not mentioned, the instructions of the Engineer Incharge shall be obtained before fixing.

4.02 Light Control Switches

The Light Control Switches shall be installed directly on back boxes/outlet boxes recessed in CC/RCC walls or columns. The fixing of Light Control Switches shall be by means of screws provided with them so as to finish flush with the surface.

4.03 Switched Socket Outlets

The Switched Socket Outlets shall be installed directly on back boxes/outlet boxes recessed in CC/RCC walls or columns. The fixing of Switched Socket Outlets shall be by means of screws provided with them so as to finish flush with the surface.

4.04 Fan Controllers/Light Dimmers

The Fan Controllers/Light Dimmers shall be installed directly on back boxes/outlet boxes recessed in CC/RCC walls or columns. The fixing of Fan Controllers/Light Dimmers shall be by means of screws provided with them so as to finish flush with the surface.

5. MEASUREMENT AND PAYMENT

5.01 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

5.02 Light Control Switches

5.02.1 Measurement

Measurement shall be made for the number of each item acceptably supplied and installed by the Contractor as a complete unit.

5.02.2 Payment

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and completion of each type and rating of the Light Control Switch including PVC outlet box, nuts, bolts and other accessories as required for complete installation.

5.03 Switched Socket Outlets

5.03.1 Measurement

Measurement shall be made for the number of each item acceptably supplied and installed by the Contractor as a complete unit.

5.03.2 Payment

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and completion of each type and rating of the Switched Socket outlet including PVC outlet box, nuts, bolts and other accessories as required for complete installation.

5.04 Fan Controllers

5.04.1 Measurement

Measurement shall be made for the number of each item acceptably supplied and installed by the Contractor as a complete unit.

5.04.2 Payment

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and completion of each type and rating of Fan Controller unit including PVC outlet box, nuts, bolts and other accessories as required for complete installation.

5.05 Light Dimmers

5.05.1 Measurement

Measurement shall be made for the number of each item acceptably supplied and installed by the Contractor as a complete unit.

5.05.2 **Payment**

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and completion of each type and rating of Light Dimmer unit including PVC outlet box, nuts, bolts and other accessories as required for complete installation.

SECTION - 3

CONDUITS AND PIPES

1.0 GENERAL

The work under this section consists of supplying, installing, and commissioning of all material and services of the complete conduits and pipes as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the layout with the Engineer and co-ordinate at Site with other services for exact route, location and position of the conduits and pipes for electrical lines.

The conduits and pipes with accessories shall also comply with the General Specifications for Electrical Works Section-1 and with other relevant provisions of the Tender Document.

The extent of work shown on the Drawings does not indicate the exact position of conduits and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services Drawings, as per site requirements and as directed by the Engineer.

2.0 APPLICABLE STANDARD/CODES

Latest editions of the following standards/codes shall be applicable for the materials in scope of this Section:

BS 6099	-	PVC conduits and accessories
BS 3595	-	PVC pipes & accessories
BS 4346	-	Cement Solvent for jointing

3.0 MATERIAL

3.01 PVC Conduits and Accessories

The heavy gauge PVC conduits and accessories conforming to BS6099 shall be generally used. The PVC conduits and accessories of light gauge may be used on the project with the concurrence of the Engineer.

The PVC bends, sockets, elbows, couplings etc. shall conform to the same specifications as for the conduits. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where

conduit changes direction. Bending of conduits by heating or otherwise will not be allowed in any situation. The use of sharp 90-degree bends and tees will not be allowed for concealed wiring.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 63-mm diameter and depth. The junction boxes for wall light points shall have minimum dimensions of 63-mm diameter and 38 mm deep. Round junction boxes shall be provided with one piece PVC cover plate fixed to the box by means of brass screws.

3.02 PVC Pipe and Accessories

The PVC pipe shall be rigid. All pipes shall be minimum Class D (Working pressure - 12 bar), unless otherwise stated on drawings or bill of quantities. The buried PVC pipe should be able to withstand the external load acting upon it by continuous movement of heavy duty vehicles such as trucks, cranes, forklift, etc. Where pipe changes direction, manufactured smooth bends shall be used. Bending of pipes by heating or otherwise will be allowed in special cases only. Bending of pipes by heating shall be carried out by first filling the pipe with sand inside and then immediately removing the sand. The use of sharp 90-degree bends and tees will not be allowed. The bends shall conform to same specifications as given for PVC conduits. For joining of pipe all precautions and procedures recommended by manufacturer shall be followed.

4.0 INSTALLATION

4.01 Concealed Conduits

Where concealed conduit system is to be installed as stated on drawings, the conduit shall be installed concealed in roof, wall, column, etc. Conduits shall be laid underfloor only where specifically stated.

When concealed, the conduit shall have a minimum of 32-mm cover of concrete measured from the top of conduit to finished surface. In the reinforced cement concrete (RCC) work the conduit shall be laid before pouring of concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and Accessories after pouring of concrete. The conduit shall be supported on top of bottom reinforcement of slab. All outlet boxes shall be firmly supported and installed such that they finish flush with the soffit of slab or beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting or in block masonry work, chase shall be made with appropriate tools and shall not be made deeper than required. The conduit

shall then be fixed firmly in the recess and covered with cement concrete mixture. The work of cutting in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from the Engineer before starting chasing and cutting.

The termination of conduits shall be at or near the equipment switchboard as shown diagrammatically on the Drawings. The exact locations of the termination shall be coordinated with the equipment/switchboard to be installed. Any extension of conduit to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against falling concrete. At all terminations of conduit, sharp edges of conduit ends shall be prevented to avoid the cutting or damaging of wire or cables during pulling through the conduits.

Underfloor conduit shall be installed at a minimum depth of 2 inches from the finished floor level or as shown on the Drawings. The conduits shall be installed empty before finishing of floor or in RCC work with a 18 SWG steel wire drawn through the conduit for pulling cable. No conduits shall be laid under floor in bathroom.

The entire conduit system shall be installed and checked before wiring as carried out. Any obstruction found shall be cleared before the installation of cable. Pull boxes and adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements.

- Pull boxes

  For straight runs the spacing shall not be more than 180 feet

  For runs with one 90 degree bend the spacing shall not be more than 90 feet

  For runs with two 90 degree bends the spacing shall not be more than 40 feet

- Adaptable boxes

  For conduit upto 1-inch dia. the boxes shall be 2 inch in depth

  For conduit upto 1-1/2 inch dia. the boxes shall be 2-1/2 inch in depth

For conduit upto 2-inch dia. the boxes shall be 3-1/2 inch in depth

The rectangular inspection boxes or pull boxes shall be 18 SWG heavy gauge sheet steel of suitable design to receive conduits. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than four times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

Adaptable boxes shall be 18 SWG sheet steel and painted and finished to the same quality as the Lighting distribution boards.

Wherever the conduit lengths cross the expansion joint either along the columns or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed the conduit shall not crack or break.

4.02 PVC Pipe

Rigid PVC pipes shall be installed under roads and paved areas, at crossing with other services and at cable entering building as shown on the Drawings. The depth of the pipe shall vary according to the conditions at site, and approval of Engineer shall be obtained prior to installation. In general the pipes shall be installed underground at the following depths measured from the top of the pipe:

a)	Under roads and paved surface	800 mm below the finished surface
b)	When crossing other services for the crossing length	250-mm vertical clearance 500 mm horizontal clearance with CC protective cover

The trench of required dimensions shall be excavated and the bottom of trench cleaned and leveled. A four-inch thick bed of fine sand shall be provided over which the PVC pipes installed after proper alignment. Where two or more pipes are installed in the same trench the clearance between pipes shall not be less than two inches. After laying of pipe the trench shall be backfilled with clean-screened earth in layer of four inches. Each layer shall be properly compacted.

Where underground cables enter connection terminal boxes the PVC pipe shall be installed on surface by means of PVC clamps at a maximum interval of eighteen inches.

After installation, the ends of the pipe shall be plugged with material impervious to water and chemicals. All joints shall be sealed adequately to prevent entry of foreign elements.

The installation of pipes shall be completed in all respects including its fixing at terminations, before cabling work is started. All sharp edges and burrs shall be removed by using reamer or any approved device. The pipe shall be thoroughly cleaned of dirt and dust from inside. The pipes shall be installed in proper co-ordination with other works.

5.0 MEASUREMENT AND PAYMENT

5.01 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supplying, installation and completion for all work specified herein and as shown on the Tender Drawing related to the item.

5.02 PVC Conduits

5.02.1 Measurement

Measurement shall be made for the number of running metres of conduits acceptably supplied and installed by the Contractor as a complete unit.

5.02.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing and completion of the laying of the conduits including jointing materials and accessories. The complete work wherever applicable shall include cutting/chasing of civil work for concealed conduit system, excavation and backfilling of ground for underground pipes, painting, plugging, bitumen coating, etc. as applicable for each type of work.

5.03 PVC Pipes

5.02.1 Measurement

Measurement shall be made for the number of running metres of pipes acceptably supplied and installed by the Contractor as a complete unit.

5.02.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing and completion of the laying of the PVC pipes including jointing materials and accessories.

SECTION 4

EARTHING

1. GENERAL

The work under this section consists of supplying, installing, testing and commissioning of all material and accessories of the complete earthing system as specified herein, as shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and Co-ordinate at Site with other services for exact route, location and position of the electrical lines and equipment.

The earthing system shall also comply with the General Specifications for Electrical Works Section-8001 and with other relevant provisions of the Tender Documents and latest WAPDA Specifications.

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

2. APPLICABLE STANDARDS/CODES

The latest editions of following standards/codes shall be applicable for the materials in scope of this section:-

BS 951	-	Earthing Clamps
CP 1013	-	Earthing
BS 2874	-	Nuts, bolts, washers, screws & rivets fixing for use on Copper
BS 1433	-	Hard drawn bare copper conductor for earthing
BS 6346	-	PVC insulated cables

3. MATERIAL

3.01 Earth Electrode (Plate Type)

The earth electrode shall comprise a two feet x two feet and 1/8 inch thick electrolytic copper plate. The surface of the plate shall be tinned for

protection. The plate shall have four terminals for connecting of the earthing leads. Nuts, bolts and washers, shall be either of brass or tinned copper.

3.02 Earth Electrode (Rod Type)

The earth electrode shall comprise ten feet long, 5/16 inch dia. copper deposited steel rod having flat head at drive end and pointed conical tip at the driven end. The tip shall be hardened to facilitate driving. At the top of the pipe, a clamp for bolted connections shall be provided suitable for connection to the down conductor.

3.03 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point on the high mast. It shall be round hard drawn bare electrolytic copper of size shown on the Drawings.

3.04 Earth Continuity Conductor

Earth continuity conductor (ECC) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes indicated on the Drawings.

The specifications for single core PVC insulated or PVC/PVC cables used as ECC shall be same as those in relevant sections of Technical Specifications.

3.05 Earth Connecting Point

Earth connecting points shall comprise tinned copper bar, rectangular in shape, having dimensions of 350 x 50 x 6 mm. Atleast, six terminals for connection shall be arranged on the bar, which can be increased or decreased as required by the engineer.

The terminals shall have brass or tinned copper bolts, nuts and washers for protection against corrosion. Two holes shall be provided off centre of the copper bar for fixing to the wall by means of 10 mm dia. nut and bolt and shall be insulated by means of rubber gaskets/washers.

4. INSTALLATION

4.01 General

Complete earthing systems as shown on the Drawing shall be installed by the Contractor. The earthing system shall have earth resistance, including

the resistance of soil, earth leads and ECC of less than **One** ohm.

At all connections of earth continuity conductor to high mast or any other metallic body, proper size copper or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or terminations shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall in general run in cable trench or in conduits/pipes as shown on the Drawings. For under floor runs, these shall be installed in pipe/conduit of appropriate sizes. Where laid along underground cables, these shall be laid directly underground in unpaved areas and in pipes under paved areas.

4.02 **Earth Electrode (Plate Type)**

The electrode plate shall be installed at a minimum depth of 15 feet from finished ground level or 3 feet below permanent water level whichever is less. The minimum horizontal distance between earth electrodes shall be 12 feet. Proper mixture of lime and charcoal shall be made and buried alongwith the copper plate in the ground to increase the soil conductivity. The earthing leads shall be installed in proper size G.I. pipes. The electrode shall be installed as per details shown on the Drawings.

4.03 **Earth Electrode (Rod Type)**

In case the soil conditions at site permit, the earth electrodes may be installed by hammering the electrode in soil, until the top of the rod is about 12 inches below the proposed ground level. If hammering down is not possible due to site conditions, a pit shall be first excavated in bare ground upto the required depth and electrode shall be installed upright in the pit. The excavated pit shall be backfilled in layers of 20 inches, each layer tamped and compacted. At the ground level an inspection chamber of cement concrete shall be constructed having dimensions as shown on the Drawings. The inspection chamber shall have a cover supported on angle iron frame. The cover shall be approved by the Engineer and shall finish flush with the ground level.

4.04 **Earth Continuity Conductor**

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar/terminals provided in equipment. The body of all switchboards shall

also be connected to earth by specified size of ECC. All other metal work shall also be connected to earth by specified size of ECC.

At any joint or terminations, the ECC shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

4.05 Earth Connecting Point

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws.

5. MEASUREMENT AND PAYMENT

5.01 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supplying, installation, testing and commissioning of all work specified herein, as shown on the Tender Drawing related to the item.

5.02 Earth Electrode

5.02.1 Measurement

Measurement shall be made for each type of earth electrode acceptably supplied and installed by the Contractor as a complete unit.

5.02.2 Payment

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each, and shall constitute full compensation for supplying, installing, testing, commissioning and completion of earth electrodes including earthing leads, excavation, backfilling, inspection chamber with cover, G.I. pipes for earthing leads, nuts, bolts, washers, lugs, brazing and all related civil works.

5.03 Earth Continuity Conductor

5.03.1 Measurement:

Measurement shall be made for the number of running metre for each size of earth continuity conductor (ECC) acceptably supplied, installed and tested by the Contractor.

5.03.2 **Payment**

Payment shall be made for the total number of running metres of each size of ECC measured, as provided above, at the Contract unit price each and shall include full compensation for supplying, installing, connecting, testing and completing of ECC including all accessories, such as sockets, thimbles, lugs, bolts, nuts, brazing etc.

5.04 **Earth Connecting Point**

5.04.1 **Measurement**

Measurement shall be made for each earth connecting point acceptably supplied and installed by the Contractor as a complete unit.

5.04.2 **Payment**

Payment shall be made for the total number of units measured, as provided above, at the contract unit price each and shall constitute full compensation for supplying, installing and completion of earth connecting point and all other associated accessories such as nuts, bolts, washers, lugs etc.

SECTION - 5

LOW VOLTAGE CABLE

1. GENERAL

The work under this section consists of supplying, installing, testing and commissioning of all material and services of Low Voltage cables and the accessories as specified herein or as shown on the Tender Drawings and in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and position of the electrical lines.

The LV cables with accessories shall also comply with the General Specifications for Electrical Works Section-1 and with other relevant provisions of the Tender Document and latest WAPDA specifications.

All single core PVC insulated cables for the following shall be of 600/1000 volt grade copper conductor cables;

- wiring of light circuits
- switch to point wiring
- light point to light point wiring
- wiring of circuits for 5 amps, 250 volt, 2&3 pin switch socket unit
- wiring between 5 amps, 250 volt, 2&3 pin switch socket units
- wiring of push buttons & between push buttons
- wiring of light circuits controlled by push buttons
- wiring between light circuits controlled by push buttons

All single core PVC insulated power cables for the following shall be copper conductor and of 600/1000 volt grade:

- wiring of circuits for 15 amps, 250 volt, 3 pin switch socket unit
- wiring of circuits for 20 amps, 250 volt, 3 pin switch socket unit

All multicore armoured/unarmoured control cables shall be copper conductor and of 300/500 volt grade.

All multicore armoured/unarmoured power cables shall be copper conductor

and of 600/1000 volt grade.

All multicore armoured power cables shall be copper conductor and of 600/1000 volt grade.

2. APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials within the scope of this section:

BS 6004	-	PVC insulated cables (non-armoured) for electric power & lighting
BS 6346	-	PVC insulated cables for electricity supply
BS 6746	-	PVC insulation and sheath of electric cables
BS 6360	-	Conductors for insulated cables
IEC 60228	-	Conductors for insulated cables
BS 6500	-	Insulated flexible cords

3. MATERIAL

3.01 General

The power, lighting and control cables shall be furnished and installed in accordance with the details shown on the Drawings. The general guide lines and criteria for reference is given below:

3.01.1 Phase Identification

All cables shall have phase identification colors on insulation of each core. The colour code for three phase circuits shall be;

- Red, Yellow and Blue for phase conductors
- Black for neutral conductor
- Green for earth conductor where PVC insulated cable is installed.

Single phase circuits shall have insulation of;

- Red colour for phase/line
- Black colour for neutral

- Green colour for earth conductor.

All DC circuits shall have insulation of;

- Red colour for positive conductor
- Black colour for negative conductor
- Green colour for earth conductor.

3.01.2 **Cable Accessories**

All accessories shall be provided for the complete cabling and wiring systems. These shall include but not limited to items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and as approved by the Engineer), clips, lugs, tapes, solder, identification tags, bushes, glands etc.

4. INSTALLATION

4.01 Conduit Wiring

The wiring through conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes etc., are fixed in position.

The wires shall be pulled in conduit with care, preferably without the use of any lubricant. Where necessary and after approval of Engineer, the cable manufacturer's recommended lubricant shall be used. Use of any kind of oil or soap will not be permitted. Where several wires are to be installed in the same conduit, they shall be pulled together alongwith the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than ten times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body, sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable/wire shall be provided at each termination to facilitate repairs in future.

4.02 Cables on Surface

All cables for installation on surface of wall, column, ceiling etc., shall be fixed to the surface by means of galvanized steel clips secured to a steel channel by means of suitable stud plate, nuts and washer. The distance between each cable clip shall be such, so as to support the entire weight of the cable and that distance between the cable and surface and also the vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting channels are to be furnished for cable along the same route. The Engineer before commencement of installation shall approve alternate cable fixing arrangement, which the Contractor can offer.

4.03 Cables in Flexible/Rigid Conduits on Surface

All cables for 'on surface conduits' shall be installed through the conduits without the use of lubricants. The flexible/rigid conduits shall be fixed to wall/ceiling surface by means of cable clamps using rawl plays and galvanized screws.

4.04 Underground Cable

The cables to be installed directly underground shall be laid in trench in single tiers. The depth of cable under ground, shall be three feet minimum, measured from the top of the largest cable to the general ground level. The burial depth may be increased as required due to site conditions or when crossing other service pipes and roads. Burial depth less than three feet and more than five feet shall require Engineer's approval.

When cables cross road, paved area, other services or other cables they shall be laid in protective pipes of required size. Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables shall be plugged water tight by means of bituminised resin or equivalent method as approved by the Engineer. A minimum clearance of ten inches vertically and 20 inches horizontally shall be maintained between cables and other services.

Cable identification tags of corrosion resistant material shall be tied to cables with bronze wire at a maximum of 65 feet interval along the cable length for identification of cable and circuit. Above ground cable markers of 8 SWG (4 mm) sheet steel and 200 mm^2 shall be erected at 100 feet intervals along the straight trench, and at each bend and joint box for indication of presence of underground cable. For more than three feet wide trenches, cable markers shall be provided at both edges of the trench. The cable marker shall be finished in gray heavy enamel paint over two base coats of anti-rust red oxide paint, with the necessary instructions indicated in approved colours.

The Contractor shall furnish samples of cable marker for approval of Engineer before installation. The marker shall be welded to an angle iron fixed to the ground on a cement concrete base or as directed by the Engineer. The earth continuity conductor shall be laid in the trench with the cables. The Contractor shall submit to the Engineer for approval, schedule of cable markers showing location of marker and instructions on each.

The cable trench shall be excavated as per route and location shown on the Drawing. Before laying of cables in the trench, the bed of the trench shall be leveled and filled with a four inch thick layer of fine sand (1/32 inch diameter maximum particles size). The sand layer shall be leveled and the cables placed thereon, the cables shall be covered with a layer of fine sand four inch thick measured above the top of the largest cable.

The cable protective bricks placed above the top of sand cover shall be of Class - C cement concrete, minimum two inch thick and 12 inches x 12 inches square or as approved by the Engineer. The bricks shall be placed over the sand layer end to end to cover the entire length and breadth of the cable trench. After the concrete bricks are placed, the remainder of the trench shall be backfilled with earth in layer 16 inches thick. Each layer shall be thoroughly tamped and compacted.

Sufficient slack shall be left in cables for which purpose the cut lengths of cables shall be about 3% more in the measured lengths between terminations. At underground joint box, ample slack shall be left to prevent straining of cable joints due to settlement of the cable trench.

The cut lengths of cables wherever stated are only as a guide. The Contractor shall measure actual lengths between terminations of each circuit and if the discrepancy between measured lengths at site and where given on the Drawing differ by more than ±10%, the Contactor shall report to Engineer and act as directed. Cables, whether installed underground or in cement concrete trenches shall not be bent to a radius less than that recommended by the cable manufacturers.

5. MEASUREMENT AND PAYMENT

5.01 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

5.02 Light Circuit Wiring

5.02.1 Measurement

Measurement shall be made for the total number of light circuit wiring from LV distribution board/LV switchboard to point/switch including wiring between switches on same circuit, acceptably carried out by the Contractor as a complete unit.

5.02.2 **Payment**

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, connection, testing, commissioning and completion of the circuit wiring from the LV switchboard/LV distribution board to point/switch including wiring between switches on same circuit complete with conduit, wire/cable, earth continuity conductor, accessories etc.

5.03 Light/Fan Point/Point to Point Wiring

5.03.1 Measurement

Measurement shall be made for each light point, wiring between the light point and switch, point to point, acceptably carried out by the Contractor as a complete unit.

5.03.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of the wiring between light point to switch and point to point including required size of cable, conduit, earth continuity conductor, flexible cable, ceiling rose, accessories etc.

5.04 Wiring of Lights Directly Controlled from Distribution Board/Local MCBs/Wiring of Push Buttons

5.04.1 Measurement

Measurement shall be made for wiring of each light point directly controlled from distribution board or local MCBs type switch and wiring of push buttons acceptably carried out by the Contractor as a complete unit.

5.04.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of wiring of light points directly controlled

from distribution boards or local MCB type switches and wiring of push buttons including required size of wire, conduit, earth continuity conductor, flexible cable, ceiling rose, accessories etc.

5.05 Wiring of 5 Amps, 250 Volt Combined 2 & 3 Pin Switched Socket Unit from LV Switchboard/Distribution Board

5.05.1 Measurement

Measurement shall be made for number of points for wiring of 5 Amps, 250 Volt, combined 2 & 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

5.05.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring for 5 Amps 250 Volt, combined 2 & 3 pin switched socket unit from LV switchboard/distribution board including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

5.06 Wiring between 5 Amps, 250 Volt Combined 2 & 3 Pin Switched Socket Units

5.06.1 Measurement

Measurement shall be made for number of points for wiring between 5 Amps, 250 Volt, combined 2 & 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

5.06.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring between 5 Amps 250 Volts, combined 2 & 3 pin switched socket unit including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

5.07 Wiring of 15 Amps, 250 Volt 3 Pin Switched Socket Unit from LV Switchboard/Distribution Board/Bus Bars

5.07.1 Measurement

Measurement shall be made for number of points for wiring of 15 Amps, 250 Volt, 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

5.07.2 **Payment**

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring for 15 Amps 250 Volt, 3 pin switched socket unit from LV switchboard/distribution board/Bus Bars including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

5.08 Wiring between 15 Amps, 250 Volt 3 Pin Switched Socket Units

5.08.1 **Measurement**

Measurement shall be made for number of points for wiring between 15 Amps, 250 Volt, 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

5.08.2 **Payment**

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring between 15 Amps 250 Volt, 3 pin switched socket units including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

5.09 Wiring of 20 Amps, 250 Volt 3 Pin Switched Socket Unit from LV Switchboard/Distribution Board

5.09.1 **Measurement**

Measurement shall be made for number of points for wiring of 20 Amps, 250 Volt, 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

5.09.2 **Payment**

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment

shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring for 20 Amps 250 Volt, 3 pin switched socket unit from LV switchboard/ distribution board including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

5.10 LV Cables

5.10.1 Measurement

Measurement shall be made for the number of running metre for each size and type of LV cable acceptably supplied and installed by the Contractor.

5.10.2 Payment

Payment shall be made for the number of running metre of each size of cable measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of the LV cables including all accessories.

5.11 Excavation of Cable Trench

5.11.1 Measurement

Measurement shall be made for the number of cubic metre for excavation of each size of cable trench acceptably carried out by the Contractor.

5.11.2 Payment

Payment shall be made for the number of cubic metre of excavation for each size of cable trench measured, as provided above, at the Contract unit price each and shall constitute full compensation for excavation of the LV cable trench in ordinary soil and slightly rocky site.

5.12 Backfilling of Cable Trench

5.12.1 Measurement

Measurement shall be made for the number of cubic metre of backfilling for each size of cable trench acceptably carried out by the Contractor.

5.12.2 Payment

Payment shall be made for the numbers of cubic metre of

backfilling for each size of cable trench measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for four-inch thick sand bed, four inch thick sand cover, cable protective tiles/bricks, backfilling of already excavated earth, watering, compaction, consolidating etc. complete to the satisfaction of the Engineer.

SECTION - 6
MEDIUM VOLTAGE (MV) CABLE

1.0 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services of Medium Voltage (15KV) cables and the accessories as specified herein or as shown on the Tender Drawings and in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and position of the electrical lines.

The MV cables with accessories shall also comply with the General Specifications for Electrical Works Section-8001 and with other relevant provisions of the Tender Document and latest WAPDA Specifications.

2.0 GENERAL

The cable shall be suitable for nominal service voltage of 11 kV, have copper conductor and be cross-linked polyethylene (XLPE), insulated, shielded, armoured and sheathed. It shall be suitable for indoor and outdoor use in the transmission and distribution of electrical energy.

3.0 APPLICABLE STANDARD/CODES

Latest editions of the following standards and codes shall be applicable for the materials within the scope of this Section:

IEC 183 - Guide to the selection of HV cables.

IEC 502 - Extruded solid electric insulated power cable for rated voltage from 1kV to 30 kV

IEC 540 - Test methods for insulation and sheaths of electrical cables and cords.

4.0 MATERIAL

4.1 MV Cable

The cable shall meet the following specifications:

Nominal/System Voltage	-	11 KV
Frequency	-	50 HZ
System	-	3 phase
Conductor Size	-	Given in BOQ
Number of Cores	-	3 numbers
Rated Voltage	-	15 KV phase to phase 8.76 KV phase to ground
Continuous Operating Temperature of conductor	-	90 degrees Celsius
Conductor material	-	Copper stranded
Insulation	-	Cross-linked polyethylene
Shielding	-	Copper tape
Jacket	-	PVC
Armoring	-	Galvanized wire
Oversheathing	-	Extruded PVC
Phase identification	-	Red, Yellow, Blue

4.1.1 **Conductor Material**

The conductors shall be of high conductivity electrolytic copper stranded in accordance with specified standard.

4.1.2 **Insulation**

The insulation shall be cross-linked polyethylene extruded over the conductor. The insulation shall be laid to avoid any gap/air pockets between the conductor and insulation.

The insulation shall be easy to strip from individual conductors and to separate for jointing/termination purposes.

4.1.3 Shielding

A layer of semi-conducting material applied directly over the insulation shall shield each core. A bare copper tape applied with suitable overlapping shall cover the semi-conducting insulation.

Phase identification tape of red, yellow, and blue colour shall be wrapped over the copper shield.

4.1.4 Assembly

The three insulated conductors shall be assembled with PVC or any non-hygroscopic filler and bound with tape. The tape binder shall then be covered with extruded PVC jacket. The PVC jacket shall be padded with a suitable material before application of armour.

4.1.5 Armour

Armoring shall be provided with single layer of galvanized steel wire to provide cable protection and also act as a low resistance earth return path. The armoring shall be covered with binder tape. The armour shall be of appropriate size to carry the system fault current.

4.1.6 Oversheath

The entire cable assembly shall be covered with a PVC jacket of thickness not less than 2.5mm. The colour of the jacket shall be black. In addition to any other marking proposed by manufacturer, the size of cable and voltage grade shall be given on the oversheath at every 3 meters interval.

4.2 Cable Reels

The cable shall be supplied in non-returnable, mechanically strong, sea/rail/road worthy, wooden or metallic cable drums, protected against weather. The cable drum should bear the markings for cable type, cable size, voltage grade, year of manufacture, name of manufacturer, direction of unreeling and any other additional marking normally provided by the manufacturer. Cable ends on cable reels shall be protected by means of suitable seal.

4.3 Factory Tests

Physical and electrical acceptance tests in accordance with applicable standard shall be carried out at the manufacturer works. Three copies of test reports will be furnished to the Engineer, which shall include brief description of tests, test records and results.

5.0 INSTALLATION

5.1 General

The Contractor shall furnish all installation material, labour, tools and accessories for cable installation. The cable and accessories shall be installed as described in accordance with the installation instructions given in the Section for Low Voltage Cable of these Specifications, drawings and in accordance with manufacturer's instructions. Prior to installation of jointing and termination kits, the cable lengths shall be checked and tested to ensure that the cables are in sound condition and no damage has been done during handling and installation. After the MV cable and jointing/termination kits are installed, it shall again be tested prior to commissioning and in accordance with recommendations of standard to which the cable is manufactured.

The Contractor shall confirm exact cut lengths for the cable by actual measurements at site prior to the commencement of manufacturing. The cable lengths where shown on the drawing are tentative and only for general guidance. The Contractor shall be solely responsible for furnishing correct lengths of cable to avoid joints in cable length except where necessary, after obtaining approval of the Engineer.

5.2 Underground Cables

The cables to be installed directly underground shall be laid in trenches in single tiers. Unless that shown specifically on the drawing the depth of cable below finished ground level shall be 900-mm minimum measured from the top of the largest cable to the general ground level. The burial depth may be increased as required due to site conditions or when crossing other service pipes and roads. Burial depth less than 900mm and more than 1500mm shall require Engineer's approval.

When cables cross road, paved area, other services or other cables, they shall be laid in protective pipes of required size. Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of bituminised resiin or equivalent method as approved by the Engineer. A minimum clearance of 250mm vertically and 500mm horizontally shall be maintained between cables and other services.

The cable trench shall be excavated as per route and location shown on the drawing. Before laying of cables in the trench, the bed of the trench shall be leveled and filled with a 75mm thick layer of fine sand (1.3mm diameter maximum particles size). The sand layer shall be leveled and the cables placed thereon. The cables shall be covered with a layer of fine sand 75mm thick measured above the top of the largest cable. The cable protective bricks place above the top of sand cover shall be of class-A cement concrete, minimum 50mm thick and 300mm square. The bricks shall be placed over the sand layer end to end to cover the entire length and breadth of the cable trench. After the concrete bricks are placed, the remainder of the trench shall be backfilled with earth in layer 400mm thick. Each layer shall be thoroughly tamped and compacted.

Cable identification tags of corrosion resistant material shall be tied to cables with bronze wire at a maximum of 20 metre interval along the cable length for identification of cable and circuit. The earth continuity conductor shall be laid in the trench with the cables. The Contractor shall submit to the Engineer for approval, schedule of cable markers showing location of marker and instructions on each.

Sufficient slack shall be left in cables for which purpose the cut lengths of cables shall allow about 3% more in the measured lengths between terminations. At underground joint box, ample slack shall be left to prevent straining of cable joints due to settlement of the cable trench. The cut lengths of cables wherever stated are only as a guide. The Contractor shall measure lengths between terminations of each circuit and if the discrepancy between measured lengths at site and where given on the drawing differ by more than 5%, the Contractor shall report to Engineer and act as directed. Cables, whether installed underground, or in cement concrete trenches, shall not be bent to a radius less than that recommended by the cable manufacturers.

5.3 Cable Marker

Above ground, cable markers shall be erected at 30 metre intervals along the straight trench, and at each bend and joint box for indication of

presence of underground cable. For more than one metre wide trenches, cable markers shall be provided at both edges of the trench. The cable marker shall bear the necessary instructions indicated in approved colours. The Contractor shall furnish samples of cable marker for approval of Engineer before installation. The marker shall be welded to 50x50x4 mm angle iron fixed to the ground on a cement concrete base or as directed by the Engineer.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

6.2 MV Cable

6.2.1 Measurement

Measurement shall be made for the total number of running meters or running feet of MV cable acceptably supplied and installed by the Contractor and which has satisfactorily passed all the required tests prior to and after installation.

6.2.2 Payment

Payment shall be made for the total number of running meters or running feet of the MV cable, as provided above, at the Contract unit price and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of the MV cable including all accessories.

6.3 Excavation of Cable Trench

6.3.1 Measurement

Measurement shall be made for the number of cubic feet or cubic meters for excavation of each size of cable trench acceptably carried out by the Contractor.

6.3.2 Payment

Payment shall be made for the number of cubic feet or cubic meters of excavation for each size of cable trench measured, as provided above, at the Contract unit price each and shall constitute full compensation for excavation of the cable trench in ordinary soil & slightly rocky site.

6.4 Backfilling of Cable Trench

6.4.1 Measurement

Measurement shall be made for the number of cubic feet or cubic meters of backfilling for each size of cable trench acceptably carried out by the Contractor.

6.4.2 Payment

Payment shall be made for the number of cubic feet or cubic meters of backfilling for each size of cable trench measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for four-inch thick sand bed, four inch thick sand cover, cable protective tiles/ bricks, backfilling of already excavated earth, watering, compaction, consolidating, etc. complete to the satisfaction of the Engineer.

6.5 Cable Marker

6.5.1 Measurement

Measurement shall be made for the number of each size and type of cable markers acceptably supplied and installed by the Contractor as a complete unit.

6.5.2 Payment

Payment shall be measured for the number of units measured as above at the Contract price each and shall constitute full compensation for the supplying and installation of cable markers.

SECTION – 7

MEDIUM VOLTAGE (MV) CABLE TERMINATION KITS

1.0 SCOPE OF WORK

The work under this section consists of supplying of Medium Voltage (MV) cable Termination Kits as specified herein and given in the Bill of Quantities.

2.0 GENERAL

The MV cable termination kits shall be suitable for MV 8.76/15 kV, XLPE copper conductors cables. It shall be suitable for indoor, outdoor and underground installations.

3.0 APPLICABLE STANDARD/CODES

The Latest editions of the relevant standards and codes shall be applicable for the materials within the scope of this Section.

4.0 MATERIAL

4.1 Termination Kits for 8.76/15 kV MV Cables

The termination kits shall be suitable for indoor, outdoor and underground installations. The termination kits shall be complete with all materials.

The MV termination kits shall be from special Silicon skirted or tubular EPDM rubbers.

The tubes shall be pre-stretched to avoid the use of torches or external heat sources.

The MV termination kits shall be supplied complete with stress control tape with a di-electric constant of 30 minimum.

The MV termination kits shall be supplied with all required mounting, installation and operational accessories.

4.2 Straight - Through Joint

The joint-boxes for the cable shall be suitable for indoor or outdoor installation in accordance with the system requirements.

The joint boxes shall be horizontal, straight through, split type. Where installed underground, these shall be suitably protected against corrosion and ingress of moisture. At least two venting holes with plugs shall be provided for compound filling and inspection. Ground straps shall be furnished on the inside of joint box for ground continuity of the cable armour.

4.3 Factory Tests

Physical and electrical acceptance tests in accordance with applicable standard shall be carried out at the manufacturer works. Three copies of test reports will be furnished to the Owner, which shall include brief description of tests, test records and results.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

6.3 MV Termination Kit and Straight through Joints

6.3.1 Measurement

Measurement shall be made for each type of MV termination kit/straight through joint acceptably supplied by the manufacturer/supplier as a complete unit.

6.3.2 Payment

Payment shall be made for the number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying of MV termination kits/straight through joints including all installation accessories, support for joint as required.

SECTION - 8

SPECIFICATIONS OF LED LIGHTS

1.0 SCOPE OF WORK

The work under this section consists of manufacturing, fabricating, supplying, installing, earthing, testing and commissioning of all material with accessories and services for the complete LED fixtures as specified herein and as shown on the drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact locations and positions of the LED fixtures.

The light fixtures with accessories shall also comply with the General Specifications as applicable for Electric Works section- 8001 and with other relevant provisions of the Documents.

1.1 Type of Light Fixtures

A. Down Lighters

LED based down lighters should be suitable for all indoor applications with different mounting provision of recessed & surface.

The total lumens offered by the composite fixture shall be in the range of (900-1000) lm for 10 W fixtures (± 2W) and (1900-2000) lm for 20W (± 2W) fixtures with efficacy greater than 95 lm/W. The power factor of the fixture shall be minimum 0.9 with Color rendering greater than 80. Luminaire should have color temperature options (3000K, 4000K, 6500K) as per application requirements .The total life time span offered by the fixture shall be 45000 hours @L70 (tolerance +/- 5,000 hours) Overall luminaire system efficiency should be more than 80%.Luminaire should comply with IEC standard 60598 and relevant applicable standards pertaining to EMC and Photo biological safety. Earthing provision should be given inside the luminaries and the ingress protection of the fixture shall be at least IP20. The housing of the fixture shall be preferably with die cast aluminum. Proper heat dissipation arrangement shall also be ensured. Complete Test reports complying with applicable standards shall also be furnished as applicable.

B. Batten Lights

LED Batten light should be suitable for all indoor applications with mounting provision of surface. The total lumens offered by the composite fixture as minimum shall be in the range of (800-1000) lm for 8-10 W fixtures (± 2W) and (1600-2000) lm for 16-20W fixtures (± 2W) respectively with the efficacy greater than 95 lm/W. The power factor of the fixture shall be minimum 0.8 with Color rendering greater than 70. Luminaire should have color

temperature options (3000K, 4000K, 6500K) as per application requirements. The total life time span offered by the fixture shall be 30000 hours @L70 (tolerance +/- 5,000 hours) Overall luminaire system efficiency should be more than 80%.Luminaire should comply with IEC standard 60598 and relevant applicable standards. Earthing provision should be given inside the luminaries and the ingress protection of the fixture shall be at least IP20.

C. Bulk Head

LED Bulk Head light should be suitable for all semi indoor and outdoor applications with mounting provision of surface. The total lumens offered by the complete fixture shall be in the range of (1600-2500) lm for 20-30 W fixture range (±3W) with the efficacy of more than 80 lm/W. The power factor of the fixture shall be minimum 0.85 with Color rendering index of 80. Luminaire should have color temperature options (3000K, 4000K, 6500K) as per applications requirements .The total life time span offered by the fixture shall be 35000 hours @L70 (tolerance +/- 5,000 hours) Overall luminaire system efficiency should be more than 80%.Luminaire should comply with IEC standard 60598 and relevant applicable standards. Earthing provision should be given inside the luminaries and the ingress protection of the fixture shall be at least IP 54 for semi indoor and IP 65 for outdoor installation with impact resistance (IK) above 6. The housing of the fixture shall be preferably die cast aluminum with PC front cover.

D. In Ground Recessed Lights for Façade lighting

LED Inground recessed lights shall be suitable for uplight and wall washer effect applications for building façade with mounting provision of recessed type. The total lumens offered by the complete fixture shall be greater than 1500 lm for 18 W fixture (+/- 5 W) with the efficacy greater than 85 lm/W. The power factor of the fixture shall be minimum 0.9 with Color rendering index of 80. Luminaire should have color temperature options (3000K, 4000K, 6500K) with different beam angles of 20º,30º,45º as per applications requirements .The total life time span offered by the fixture shall be 35000 hours @L70 (tolerance +/- 5,000 hours) Overall luminaire system efficiency should be more than 80%.Luminaire should comply with IEC standard 60598 and relevant applicable standards. Earthing provision should be given inside the luminaries and the ingress protection of the fixture shall be at least IP 67 with impact resistance (IK) above 6. The housing of the fixture shall be preferably die cast aluminum with proper recessed box for installation in ground with provision of surge protection if required.

E. Flood Lights for Façade, Parking Sheds and Landscape lighting

Floods lights shall be suitable for uplight and wall washer effect applications for building façade, may also be used under parking sheds and for landscape lighting with required mounting provision. The total lumens offered by the complete fixture shall be greater than 2500 lm for 30 W fixtures (± 5W) with the efficacy of around 85 lm/W. The power factor of the fixture shall be

minimum 0.9 with Color rendering index of more than 70. Luminaire should have color temperature options (3000K, 4000K, 6500K) with different beam angles as per applications requirements .The total life time span offered by the fixture shall be 35000 hours @L70 (tolerance +/- 5,000 hours) Overall luminaire system efficiency should be more than 80%.Luminaire should comply with IEC standard 60598 and relevant applicable standards. Earthing provision should be given inside the luminaries and the ingress protection of the fixture shall be at least IP 65 with impact resistance (IK) above 6. The housing of the fixture shall be preferably die cast aluminum with proper heat dissipation and surge protection arrangement.

F. Post top Lights for Decorative Lighting

LED Post top lights shall be suitable for mounting on poles of height (3m-5m) for area decorative lighting. The total lumens offered by the complete fixture shall be 2500 lm minimum for 30 W fixtures (± 5W) with the efficacy of around 85 lm/W. The power factor of the fixture shall be minimum 0.9 with Color rendering index of more than 70. Luminaire should have color temperature options (3000K, 4000K, 6500K) as per applications requirements .The total life time span offered by the fixture shall be 35000 hours @L70 (tolerance +/- 5,000 hours) Overall luminaire system efficiency should be more than 80%.Luminaire should comply with IEC standard 60598 and relevant applicable standards. Earthing provision should be given inside the luminaries and the ingress protection of the fixture shall be at least IP 65 with impact resistance (IK) above 6. The housing of the fixture shall be preferably die cast aluminum with proper heat dissipation and surge protection arrangement.

G. Planter/Spot Lights

LED Planter/Spot lights shall be suitable for landscape and green areas lighting with suitable surface mounting and spiker in earth arrangement. The total lumens offered by the complete fixture shall be greater than 500 lm for 8-15 W fixtures (± 2W). The power factor of the fixture shall be minimum 0.8 with Color rendering index of more than 70. Luminaire should have color temperature options (3000K, 4000K, 6500K) as per applications requirements .The total life time span offered by the fixture shall be 25000 hours @L70 (tolerance +/- 5,000 hours) Overall luminaire system efficiency should be more than 80%.Luminaire should comply with IEC standard 60598 and relevant applicable standards. Earthing provision should be given inside the luminaries and the ingress protection of the fixture shall be at least IP 65 with impact resistance (IK) 6 or above. The housing of the fixture shall be preferably die cast aluminum with tempered glass and proper heat dissipation arrangement.

H. Bollard Lights

LED Bollard lights shall be suitable for area lighting with height of 0.5-0.8m and aluminum body. The total lumens offered by the complete fixture shall be greater than 700 lm for 9-15W fixture (± 2W). The lifetime shall be 40,000 hours (tolerance ±5,000 hours). Color rendering index shall be more than 80.

Standard Fixture power factor shall not be less than 0.90.

Fixture shall have different color temperature options ranging from 3000K to 4000K as per application requirements. System efficiency shall be more than 70%. The fixture shall have ingress protection (IP) of IP-65 or above and Impact Resistance (IK) 06 or above. It shall comply with EN 60598 and any other international standards as applicable.

1.2 Optics

The fixtures for above referred lighting shall have flexible optical systems for the wattage range in the respective group.

The fixture shall use high efficiency LED and optics system.

The Light Output Ratio (LOR) shall not be less than 90%.

The multilayer optics design shall ensure adequate luminance and illuminance uniformity in the unlikely event of an individual LED failure.

The fixture shall offer choice of different beam light distribution as required for particular fixture

The optical lens system shall feature long life with no discoloration (UV protection), highest possible light transmission and white painted circuit board for high reflectivity for maximum light output.

1.3 Warranty/Maintenance

The LED manufacturer /authorized agent/assembler shall not only be responsible for 5 years of warranty but also during the warranty period maintenance of the fixtures including free of cost replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through the manufacturer/authorized agents under the supervision of the contractor/ maintenance agency.

The involvement of the manufacturer/authorized agent for maintenance/ replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacturer recommended methodology/components installation is not followed. In addition to this it is also necessary that genuine branded products those offered at the time of supply with the fixtures are provided for the 5 years of warranty / component replacement period.

Undertaking in this regard shall be submitted by the contractor as well as manufacturer/authorized agent/assembler to the Client.

Further, if required, the manufacturer/authorized agent/assembler through contractor shall provide the proof of genuineness from the manufacturer for

various components provided/installed in the fixtures after fulfilling the technical requirements

1.4 LED Driver/Electronic Control Gear for LED Modules

The LED driver shall be designed to operate luminaries LED with current controlled output through Class I electrical classification. The driver shall be suitable for nominal 230V, +10%, -15%, 50Hz mains supply. The LED driver shall have an efficiency of at least 85%.The test reports showing compliance with applicable standards shall be submitted by the manufacturer.

1.5 LED Chip

The LED chip shall be Philips Lumiled, Cree, Nichia, Osram, Samsung, LG, ETI, & seoul semiconductor make or equivalent in performance. (duly tested as specified and in full conformance to the technical requirements/specifications) as specified.

The LEDs shall:

- be designed for lumen maintenance of L70 or 70% at the end of useful life at ambient temperature of 35 deg C.
- have a useful life burning hours as specified for relevant fixture
- have a color rendering index (Ra) of 80 (+10/-10)and a color temperature 2700K-6500K.as per application requirements
- have a color consistency within 5 SDCM (standard deviation of color matching) as defined by MacAdam.
- LM 80 Report with TM21 extrapolation graph must be attached.

1.6 Thermal Management

Managing thermal properties in LED fixtures is most critical to ensure optimum performance of LEDs and reliability of the system.

The housing under the circuit board shall be specially designed to ensure perfect contact between the board and the fixture housing for efficient heat dissipation.

PCBs shall be used to maximize heat transfer process and to offer reinforced electrical insulation via dielectric layer. The PCB shall be mounted on the housing using a highly efficient thermal interface material. Use of Silicon glue is not acceptable.

The housing over the driver chamber shall have ribs or any other mechanism with adequate surface area to ensure fast heat dissipation.

1.7 Photometric

Fixtures shall have Illumination Engineering Society (IES) files of different distribution patterns.

LM-80 LED and photometric test reports and IES files from a third party testing laboratory shall be available.

1.8 Technical Data and Drawings

Technical and descriptive data and drawings to be submitted shall include but not be limited to the following:

i) Technical data of fixtures, driver and LEDs

ii) IES photometric file

iii) Customer testimonials

iv) Factory ISO certificate

v) Reports showing compliance to applicable standards and other type tests stipulated in the respective standards/codes, if any applicable

2.0 INSTALLATION

The installation of LED light fixtures shall be in strict accordance with the manufacturer's instructions/recommendations and these specifications.

3.0 MEASUREMENT AND PAYMENT

i) General

The Contractor's bid amount against each bill of quantities item as given shall include supply, installation, testing, commissioning and completion of all work specified herein and/or shown on the Drawings related to the LED light fixture.

ii) Measurement

Measurement shall be made as complete job for all related equipment such as power supply, driver etc. along with all accessories acceptably supplied and installed by the Contractor as a complete unit.

iii) Payment

Payment shall be made for the number of units measured, as provided alone, at the contract unit price and shall constitute full compensation for supplying installing, testing and commissioning along with all accessories.

TECHNICAL SPECIFICATIONS LED PANEL LIGHT

Product: LED Panel light fixture for wattage 40W (±10W) recessed/suspended/surface mounted

Specifications:

The LED light fixture (Panel type) should be recessed/suspended/surface mounted and have capability deliver energy efficiency without sacrificing light quality in general lighting applications.

The composite system efficacy of the light fixture should at least 95 lm/W.

The power factor of the composite fixture shall be minimum 0.90

Luminaire must provide minimum 50% energy-saving compared with conventional Fluorescent light fixture. The system lumens output of the light fixture should not be less than 3500 lumens.

The Color Rendering Index of the fixture should be greater than 80 and the color temperature of the light fixture shall be available in different options (3000K, 4000K, 6500K) as per application requirements

The ambient temp for the light fixture is - 2°C < Ta < 40°C.

Housing:

The housing will include integrated heat sink and optical system. The housing will be made of Plastic frame in white color, & the heat sink will make of aluminium for better heat transfer.

Optics

The fixtures for above referred lighting shall have flexible optical systems for the wattage range in the respective group.

The fixture shall use high efficiency LED and optics system.

The Light Output Ratio (LOR) shall not be less than 90%.

The multilayer optics design shall ensure adequate illumination uniformity in the unlikely event of an individual LED failure.

The optical lens system shall feature long life with no discoloration (UV protection), highest possible light transmission and white painted circuit board for high reflectivity

for maximum light output.

Mounting Type

The luminaire shall have provision of Recessed, Suspended and surface mounting with sizes as per project specified requirements Suspension kit for suspended and box arrangement for surface mounted version must be available

LED Driver/Electronic Control Gear Specification

The LED driver shall be designed to operate large array of high powered LEDs through current controlled output through Class I electrical classification. The driver shall be suitable for 230V, +10%, -15%, 50Hz, single phase mains AC supply.

The LED driver shall have an efficiency of at least 85%.

The LED driver shall be of Harvard, TCI, Philips, VOSSLOH Schwabe, GE, Tridonic, meanwell, Pierlite, NVC, Make or equivalent (duly type tested as specified and in full conformance to the technical requirements/specifications).

LED:

The LED chip shall be Philips Lumiled, Cree, Nichia, Osram, Samsung, LG , ETI,seoul semiconductor make or equivalent in performance. (duly tested as specified and in full conformance to the technical requirements/specifications) as specified.

The LEDs shall:

- Be designed for lumen maintenance of L70 or 70% at the end of useful life
- Have a useful life of 50,000 burning hours.
- Have a minimum color rendering index (Ra) of 80 (+10/-10) and a color temperature above 5000K.
- Have a color consistency within 5 SDCM (standard deviation of color matching) as defined by MacAdam.
- LM 80 Report with TM21 extrapolation graph must be attached.

Thermal Management

Managing thermal properties in LED fixtures is most critical to ensure optimum performance of LEDs and reliability of the system.

The housing under the circuit board shall be specially designed to ensure perfect contact between the board and the fixture housing for efficient heat dissipation.

PCBs shall be used to maximize heat transfer process and to offer reinforced electri insulation via dielectric layer. The PCB shall be mounted on the housing using a hig efficient thermal interface material. Use of Silicon glue is not acceptable. The housing o

the driver chamber shall have ribs or any other mechanism with adequate surface area ensure fast heat dissipation.

1.7 Photometrics

Fixtures shall have Illumination Engineering Society (IES) files of differ distribution patterns.

LM-80 LED and photometric test reports and IES files from a third party test laboratory shall be available.

Applicable Standards and Codes

The luminaire should fully conform to the following standards (the supplier/contractors shall furnish the detailed type test reports for the luminaries being offered to establish conformance to the specified requirements) :

1. IEC 60598-1
2. IEC 60598-2-2– Electrical Insulation Class I
3. IEC62031: LED modules for general lighting – Safety specifications
4. LM-79
5. LM 80 Report with TM21 extrapolation graph must be attached.
6. IES Photometry file

The LED Driver/fixture should fully conform to the following standards (the supplier/contractors shall furnish the detailed type test reports for the luminaries being offered to establish conformance to the specified requirements) :

1. EN 55015 : 2013 – Emission – Electrical lighting and similar equipment
2. EN 61547: 2009 – Immunity – Equipment for general lighting purpose
3. EN 61000-3-2 : 2009 – Limits for harmonic currents emissions.
4. EN 61000-3-3 : 2008 – Limits for voltage fluctuation and flicker.
5. IEC62471 2008 :Photo biological safety of lamps and lamps systems
6. EN 62493 Assessment of lighting equipment related to human exposure to electromagnetic fields

All test reports and certificates must be from third party accredited laboratory.

Warranties

The LED manufacturer /authorized agent/assembler shall not only be responsible for 5 years of warranty but also during the warranty period maintenance of the fixtures including free of cost replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through

the manufacturer/authorized agents under the supervision of the contractor/ maintenance agency.

The involvement of the manufacturer/authorized agent for maintenance/ replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacturer recommended methodology/components installation is not followed. In addition to this it is also necessary that genuine branded products those offered at the time of supply with the fixtures are provided for the 5 years of warranty / component replacement period.

Undertaking in this regard shall be submitted by the contractor as well as manufacturer/authorized agent/assembler to the Client.

Further, if required, the manufacturer/authorized agent/assembler through contractor shall provide the proof of genuineness from the manufacturer for various components provided/installed in the fixtures after fulfilling the technical requirements

Technical and Descriptive Data and Drawings

Technical and descriptive data and drawings to be submitted shall include but not be limited to the following:

- Technical data of fixtures, LEDs and driver
- IES photometric file
- All detailed type test reports to establish conformance to specified international codes and standards as stipulated above.
- LM-80 test report of LED used
- 3rd Party IEC 60598 test reports specific to the fixtures being offered.
- EMC test report
- Photo- biological safety test report
- Customer testimonials
- Factory ISO certificate
- Reports of other type tests stipulated in the respective standards/codes

International Independent Laboratories

For the specified requirements of type tests and type test reports by an independent authority/independent laboratory (specific to their status/approval for performance of specific test(s) on the fixtures as defined in the project), the following laboratories shall be considered as independent laboratories:

- KEMA Labs, Holland.

- CESI Labs, Italy.
- CRIEPI Labs, Japan.
- Any other laboratory accredited by EA (European Co-Operation for Accreditation) or a member thereof.
- Any other laboratory accredited by ILAC (International Laboratory Accreditation Cooperation) or a member thereof.
- Any other laboratory accredited by IAF (International Accreditation Forum) or a member thereof.
- Any other laboratory accredited by STL (Short-Circuit Testing Liaison) or a member thereof.

INSTALLATION

The installation of LED light fixtures shall be in strict accordance with the manufacturer's instructions/recommendations and these specifications.

MEASUREMENT AND PAYMENT

General

The Contractor's bid amount against each bill of quantities item as given shall include supply, installation, testing, commissioning and completion of all work specified herein and/or shown on the Drawings related to the LED light fixture.

Measurement

Measurement shall be made as complete job for all related equipment such as power supply, driver etc. along with all accessories acceptably supplied and installed by the Contractor as a complete unit.

Payment

Payment shall be made for the number of units measured, as provided alone, at the contract unit price and shall constitute full compensation for supplying installing, testing and commissioning along with all accessories.

SECTION – 9

ELECTRICAL WORKS

1.1 DESCRIPTION

The work under this Contract consists of supplying, storage at site, installing, testing and commissioning of all materials and services comprising poles, lighting fixtures, lighting control panels, distribution transformers, cables, earthing, conduits and pipes etc., as specified herein, shown on the Drawings and given in the Bill of Quantities. Small items which are not expressly specified but which are necessary for completion of work shall be supplied by the Contractor without extra cost. The supply connection for lights etc. shall be obtained from the nearby WAPDA source. The work shall be complete in every respect for satisfactory operation as per specifications and standards give hereinafter.

The Contractor shall co-ordinate with the Engineer at site with respect to other services for exact location and position of all electrical equipments.

1.2 GENERAL

The location of the lighting fittings, poles, distribution boards, lighting control panels, distribution transformers and cables etc. are tentatively shown on the drawings. The Contractor shall ensure the exact position and location of poles and cable routes etc. in coordination with other services as per site requirement. The Contractor shall be responsible for proper light distribution on the road/underpass surface from the proposed luminaires and other equipment after installation and commissioning. He shall be fully responsible during maintenance period of the works.

The road/underpass lighting work shall be installed as per requirements of BS-5489 or other similar international standards. The Contractor shall also comply with the regulations of Pakistan Electricity Act and requirements of Water and Power Development Authority (WAPDA), wherever applicable.

The quality of equipment shall be of the best grade for each type, even though such quality may not be stated specifically in the specifications. All materials and products shall be new and manufactured by well known firms. Furthermore, these shall be sound and uniform in quality, size, shape, colour and texture and free from cracks, wrapage or other defects.

Component parts of each electrical system or piece of equipment shall be the latest standard product of a single manufacturer unless otherwise specified and provided sub-components, manufactured by different manufacturers are of specified standards design and dimensions and interchangeability is possible and shall normally have been satisfactory in service for at least two

years.

The design criteria for road lighting are based on the following parameters;

Luminance (L) cd/m^2	1~1.5 cd/m^2
Overall Uniformity (Uo) (Uo = L min./L avg.)	0.4
Uniformity of Each lane (UI) (UI = L min./L max.)	0.5 – 0.7
Threshold increment not exceeding	≤ 10

Road surface characteristics as per IEC classification is type R2 with qo = 0.07.

The contractor shall be responsible and confirm in writing that his selection of equipment will ensure on the road surfaces luminance level and uniformities equal or better than those defined in the lighting design criteria.

Within six (6) weeks after award of the contract, the contractor shall submit the technical details of the luminaries and other equipment and having obtained conditional approval thereof submit in duplicate, full detail of the calculated results for the level and uniformity of luminance and illumination on all road surface .These detail should be submitted in the format as described in the relevant IEC publication and after initial approval by the engineer.

1.3 APPLICABLE REGULATIONS AND STANDARDS/CODES

The latest edition of the following standards & codes shall be applicable for the materials within the scope of this work.

IEC	-	International Electro-technical Commission
IEEE	-	Institute of Electrical and Electronics Engineers U.S.A. (IEEE Wiring Regulation UK).
BSS	-	British Standard Specifications
VDE	-	Verband Deutscher Electro-technical (Association of German Electrical Engineers)

NEMA - National Electrical Manufacturers Association, U.S.A.

PSI - Pakistan Standards Institution

CIE - Commission Electro-technique International

1.4 TESTING

1.4.1 Factory Tests

a. General

All type and routine tests on switchgear and all other equipment shall be performed at the manufacturer's works in the presence of the Engineer or his representative. Type tests may be waived off in case test certificates as certified by an approved standard laboratory of international repute are provided by the Contractor and approved by the Engineer. Submission or merely producing the type test certificates shall not relieve the Contractor to carry out the required standard/routine tests.

The Contractor shall arrange at his own cost factory visit(s) for pre-shipment inspection/testing for all major electrical equipment offered. Airfare to and from inspector's home town (two persons), boarding, lodging and transport shall be Contractor's, responsibility and all costs in this respect shall also be borne by the contractor.

In addition, for all pre-shipment inspections carried abroad, the Contractor shall provide (for two persons) daily allowance @ 200 US$ per day for out of pocket expenses, at per diem rate per person currently recommended by Chamber of Commerce and Industry for foreign travelers on business visa. The number of days shall be actual days spent in travel from and to the home town of the concerned inspector but not less than five (5) days. The 200 US$ per day per person in cash shall be provided before start of travel from hometown.

For all pre-shipment inspections carried out within Pakistan, the Contractor shall provide (for two persons) daily allowance of Rs. 2,000 for out of pocket expenses, at per diem rate per person. The amount shall be provided in cash before start of travel from hometown for the entire duration of the visit.

The Contractor shall inform the Engineer about the date and time of test of each equipment at least two weeks in advance. The witnessing of test by the Engineer or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment, and for furnishing the guarantees. All test results shall be supplied in triplicate.

b. Insulation Resistance Test

Insulation resistance test shall be made on all Electrical equipment by using a meggar of 500 volts for circuits upto 250 volts and 1000 volts for circuits between 250 and 500 volts.

The insulation resistance values of cables, switchgear, etc., shall be as per BSS, IEC and Pakistan Electricity Rules.

1.4.2 Field Tests

a. General

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with Specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the procedure, test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials etc. and all qualified personnel required for the testing, setting and adjustment of all Electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests.

The Contractor shall record all test values of the tests made by him on all equipment. Three (3) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams etc.

b. Earth Resistance Test

Earth resistance test shall be made by the Contractor on the earthing system, separating and reconnecting each earth connection.

If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The Electrical resistance of the ECC together with the resistance of the

earthing leads measured from the connection with earth electrode to any other position in the complete installation shall not exceed five ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earth electrodes are installed, the earth resistance test of each electrode shall be measured by means of resistance bridge instrument.

c. Switchgear Test

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams furnished by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for connections to give proper phase sequence.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses disconnect switches, number of interlocks, indicating lights, alarms and remote control devices shall be in accordance with approved manufacturer drawings. Name plates shall be checked for proper designation of equipment served.

SP-2 POLES FOR ROAD LIGHTING

2.1 SCOPE OF WORK

The work under this section consists of designing, manufacturing, supplying, installation testing and commissioning of the street lighting poles and accessories as specified herein, or as shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact location and position of the electrical poles.

The poles with accessories shall also comply with the General Specifications for Electrical Works Section-8001 and with other relevant provisions of the Tender Documents.

2.2 APPLICABLE STANDARDS/CODES

The latest editions of the following standards/codes shall be applicable to the material specified within the scope of this Section:

ASTM A36	-	Steel for Pole and Base Plate
ASTM A307	-	Anchor Bolts
BS EN ISO 1461	-	Galvanization
ASTM A123 & A385	-	Galvanization

2.3 CONSTRUCTION OF POLES

The galvanized steel poles shall be of mild steel as shown on drawing from base plate to lantern connection, well proportioned and neatly finished. The height of the pole from the centre line of the spigot for lantern connection to the ground line and out-reach of each arm from the vertical centre line of the pole to the tip of the spigot for lantern attachment shall be as shown on Drawing. Approval of the Engineer shall be obtained before ordering the poles for manufacturing.

The pole (vertical portion) alongwith base plate shall preferably be in one piece. But if manufacturing in one length is not possible, it can be in two or three pieces with force fit lap joint.

The steel poles after fabrication shall be galvanized by hot dip process (inside and outside) as per applicable standards -Hot Dip Galvanized Coatings on Iron and Steel Articles'. The poles shall be prepared before galvanizing by removing grease, burs and slag etc. so that zinc coating is adherent, dense, smooth, continuous and uniform. The Contractor shall ensure before placing of order that the firm has adequate facility for hot dip galvanizing process as per standard practice. The steel used in the manufacture of poles shall be made by open hearth or electric furnace process.

The straight portion of the pole shall be truly vertical and no deviation more than 100 mm in the entire length shall be accepted.

Other tolerances shall be as follows:

- Outside diameter = +/- 1%
- Wall thickness = +/- 10%
- Overall length of pole = +/- 0.5%
- Weight = - 0.3%
+ not limited.

The pole and the bracket shall be so designed that when subjected to wind at a velocity of 160 km/hour on the full projected area of pole, bracket and the lantern a factor of safety of 3 on minimum tensile strength of the material shall be obtained. In addition, the temporary horizontal deflections at the lantern position shall not exceed 1/40 of the length of the pole above ground at aforementioned wind velocity.

The poles shall have a base compartment, designed to accommodate a loop-in services cutout for 4 core PVC/SWA/PVC cables of given sizes. A 8 mm stainless steel stud complete with nut and washers shall be provided in the base compartment of the pole for earthing purpose.

The edges of the door opening on the pole shall be reinforced with a 10 mm thick M.S. square bar to reinstate the strength of pole at this location. The opening cover shall consist of weather proof hinged door. The door shall be provided with a heavy duty non-rusting lock.

Flag brackets shall be fitted to poles if shown on the drawing and shall be as approved by the Engineer.

2.4 INSTALLATION

Lighting poles shall be handled/transported and erected in such a way so as to avoid any damages. Any damage to pole or galvanizing shall be made good to the satisfaction of the Engineer.

The lighting poles shall be stored clear of soil, ground water or other rust producing materials. The fixing of poles shall be carried out in accordance with manufacturer's instructions and good engineering practice.

The poles shall be erected in a true vertical position.

Where lighting poles are to be installed in the vicinity of overhead power lines, the Contractor shall inform the Engineer and act as directed. He shall maintain clearances as per WAPDA requirements from the power lines.

The Contractor shall number all the poles with high quality paint using stencil for 50 mm high lettering. The numbering shall be at 1200 mm from the bottom of pole towards the road. The numbering shall be in a manner as directed by the Engineer.

Earth backfill around pole foundation shall be done in 150 mm thick layers and shall be well ramed and compacted to provide full lateral support.

2.4.1 Data to be submitted

Before manufacturing, the Contractor shall submit for approval of the Engineer, the shop drawing of the pole anchor bolts, base plate and pole bracket together with details of the base compartment, cover and the means adopted for making it waterproof and tamperproof. Design calculation sheets for the poles from manufacturer shall also be submitted by the contractor to show that poles/foundations are safe for all specified stresses.

2.5 TESTS

2.5.1 General

The poles shall be tested and the results recorded for each test by the manufacturer in the presence of an authorized representative of the Owner or Engineer as stated below.

2.5.2 Inspection

Prior to inspection, checklist shall be submitted pertaining to fabrication of each pole lot duly filled in by the manufacturer.

The material, weight and dimensions of poles as specified shall be certified by the manufacturer. The poles shall be inspected and in case being found below the limits of tolerance as aforementioned, shall be rejected.

2.5.3 Sample Test

Sample of poles shall be selected at random basis from each lot of high masts and poles and shall be checked in accordance with the project specific requirements, BoQ, relevant construction drawings and applicable manufacturing standards. Factory routine test certificates shall be submitted by the manufacturer for each type of high masts/poles.

2.5.4 Galvanizing

Weight, uniformity of coating and other requirements shall be strictly inspected in accordance with applicable standards.

2.5.5 Service Cutouts

Each pole shall be provided with a waterproof and dust tight loop-in-service cutout accommodated in the base compartment of the pole.

The junction box shall comprise two (2) 2A MCB, for double arm poles and one (1) 2A MCB in accordance with IEC 60947 for single arm poles, a solid neutral link and an earthing terminal. It shall incorporate arrangements for looping "IN" and "OUT" for 4 core up to 25 mm^2 PVC/SWA/PVC cable having copper/aluminium conductor. The earth terminals, nuts and washers shall be adequately sized to take the earth continuity conductors with tight connections.

Dimensional drawings and details of the junction cutout box of pole shall be submitted for approval to the Engineer.

2.6 MEASUREMENT AND PAYMENT

2.6.1 Measurement

Measurement shall be made for the number of poles including all accessories and foundation block acceptably supplied and installed by the Contractor as shown on the drawing.

2.6.2 Payment

Payment shall be made for the number of units measured, as provided above, at the contract unit price each, and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of each pole

including junction cutout box.

The galvanized steel poles shall be of mild steel as shown on drawing from base plate to lantern connection, well proportioned and neatly finished. The height of the pole from the centre line of the spigot for lantern connection to the ground line and out-reach of each arm from the vertical centre line of the pole to the tip of the spigot for lantern attachment shall be as shown on Drawing. Approval of the Engineer shall be obtained before ordering the poles for manufacturing.

SP-3 LUMINARIES

Technical Specifications of LED lights issued by Energy Department, Govt. of Punjab (copy enclosed) shall be followed on the project in addition to the following:.

1) The fixture shall offer composite system efficiency above 120 lumen/Watt (tolerance of +/-5%).

2) <u>Warranties & Maintenance</u>

The complete fixture including all accessories shall have at least four (04) years warranty, after one year of Defect Liability Period (DLP), against any manufacturing defects and failures.

The LED manufacturer /authorized agent/assembler shall not only be responsible for 5 years of warranty but also during the warranty period maintenance of the fixtures including free of cost replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through the manufacturer/authorized agents under the supervision of the contractor/ maintenance agency.

The involvement of the manufacturer/authorized agent for maintenance/replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacturer recommended methodology/components installation is not followed. In addition to this it is also necessary that genuine branded products those offered at the time of supply with the fixtures are provided for the 5 years of warranty / component replacement period.

Undertaking in this regard shall be submitted by the contractor as well as manufacturer/authorized agent/assembler to the Client.

Further, if required, the manufacturer/authorized agent/assembler through contractor shall provide the proof of genuineness from the manufacturer for various components provided/installed in the fixtures after fulfilling the technical requirements

The road light supplier/manufacturer shall be bound to make on site measurements to the Client's representatives wherever, applicable (i.e., where a dedicated & proper lighting network has been designed) if required, by the client for cd/m^2 (Luminance) on annual basis to ensure the compliance of the desired output light levels in accordance with CIE 140 with Luminance meter. In this manner the light output depreciation and useful life of the LEDs (50,000 burning hours) shall be compared accordingly. In case, the lighting output depreciation is not within the limits prescribed by the standard as well

as any other non compliance/mal-operation of any component is noted, the contractor/ road lighting manufacturer shall be responsible for replacement of any/all component free of cost during the warranty period. The undertaking in this regard shall be submitted through the contractor on manufacturer's letter head to the Client.

An undertaking shall be submitted by the contractor/supplier on manufacturer's letter head clearly confirming that the submitted reports are original and test values/results mentioned in the reports are authenticated.

The Client shall have the right to verify the submitted test reports directly from the testing house.

Contractor/supplier/manufacturer shall confirm that the LED chip/wafers, drivers, SPDs used are genuine and shall furnish the undertaking of LED chip/wafer, drivers & SPDs manufacturers on its letter head where applicable for use of LED chips/wafers, driver & SPDs in the fabrication/manufacturing of LED light fixture.

The Contractor shall have an active team in consultation with the Client responsible to check the non operational lights on daily basis and shall rectify within two (02) days on self response basis (pertaining to his scope only) during DLP and uptil warranty after DLP, otherwise the penalty @ of PKR 200 per day of delay for each non-operational light will be charged from the Contractor. In case the fault is not on his part he will promptly notify the same to the concerned authority.

SP-4 CONDUITS AND PIPES

4.1 DESCRIPTION

When cables cross road, paved area or other services, they shall be laid in protective pipes of required size. The pipe ends after installation of cable shall be plugged to make them watertight by means of bituminized hesian or equivalent material.

Conduits/ pipes/ ducts for electrical cables shall be properly sealed with the water proofing material “Plastic Polyurethane Foam” as per relevant ASTM standard to avoid rain water entry to the conduits. The contractor shall also provide the technical data of the sealant material before the execution of the work.

4.2 GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduits and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

4.3 APPLICABLE STANDARD/CODES

Latest editions of the following standards / codes shall be applicable for the materials in scope of this Section:

BS 6099	-	PVC conduits and accessories.
BS 3595	-	PVC pipes & accessories.
BS 4346	-	Cement Solvent for jointing

4.4 MATERIAL

4.4.1 PVC Conduits and Accessories

The heavy gauge PVC conduits and accessories conforming to BS6099 shall be generally used. The PVC conduits and accessories of light gauge may be used on the project with the concurrence of the Engineer.

The PVC bends, sockets, elbows, couplings, etc. shall conform to the same specifications as for the conduits. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction.

Bending of conduits by heating or otherwise will not be allowed in any situation. The use of sharp 90-degree bends and tees will not be allowed for concealed wiring.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 63-mm diameter and depth. The junction boxes for wall light points shall have minimum dimensions of 63-mm diameter and 38 mm deep. Round junction boxes shall be provided with one piece PVC cover plate fixed to the box by means of brass screws.

4.4.2 PVC Pipe and Accessories

The PVC pipe shall be rigid. All pipes shall be minimum Class D, unless otherwise stated on drawings or bill of quantities. The buried PVC pipe should be able to withstand the external load acting upon it by continuous movement of heavy duty vehicles such as trucks. Cranes, forklift, etc. Where pipe change direction, manufactured smooth bends shall be used. Bending of pipes by heating or otherwise will be allowed in special cases only. Bending of pipes by heating shall be carried out by first filling the pipe with sand inside and then immediately removing the sand. The use of sharp 90-degree bends and tees will not be allowed. The bends shall conform to same specifications as given for PVC conduits. for joining of pipe all precautions and procedures recommended by manufacturer shall be followed.

4.5 INSTALLATION

4.5.1 Concealed Conduits

Where concealed conduit system as stated on drawings, the conduit shall be installed concealed in roof, wall, column, etc. Conduits shall be laid underfloor only where specifically stated.

When concealed the conduit shall have a minimum of 32-mm cover of concrete measured from the top of conduit to finished surface. In the reinforced cement concrete (RCC) work the conduit shall be laid before pouring of Concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and Accessories after pouring of concrete. The conduit shall be supported on top of bottom reinforcement of slab. All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab or beam.

Where conduits have to be concealed an cement concrete (CC) work after concreting or in block masonry chase shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture. The work of cutting in the cement concrete work or block masonry work shall be

coordinated with the civil work. The Contractor shall obtain approval from the Engineer before starting chasing and cutting.

The termination of conduits at or near the equipment switchboard as shown diagrammatically on the drawings. The exact locations of the termination shall be coordinated with the equipment/switchboard to be installed. Any extension of conduit to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against falling with concrete. At all terminations of conduit sharp edges of conduit ends shall be prevented to avoid the cutting or damaging of wire or cables during pulling through the conduits.

Under floor conduit shall be installed at a minimum depth of 2 inches from the finished floor level or as shown on the drawings. The conduits shall be installed empty before finishing of floor or in RCC work with a 18 SWG steel wire drawn through the conduit for pulling cable. No conduits shall be laid under floor in bathroom.

The entire conduit system shall be installed and checked before wiring as carried out. Any obstruction found shall be cleared before the installation of cable. Pull boxes and adaptable boxes shall be provided an conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements.

- Pull boxes
- For straight runs the spacing shall not be more than 180 feet
- For runs with one 90degree bend the spacing shall not be more than 90feet
- For runs with two 90degree bends the spacing shall not be more than 40feet
- Adaptable boxes
- For conduit upto 1-inch dia. the boxes shall be 2 inch in depth
- For conduit upto 1-1/2 inch dia. the boxes shall be 2-1/2 inch in depth
- For conduit upto 2-inch dia. the boxes shall be 3-1/2 inch in depth

The rectangular inspection boxes or pull boxes shall be 18 SWG heavy gauge sheet steel of suitable design to receive conduits. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than four times the cable manufacturer's recommended Bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

Adaptable boxes shall be 18 SWG sheet steel and painted and finished to the same quality as the Lighting distribution boards.

Wherever the conduit lengths cross the expansion joint either along the columns or slab suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed the conduit shall not crack or break.

4.5.2. PVC Pipe

Rigid PVC pipes shall be installed under roads and paved areas, at crossing with other services and at cable entering building as shown on the drawings. The depth of the pipe shall vary according to the conditions at site, and approval of Engineer shall be obtained prior to installation. In general the pipes shall be installed underground at the following depths measured from the top of the pipe:

a)	Under roads and paved surface	900 mm below the finished surface
b)	When crossing other services for the crossing length.	250-mm vertical clearance. 500 mm horizontal clearance with CC protective cover.

The trench of required dimensions shall be excavated and the bottom of trench cleaned and leveled. A Four-inch thick bed of fine sand shall be provided over which the PVC pipes installed after proper alignment. Where two or more pipes are installed in the same trench the clearance between pipes shall not be less than Two inches. After laying of pipe the trench shall be backfilled with clean-screened earth in layer of Four inches. Each layer shall be properly compacted.

Where underground cables enter connection terminal boxes the PVC pipe shall be installed on surface by means of PVC clamps at a maximum interval of Eighteen inches.

After installation, the ends of the pipe shall be plugged with material impervious to water and chemicals. All joints shall be sealed adequately to prevent entry of foreign elements.

The installation of pipes shall be completed in all respects including its fixing at terminations, before cabling work is started. All sharp edges and burrs shall be removed by using reamer or any approved device. The pipe shall be thorough cleaned of dirt and dust from inside. the pipes shall be installed in proper co-ordination with other works.

4.6 MEASUREMENT AND PAYMENT

4.6.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supplying, installation and completion for all work specified herein and as shown on the Tender drawing related to the item.

4.6.2 PVC Conduits

4.6.2.1 Measurement

Measurement shall be made for the number of running feet or running metres of conduits acceptably supplied and installed by the Contractor as a complete unit.

4.6.2.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing and completion of the laying of the conduits including jointing materials and accessories. The complete work wherever applicable shall include cutting/ chasing of civil work, for concealed conduit system, excavation and backfilling of ground for underground pipes painting, plugging, bitumen coating, etc., as applicable for each type of work.

4.6.3 PVC Pipes

4.6.3.1 Measurement

Measurement shall be made for the number of running feet or running metres of pipes acceptably supplied and installed by the Contractor as a complete unit.

4.6.3.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing and completion of the laying of the PVC

pipes including jointing materials and accessories.

SP-5 LT CABLES

5.1 DESCRIPTION

The cable manufacturer shall be certification holder of ISO-9002 and shall be approved by the Engineer. The cables for road lighting shall be PVC insulated and PVC sheathed, 600/1000 Volt grade, designed, manufactured and tested in accordance with IEC-60502 or other equivalent international standards.

For lighting system the cables shall be single or multicore as required with stranded copper or aluminum conductors and polyvinyl chloride heat and moisture-resistant insulation of the thickness listed in IEC or British Standard.

The route of the cables shall be as shown on the drawing. Any change in route required due to site conditions shall be made in relation with other service layout and with the approval of the Engineer.

5.2 MATERIAL REQUIREMENTS

The cable shall be suitable for operation at conductor temperature upto 70^{o} C under normal conditions.

Conductors shall be of high purity electrolytic annealed copper or aluminum wires and shall conform to the requirement of the following BS or equivalent standard.

If armouring is required it shall consist of galvanized steel wires complying with BS 1442 and shall provide conductivity not less than 50% of the phase conductor.

BS 6746:	-	PVC insulation and sheath of electric cables
BS 6360:		Copper or Aluminum conductors in insulated cables and cords
IEC 60228:	-	Conductors of insulated cables

5.2.1 Cable Sizes

The sizes of LT copper conductor cables shall be as shown on the drawings. Care shall be taken so that voltage drop at the far end of the cable does not exceed 5% of the nominal voltage. Cables manufactured by the reputed firms shall be used, provided they fulfill all the requirements of the specifications.

5.2.2 Phase Identification

All cables shall have phase identification colour on the insulation of each core. The colour code of three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. From pole junction box upto lantern green or green and yellow striped PVC insulated wire shall be used as earth continuity conductor (ECC).

For all cables, to be supplied and installed, the Contractor shall submit complete technical data, including conductor material, insulation material, current carrying capacity, Voltage grade, weight for 100 metres etc. and all such data shall be supported by test certificates, current and temperature rise curves etc. for approval of Engineer.

5.2.3 Cable Accessories

All accessories shall be provided without additional cost for the complete cabling and wiring system. These shall include but not be limited to items such as clamps, fixing channels, connectors, cable joints (where necessary and as approved by the Engineer), clips, lugs, tapes, solders, identification tags, bushes & glands etc.

5.2.4 DATA TO BE SUBMITTED

The Contractor shall submit the following for approval of the Engineer before execution:

- Manufacturer
- Country of Origin
- Catalogue with indication of equipment proposed
- Detailed Specification
- Construction drawings

Compliance of the following shall be required:

1) In–process testing and tests after manufacturing (each size/type) to be supplied, as per national and international standards (as applicable) specified particularly for the project for which the cable will be ordered, including but not limited to:

   a) Single / Multi-core Cable Manufacturing as per applicable BS or IEC standards schedule of testing.

   b) Tests on completed cables in accordance with BS standard 6004 & BS 6346 or equivalent IEC standard / codes.

2) Routine tests shall be carried out from independent laboratory in the presence of Client / Consultant representatives. Review/approval of these test reports shall be carried out by the Client/Consultants.

3) In advance availability of sources / supporting documents with regard to material sources vis-à-vis imported Copper (in accordance with the mandatory requirements of imported copper laid down in the market input rates of material, Finance Department, Government of the Punjab), PVC used in the manufacturing of the cables ordered for a particular project including sales tax invoices from the respective material source and reconciliation quantity of the material procured with the manufactured cables. The import documents of material should consist of the following:

- Bill of exchange.
- Commercial invoice.
- Packing list.
- Beneficiary certificate.
- Test report of Material (Copper Rod).
- Shipment advice.
- Bill of lading.
- The vendor from which imported copper is purchased should be approved / registered with LME

4) Certificate of Registration from the client shall be submitted.

5) Cable inspection test protocol/procedure shall be furnished.

6) Pre-shipment / delivery inspection shall be carried out at Manufacturing Works of the cable manufacturers.

7) The samples from the cable drums supplied at site shall be taken and collected by the contractor in the presence of Client/consultant representatives for testing of same from UET or PCSIR Lahore in line with applicable standards / codes and test report of the same shall be submitted accordingly.

5.3 CONSTRUCTION REQUIREMENTS

Power supply to the poles at the road crossing shall be with PVC insulated PVC sheathed cable passing through pipe as specified and as shown on the drawings. Individual pole connections shall be by means of the power supply cable looping between poles. The cable from lighting control box shall enter first lighting unit at its three phase and neutral service cut-out and then similarly looped to the next. The luminaries on each pole shall be connected alternately to each of the three phases.

Cable routes shall consist of trenches or 100 mm PVC pipe as suitable or as shown on the drawings. The cable if laid in trench shall be at least 500 mm below the general ground and 750 mm below road (class-1) level, with sand cushion around cable and a layer of 230 mm wide bricks over sand along the entire route of cable. The bricks shall be laid in such a way to provide equal margin of cover on both sides of the cable.

Slack shall be left in cables for which purpose the cut lengths of cables shall allow about 3% more in the measured length between terminations (Engineer will verify the lengths of cables). At junction boxes, ample slack shall be left to prevent straining of cable joints due to settlement of cable trench.

For underpass luminaries PVC insulated, PVC sheathed, SWA cable shall be pulled through already laid/buried PVC pipes in underpass slabs. The pulling of cables through pipes shall be started only after the conduit (PVC) system is completely installed and all outlet boxes, junction boxes etc. are fixed in position. The cable shall be pulled in PVC pipes with care, preferably without the use of any lubricant. Where necessary, and after approval of Engineer, the cable manufacturers recommended lubricant shall be used. Use of any kind of oil or soap will not be permitted.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in cables shall not be allowed. Slack shall be left in cables for which purpose the cut lengths of cables shall allow about 3% more in the measured length between terminations (Engineer will verify the lengths of cables). At junction boxes, ample slack shall be provided to facilitate repairs in future.

Cables, whether installed in bare ground or in pipes shall not be bent to a radius less than that recommended by the cable manufacturers.

Upon completion of cable installation, the Contractor will be required to undertake testing as approved by the Engineer or the concerned department and shall comply with IEE wiring regulations. The copies of test results shall be supplied to the Engineer.

Conduits/ pipes/ ducts for electrical cables shall be properly sealed with the water proofing material “Plastic Polyurethane Foam” as per relevant ASTM standard to avoid rain water entry to the conduits. The contractor shall also provide the technical data of the sealant material before the execution of the work.

5.4 MEASUREMENT AND PAYMENT

5.4.1 Measurement

Measurement shall be made for the number of running meters for each size and type of cable complete with required accessories acceptably supplied and installed by the Contractor. For 2.5 mm^2 cable from junction box to lighting fitting lamp holder through hollow of pole, it shall be on each cable basis.

5.4.2 Payment

Payment shall be made for the number of running metres of each size of cable measured as provided above, at the contract unit price each and shall constitute full compensation for supplying, installing, connecting and commissioning, of the cables. Payment for 2.5 mm^2 cable from junction box to lighting fitting lamp holder shall be lumpsum on each cable basis.

SP-6 LIGHTING CONTROL PANEL

6.1 DESCRIPTION

The lighting control/distribution panel shall be of 14 SWG sheet steel fabricated, cubical type, totally enclosed, dust tight and vermin proof. These shall be complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to the normal requirements. The panel with all components and accessories shall be suitable for front operation and shall;

- be provided with adequate clearance from live parts so that flashovers cannot be caused by switching, vermins, pests etc.
- have all components rated for insulation class of 600 Volt minimum.
- have the components mounted so as to facilitate ease of maintenance from the front.
- be suitable for mounting on concrete foundation.

The lighting control panel shall be complete with detachable steel base frame for embedding in concrete foundation on site.

6.2 MATERIAL REQUIREMENTS

The road lighting control box shall be of 14 SWG, G.I. sheet and equipped with the following:

- One-set of three phase, neutral and earth busbars of rating as specified (site rating).
- One incoming moulded-case circuit breaker, breaking capacity & rating as specified.
- Outgoing circuit breakers, breaking capacity & rating as specified.
- Magnetic contactors as per rating specified.
- Photo-electric cell switches dust and water proof type and as per BS 5972 or WAPDA Specifications P-102 with upto date amendments.

One photo electric cell unit shall be provided to switch ON/OFF every contactor for control of lights. Photo-electric unit shall include a delay device to prevent the switching of lamps during transient changes in voltage. Each

lighting circuit shall be equipped with Auto/Manual selector switch and ON/OFF push buttons for maintenance purpose without interference with the photo cell and the whole to be enclosed in the dust and vermin proof case. Since the lighting control panel is installed on road side, therefore its outer cover shall be plain, without electrical components. A brass batten holder with ON/OFF switch and 60 watt incandescent lamp shall be provided at suitable location in the panel to facilitate maintenance during night time. Doors with hinges shall be provided so as to give maximum access for cabling and maintenance and shall be fitted with lock. Three sets of keys shall be supplied along with road lighting control box.

All necessary interconnecting wiring within the control panel shall be carried out in the factory.

Cable glands and lugs shall be provided. Three sets for incoming outgoing 4-Core up to 35 mm^2 Copper conductor PVC/SWA/PVC cables.

A suitable earthing terminal shall be provided inside the box.

Crimping type lugs for incoming and outgoing copper cables shall be provided.

6.2.1 Moulded Case Circuit Breakers

Moulded Case Circuit Breakers shall be provided for each distribution feed circuit. The circuit breakers shall be in accordance with IEC 60947-2. The three phase fault level shall be in accordance with the circuit requirements. The I_{cu} of all MCCBs shall be equal to 100% of I_{cs}. All MCCBs shall be capable of operating at 50 ^oC.

Each circuit breaker shall have integral thermal overload and magnetic type short-circuit trip devices. The thermal release shall provide inverse time overload tripping and the magnetic release shall provide instantaneous tripping or short time delay tripping where necessary, to achieve discrimination with downstream protective devices during short circuit conditions.

6.2.2 Magnetic Contractors

The contactors shall be triple pole, 400 V continuous duty type. The main contacts shall be silver tipped, but type with double break per pole. Each contactor shall be provided with 230 V AC single phase operating coil, and minimum two normally open and two normally closed auxiliary contacts wired upto terminals. But if more number of working auxiliary contacts are required then, these shall be provided according to the system requirements.

6.2.3 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base and shall have rosettes of suitable colour.

6.2.4 Line-up Terminals

Line-up terminals wherever provided for control & power circuits shall be suitable for voltage and size of conductors as indicated on drawing.

The line-up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

6.2.5 Data to be Submitted

The Contractor shall submit the following for approval of the Engineer before execution;

- Manufacturer
- Country of Origin
- Catalogue with indication of equipment proposed
- Detailed Specification
- Construction drawings
- General arrangement and proposed foundation details.
- Details of materials used for weather and dust proofing.

6.3 CONSTRUCTION REQUIREMENTS

The road lighting control panel box shall be installed near transformer at location shown on the drawing. The Contractor shall ensure coordination with the civil contractor to avoid damage to the completed works. The Contractor shall provide foundation bolts and grout them in cement concrete with the approval of the Engineer. All installation material required for the satisfactory erection, such as bolts, nuts, washers, supporting steel etc. shall be provided and installed by the Contractor. The panel shall be installed upright and in level and shall be firmly and rigidly fixed on the concrete supports. Panel shall be erected as per manufacturer's instructions and as approved by the Engineer.

Loose parts dispatched by the manufacturer, shall be installed and connected as per assembly drawing. Any safety locking of metres, relays etc. provided by the manufacturer, for safe transport shall be released only after the panel

is installed in position. The Lighting Control Panel shall be tested and commissioned in the presence of the Engineer.

Panel openings for cables shall be properly sealed with the water proof material “Plastic Polyurethane Foam” as per relevant ASTM standard to avoid rain water/animal entry to the panel. The contractor shall also provide the technical data of the sealant material before the execution of the work.

6.4 MEASUREMENT AND PAYMENT

6.4.1 Measurement

Measurement shall be made for each panel complete with all components and accessories as given in bill of quantities acceptably supplied and installed by the Contractor as completed job.

6.4.2 Payment

Payment shall be made for the number of panels measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of panels including bolts, supporting steel base, nuts, washers, tapes and earthing etc.

SP-7 EARTHING

7.1 DESCRIPTION

Earthing system as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including the resistance of soil, earth leads and ECC, equal to or less than one ohm.

7.2 MATERIAL REQUIREMENTS

7.2.1 Earthing by Earth Rods

The earth rod shall be of steel and shall be protected against rusting by a thick exterior layer of copper (not less than 0.33 millimeter), permanently molted or electrolytically deposited on a high strength steel core which shall provide rigidity for easy driving without bending. The earth rod shall have nominal dia of 16 mm with chamfered head of 2x45 mm (chamfer). The overall length of the rod shall be 3000 ±5 mm.

7.2.2 Earthing Lead

The copper conductor used for earth wire shall conform to the latest revision of IEC 228, IEC 228A. The size and number of individual conductor shall be as specified in the applicable standards.

7.2.3 Earth Continuity Conductor

Earth continuity conductor (ECC) shall be hard drawn bare copper wire, or single core PVC insulated copper conductor cable of given size. The earth continuity conductor shall be connected at one end to the earth rod through switch clamp/eye bolts as shown in the drawings at the other end to the relevant equipment to be protected as mentioned in the specification, BOQ and shown on drawing.

The specifications for single core PVC insulated cables used as ECC shall be same as those in relevant sections of technical specifications.

7.2.4 Data to be Submitted

The Contractor shall submit the following for approval of the Engineer before execution;

- Manufacturer
- Country of Origin
- Catalogue with indication of equipment proposed
- Detailed Specification

- Construction drawings

7.3 CONSTRUCTION REQUIREMENTS

7.3.1 General

For earthing of equipment proper size copper or brass thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or terminations shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall, in general, run in cable trench or in conduits/pipes. Where laid along underground cables, these shall be laid directly underground in unpaved areas and in pipe under paved areas.

7.3.2 Earth Continuity Conductor

The body of all lighting control panels shall be connected to earth by specified size of ECC. All other metal work shall also be connected to earth by suitable size of ECC so that earth resistance is less than five ohm.

At joints or terminations, the ECC shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

7.3.3 Earth Resistance Test

Earth resistance tests shall be done on the earthing system by separating and reconnecting conductor. The resistance of earthing leads in the installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements.

7.4 MEASUREMENT AND PAYMENT

7.4.1 Measurement

For earth continuity conductors (ECC) measurement shall be made for each size of copper wires on per running meter basis acceptably supplied and installed by the Contractor.

7.4.2 Payment

Payment for copper rod type earth point shall be made for each point and provided as above at the Contract Unit price each and shall constitute full

compensation for supplying, installing, connecting and testing including earth rod, excavation, backfilling, civil work for inspection chamber, etc. as shown on the drawings. Payment of earth continuity conductors (ECC) shall be made for the number of running meters measured at the Contract unit price and shall constitute full compensation for supplying, installing & connecting including all installation accessories.

SECTION – 10

CABLE TRAYS

1.0 GENERAL

The work under this section consists of supplying, installing, and commissioning of all material and services of the complete cable trays as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the layout with the Engineer and co-ordinate at Site with other services for exact route, location and position of the cable trays for electrical lines.

The cable trays with accessories shall also comply with the General Specifications for Electrical Works and with other relevant provisions of the Tender Document.

The extent of works shown on the drawing does not indicate the exact position of cable trays. The Contractor shall ensure exact location and route of cable trays in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The Contractor should deliver, store and handle materials and products in a manner to prevent damage.

2.0 APPLICABLE STANDARDS/CODES

Latest editions of the following standards / codes shall be applicable for the materials in scope of this Section:

BS 729 Hot dip galvanized coating on iron and steel articles

3.0 PRODUCTS

3.1 The cable tray system shall be of one manufacturer and shall include factory-made trays, tray fittings, connectors and necessary accessories and supports to form a complete cable support system.

The cable tray system shall include the following factory -made tray elements:

(a) straight cable trays and ladders

(b) fittings as horizontal and vertical bends of various angles, crosses, tees, wyes, reducers, vertical riser elements

(c) connectors

(d) all necessary fixing accessories.

3.2 Manufacturer's standard accessories shall be used and site fabrication shall not be permitted.

3.3 Horizontal run of cables laid on cable tray and exposed to direct sunlight shall be provided with covering at higher level to allow for ventilation. Cable tray shall be raised 15 cm from finished floor level.

4.0 MATERIALS

4.1 The whole of the tray work, trays, fittings, supports shall be of mild steel hot dipped galvanized after manufacture to BS 729. The thickness of the protective sheath on any element shall not be less than 55 microns.

4.2 Cable trays shall be constructed from mild steel hot dip galvanized and of minimum thickness of 1.5mm.

4.3 Insert elements, bolts, screws, pins, etc., shall be mild steel cadmium plated.

4.4 Tray work shall have oval perforations. Ladder type trays shall be used for vertical runs as approved by the Engineer.

4.5 All trays (straight and fittings) shall be welded construction and be a heavy duty returned-flanged, perforated type, unless specified otherwise. The minimum thickness of heavy duty returned flanged cable trays shall be 1.5mm.

4.6 Tray components shall be accurately rolled or formed to close tolerances and all edges rounded. Flanges shall have full round smooth edges.

4.7 Ladder racks shall be of similar construction. The rungs shall be spaced at maximum 300 mm. The system shall allow for installing additional rungs and for replacement of rungs.

4.8 For all trays, flanges shall be a minimum of 50 mm deep, unless otherwise specified.

4.9 Cable tray width and radius of curved sections shall be selected to suit the number of cables as shown on drawings and to the approval of the Engineer

4.10 Cable trays and accessories installed in hazardous and extremely corrosive environments shall be heavy duty GRP or 316 S31 grade stainless steel.

5.0 INSTALLATION

5.1 Installation

5.1.1 Drilling, machining or cutting shall not be carried out after application of protective coat, unless previously agreed by the Engineer. If cutting or drilling is necessary, edges shall be cleaned up and painted with zinc based paint before erection.

5.1.2 Installation of vertical runs of tray along the line of vertical expansion joints in structure of the facility shall not be allowed.

5.1.3 Cables shall be fixed to the trays by means of PVC covered saddles or straps secured with brass or cadmium plated bolts, nuts and washers.

5.1.4 20% spare capacity shall be maintained once all cables have been installed on trays. Double banking of cables shall not be permitted space between adjacent cables shall be not less than the radius of the bigger cable.

Trays shall not be smaller than the minimum size stated on the Drawings or specified later and shall be so sized; if not specified, the Contractor shall calculate the size of the tray and submit to the Engineer for approval. The Contractor shall check the minimum size as specified is large enough for his requirements and provide 20% spare capacity for future use.

5.2 ERECTION

5.2.1 Cable trays arranged one above the other shall have spacing in relation to their width not exceeding a ratio of 1:2 with a minimum distance of 150 mm.

5.2.2 **Supports**

Install fixings and supports:

(a) at 3 meter centres
(b) 50 mm from bends, tees, intersections and risers
(c) as close as practicable to joints
(d) each side of expansion joints.

5.2.3 Supports shall be selected from the following types, to suit the site conditions:

(a) M12 steel threaded drop rods fixed to ceilings complete with GI channels or brackets
(b) wall support brackets
(c) cantilever arms
(d) steel channels

5.2.4 The cable trays shall be fixed in accordance with site conditions and manufacturer's recommendations.

5.2.5 Join cable tray and accessories with hardware per manufacturer's recommendations.

5.2.6 Avoid mid-span joints.

5.2.7 The Contractor shall submit, as required, all calculations relating to tray work and tray supports demonstrating acceptable mechanical stresses and sag.

5.2.8 Cable trays installed on roofs shall be supported using GI brackets or concrete blocks. Removable cable tray cover shall be fitted.

5.2.9 Access shall be available at all times to remove or replace cables with a minimum of 400 mm between trays and physical obstructions, A/C ductwork etc.

5.3 EARTHING

5.3.1 Cable trays and accessories shall be electrically and mechanically continuous throughout their length.

5.3.2 The entire cable tray system shall be bonded and 12 mm x 2.5 mm tinned copper links shall be bolted across each joint in the system by means of bronze nut and bolts, complete with flat and spring washers.

5.3.3 All cable trays shall be provided with earth continuity copper tape along the whole route of cable trays which shall be bonded to the main earthing system of the facility. The earth continuity copper tape shall be fixed on cable tray by means of PVC covered saddles or by other means approved by the Engineer.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supplying, installation and completion for all work specified herein and as shown on the Tender drawing related to the item.

6.2 Cable Trays

6.2.1 Measurement

Measurement shall be made for the number of running feet or running meters of cable trays acceptably supplied and installed by the Contractor as a complete unit.

6.2.2 Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing and completion of the laying of the cable trays including jointing materials and accessories.

SECTION - 11

LOW VOLTAGE (LV) DISTRIBUTION BOARDS

1.0 GENERAL

The work under this section consists of design, manufacturing, fabricating, supplying, installing, connecting, testing and commissioning of all material and services of the complete Low Voltage Distribution Boards as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact position of the electrical lines and equipment.

The Low Voltage Distribution Boards shall also comply with the General specifications for Electrical & Communications Works Section-8001 and with other relevant provisions of the Tender Documents.

The Low Voltage Distribution Boards shall be sheet steel fabricated. These shall be suitable for surface mounting, semi-recessed or recessed in wall mounting. The Low Voltage Distribution Boards shall be totally enclosed, dust and damp proof. The Low Voltage Distribution Boards shall be complete in all respects with material and accessories, factory assembled, tested and finished according to the Specifications and to the normal requirements.

All components shall be installed on a common mounting plate inside the enclosure and protected from the front with screwed sheet steel front plate. The enclosure shall be provided with rubber gasketting and a lockable hinged door with cam fastener.

The distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the distribution board.

The cabling inside the distribution board shall be suitably harnessed by means of straps or cords. An earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of distribution board at two points.

The LV Distribution Boards, in general, shall;

- be suitable for indoor installation & operation

- be suitable for operation and maintenance from front side

- be suitable for both 415 Volt AC, three phase 4 wire and 230 Volt AC, single phase 2 wire, 50 Hz system

- have all components rated for insulation class of 500V minimum for three phase and 250 Volt for single phase system

- be designed for flush mounting of all instruments on the front

- be provided with adequate clearance from live parts so that flash overs can not be caused by switching, vermins, pests etc.

- have incoming/outgoing cable termination arrangements. The power cables shall be directly connected to the terminals of TP 500V MCCBs of current ratings of 100 Amps and above. The SP/TP MCBs and/or MCCBs of current ratings upto and including 100 Amps shall be connected to DIN rail mounted wiring terminals of appropriate ratings, numbers and sizes for the outgoing wiring cables

- be provided with name plate on the front side of door

- be provided with pocket inside of door for safe keeping of the detailed as-built wiring/shop diagrams of the switch board

- have provisions for incoming and outgoing cables entry, connections and termination arrangements from top and/ or bottom plates as per site requirements

- have all openable doors grounded with the use of flexible copper cable/strip of at least 10 mm^2 cross-sectional area

2.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope of this Section :

BS 4752-1	-	Triple Moulded Case Circuit Breaker
IEC 60947	-	Single and Triple Miniature Circuit Breaker
IEC 60947	-	Low Voltage Switch gear and Control gear
IEC 60439	-	Factory Built Assemblies of LV Switch gear
IEC 60475-2	-	Switch gear and control gear for Voltages upto & including 1kV
BS 88	-	HRC Fuses
IEC 60073	-	Colors for indicator lights and push buttons

IEC 60446 - Identification of insulated/bare conductors

3.0 MATERIAL

3.01 Sheet Metal Work

The surface mounting Low Voltage Distribution Board shall be fabricated with 14 SWG sheet steel and the semi-recessed or recessed mounting type shall be fabricated with 16 SWG sheet steel.

The complete sheet steel metal work of the Low Voltage Distribution Board shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint
- Two coats of weather proof powder paint in approved colour

3.02 Components

The Low Voltage Distribution Board shall be provided with components as specified in the Specifications, mentioned in the Bill of Quantities and as shown on the Tender Drawings, required for the satisfactory operation of the distribution board and of the electrical system.

Typical component specifications are given below:

3.02.1 Bus Bars

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phase and white for neutral. The earth bus bar shall be green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

3.02.2 Moulded Case Circuit Breaker (MCCB)

The MCCB shall be moulded case, triple pole, rated for 500 Volt AC. The Operating current ratings and Rupturing capacities shall be as mentioned in the relevant items of the

Bill of Quantities and as shown on the drawings. The MCCB's shall have fixed Magnetic Short circuit and fixed Thermal Overload protections. However, the short circuit breaking capacities of triple pole moulded case circuit breaks shall be more than or at least, 25kA as per IEC 60157-2, unless specified elsewhere. All incoming Triple pole circuit breakers shall be Moulded Case Circuit Breakers. The Icu of all MCCBs shall be equal to 100% of Ics. All MCCBs should be suitable for operation (rated current) at 50 °C.
Icm should be at least 2.2 times of Icu.

The Moulded Case Circuit Breakers shall be installed in the LV switchboards such that the switching lever of the Main Incoming MCCB shall be accessible from the front of the panel with the front door in closed position and the switching levers of all outgoing MCCB's and MCB's are accessible through the front plate inside the switchboards for operations. Circuit Numbers and Designation on all circuits shall be clearly marked to facilitate connection and maintenance.

3.02.3 Miniature Circuit Breaker (MCB)

The MCB's shall be Single pole 250 Volt of current ratings as shown on the drawings. These shall have fixed magnetic short circuit and fixed thermal overload protections. The Single pole miniature circuit breakers shall have a 6 kA short circuit breaking capacity as per International standard IEC 60898 and rated for operation at 50 °C.

The Miniature Circuit Breakers shall be installed such that their switching levers are accessible through the front plate inside the Switch Boards for operations. Circuit Numbers and Designation on all circuits shall be clearly marked to facilitate connection and maintenance. These Circuit Breakers shall be suitable for working on lighting and power circuits.

3.02.4 Push Buttons

Push buttons shall be momentary make break contact type (normally open/normally close). These shall be suitable for flush mounting on Distribution board, plastic face plate etc. Push buttons shall have round/square head.

3.02.5 AC Voltmeters

AC Voltmeters shall be Digital type and shall be suitable for flush mounting on front door of the Distribution Boards. The front dimensions shall be 96 mm Wide and 48 mm high. The voltmeters shall have 3-1/2 digit, 0.55 inch display.

3.02.6 Ammeters

AC Ampere meters shall be Digital type and shall be suitable for flush mounting on front door of the Distribution Boards. The front dimensions shall be 96 mm wide and 48 mm high. The Ampere meters shall have 3-1/2 digit, 0.55 inch display.

3.02.7 Voltmeter Selector Switch

The voltmeter selector switch shall be complete with front plate, grip handle, and RY-YB-BR-OFF-RN positions.

3.02.8 Current Transformers

Air cooled, ring type current transformers shall be provided having transformation ratio as indicated on the drawings. The current transformers shall be of suitable burden having accuracy class 1.0 and have 5 amps secondary.

3.02.9 Air Break Magnetic Contactors

The contactors shall be air break, triple pole, 415 Volt suitable for the type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with 230 Volt AC single phase operating coil, and minimum two normally open (NO) and two normally closed (NC) auxiliary contacts wired up to terminals. The number of working auxiliary contacts shall be provided according to the system requirements.

3.02.10 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base, either 230 Volt neon or 12 Volt incandescent lamp through auxiliary transformer and shall have rosettes of suitable colour.

3.02.11 Line up Terminals

Line up terminals wherever provided for control of lighting, power and control circuits shall be suitable for voltage and size of conductors as indicated on drawings and as mentioned in the respective BOQ items. The line-up terminals shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

4.0 INSTALLATION

The location of distribution boards are shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in coordination with other equipment.

Low Voltage distribution board for recessed mounting in wall shall be installed such that the door shall finish flush with the surface of wall. The recess mounted distribution board shall be installed before the plastering of walls. The DB shall be protected to avoid any damage due to the civil work.

All loose parts despatched separately with the DB shall be installed as per manufacturer's instructions and all adjustments or setting shall be made, as required. All screws, nuts and bolts used for fixing the distribution board shall be galvanized. The distribution boards installation shall include connecting all incoming and outgoing cables. The cable entry in the boards shall be provided from top or bottom as required.

The distribution board body shall be connected to earth as per instructions given in section "Earthing" of these Specifications. The switchboard shall be tested and commissioned in the presence of the Engineer. The LV distribution boards shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

5.0 MEASUREMENT AND PAYMENT

5.01 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include design, fabrication, supply, installation, testing, commissioning and completion for all works specified herein and/or as shown on the Tender Drawing related to the item.

5.02 LV Distribution Board

5.02.1 Measurement

Measurement shall be made for the number of each type/designation of LV distribution boards acceptably supplied and installed by the Contractor as a complete job.

5.02.2 Payment

Payment shall be made for the number of each type/designation of jobs measured, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the LV distribution boards, including fixing arrangement and accessories for complete installation.

SECTION - 12

MEDIUM VOLTAGE SWITCHBOARD

1.0 SCOPE OF WORK

The work under this section consists of supplying, installation, testing & commissioning of all material and services of the complete Medium Voltage (MV) switchboards and accessories as specified herein or as shown on the tender drawings and given in the Bill of Quantities. The switchboard shall be got approved by WAPDA, before installation.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact location and position of the MV panel.

The MV Switchboard with accessories shall also comply with the WAPDA Specifications P-44: 96, General Specifications for Electrical Works Section-8001 and with other relevant provisions of the Tender Document.

2.0 GENERAL

The MV switchboard shall be sheet steel fabricated cubicle type totally enclosed type with IP classification IP44 dust tight and vermin proof. It shall be complete in all respect with material and accessories factory assembled, tested and finished according to the specifications and to the normal requirements.

The switchboard shall be suitable for front operation and shall:

- be suitable for addition of units on either side
- be provided with adequate clearance from live parts so that flashover cannot be caused by switching surges, vermin, pests, etc.
- be designed for flush mounting of all instruments on the front door
- have all incoming and out going connections from the bottom
- have the components mounted so as to facilitate ease of maintenance from the front
- have provision for lamp test, alarm test, alarm accept and reset facility
- be suitable for mounting on cable trenches
- be provided with anti-condensation heaters controlled automatically through adjustable thermostats for maintaining required safe operating temperature inside the panel and also avoid condensation. The heater shall also be manually operable and provided with protective miniature

circuit breaker and **ON** indication lamp

3.0 APPLICABLE STANDARDS/CODES

Latest editions of the following standards and codes shall be applicable for the materials within the scope of this section.

BS 3245	-	Bus bars
BS 30	-	Meters
IEC 5	-	High voltage AC circuit breaker
IEC 185	-	Current transformers
IEC 186 BS 3941	-	Potential transformers

4.0 MATERIAL

4.1 Medium Voltage Switchboard

The switchboard shall be manufactured and fabricated with angle-iron framework, welded, grounded, finished and clad with 12 SWG sheet steel.

The switchboard shall be supplied divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels shall be provided for fixing required size of 15kV XLPE cable. Adequate number of eyebolts shall be provided to facilitate handling.

An earth bar of appropriate cross section shall be provided and connected to the body of all sections of the switchboard. The external earth terminal shall be provided for main earth connection. The doors shall be grounded by flexible strap of copper braids.

The control cabling inside the switchboard shall be suitably numbered and harnessed by means of straps or cords. All indicating, selecting and control equipment shall be suitably arranged and labeled with clear indelible printing, indicating the rating and designation of fuses, switches etc. The nameplates shall be provided on the front of panel for each circuit and component which is accessible from outside. The nameplates shall be of stainless steel with engraved equipment designation having minimum width of 5mm. Other labeling on the switchboard such as danger signs, voltage, switchboard/ panel

identification shall be of sufficient size, legible from a distance of 10 meters.

All metal work of the switchboard shall be;

- cleaned down to bare shining metal
- De-rusted and de-greased
- Two base coats of anti-corrosive RED OXIDE paint.
- Finished inside and outside with Off White powder paint

Any interlocking if required inside the MV switchboard and between switchboard and other equipment should be provided.

4.1.1 **Capacity and Basic Data**

The switchboard shall be designed to conform to the following requirements;

Rated Current	:	As shown on drawings.
Rated Nominal Voltage	:	11 kV
Rated Maximum Voltage	:	15 kV
Power Frequency Withstand Voltage.	:	36 kV for 1 minute
Rated Short Circuit Capacity	:	450 MVA at 11 kV for one second.
Rated Breaking Currents (1 second rating)		
a. Symmetrical	:	18.4 kA
b. Asymmetrical	:	25 kA
Rated Making Current	:	2.55 times rated symmetrical Breaking current
Operating Duty	:	B-3 -MB-3 -MB
Impulse withstand Voltage	:	95 kV
Control Voltages		

Indication/Metering	:	110 Volt AC from secondary of PT
Tripping Voltage	:	Series tripping or 110 Volt DC from capacitor trip unit.

4.2 Circuit Breaker

The circuit breakers shall be triple pole, with drawable type with arc interruption in vacuum. The operating characteristics and technical data shall be as given in article 4.1.1 of this section. The bidder shall submit with his offer the type and details of equipment proposed.

The circuit breaker shall have trip free, direct acting and manually operated drive mechanism. For manual operation a handle shall be provided. The unit shall have roll-out trucks and channels for horizontal withdrawal. Interlocking device shall be provided such that the breaker can be closed only when it is in fully plugged-in or fully withdrawn position and withdrawal of circuit breaker is only possible in the open or isolated position. Safety shutters shall be provided which will automatically cover the live contacts as the circuit breaker is withdrawn. Other interlocks as essentially required for safe and proper operation of circuit breaker shall be provided. Barriers of approved heat resisting, non-tracking-insulating material shall separate the circuit breaker phases.

A triple pole grounding switch or a suitable earthing device shall be provided for cable and bus bar earthing and shall be rated to safely carry the fault current due to inadvertent closing of supply circuit breaker and also for making duty on a fault.

A triple pole grounding switch or a suitable earthing device shall be provided for cable and bus bars earthing, complete with mechanism for interlocking it with the circuit breaker and the roll-out truck and mechanical indication to show the position of grounding switch. The circuit breaker shall have automatic mechanically operated **ON** and **OFF** position indications. Luminous indications shall be provided with **ON/ OFF** and **TRIP** position. Additional indication lamps as shown on the drawings shall also be furnished. The circuit breakers shall be provided with **ON-OFF** push buttons.

Each circuit breaker shall be provided with at least three normally closed and three normally open potential free auxiliary contacts rated for 10 Amp. 230Volt AC. Provision shall be made for remote indication of the circuit breakers position/status.

A test circuit shall also be provided to facilitate testing operation of circuit breaker manually and by protective relays. Test socket with plug

shall be provided for testing the relays.

The circuit breaker shall be complete with necessary secondary wiring with ferrules to indicate the circuit. Protection shall also be provided for all control circuits.

4.3 Bus Bars

The bus bars shall be made of high conductivity electrolytic copper and shall be completely insulated and mechanically braced to safely withstand the stresses due to short-time momentary current under the fault conditions. The phase identification of bus bars shall be by the colors applied on the full length and these shall be red, yellow and blue. The clearances shall not be reduced on account of the busbar insulation or the phase barriers.

4.4 Current Transformers

Each circuit breaker shall be provided with current transformers having following ratings and characteristics:

Type	:	Cast resin
Number	:	Three single phase units
Burden	:	Suitable for load of protection and instrumentation circuits.
Accuracy	:	5% for protection and 1% for measuring with security factor 5.
Duty	:	For operating relays and instruments
CT ratio	:	As shown on the Tender Drawings
No. of cores	:	as required/as shown on drawings
Rated dynamic Current	:	2.55 times rated symmetrical short circuit current

4.5 Potential Transformers

Potential transformers (PTs shall be provided as shown on the Tender Drawings and having the following ratings and characteristics:

Type	:	Cast resin
Number	:	Three single phase units
Burden	:	Suitable for load of protection and instrumentation circuits.
Accuracy	:	Class 1.0
Duty	:	For operating relays and instruments. Each PT shall be designed to have independent secondary Windings of specified ratio for connection in star or open delta.
Voltage ratio	:	11kV/11Vs
Rated voltage factor	:	1.2 continuous and 1.0 for 30 seconds
Rated dynamic Current	:	2.55 times rated symmetrical short circuit current

4.6 Capacitor Shunt Trip Unit

In case series tripping is not provided then each circuit breaker in the MV switchboard shall be provided with 110 Volt DC trip coils, which will supply power through the capacitor trip units. The trip coils shall be fed through the relay contacts and the 'OFF' push button.

The capacitor trip unit will be fed from 110 volts secondary of potential transformer. The capacitor trip unit shall be suitable for performing two successive tripping operations carried out within five minutes.

4.7 Protective relays

The circuit breakers shall be provided with inverse definite minimum time non-directional over-current relays for phase and earth fault protection .The relays shall have the following common characteristics unless otherwise specifically mentioned:

Phase fault over current setting range:

Inverse	:	50-200 of CT secondary rating
Instantaneous	:	20-800 of CT secondary rating.

The instantaneous elements shall also have infinity setting to block their operation.

Ground-fault	:	20-80 of CT secondary rating with instantaneous element as for phase fault unit.
Time setting range	:	0-1 second
Connection	:	Secondary of CT
Auxiliary supply	:	Series tripping or through 110V

Tripping DC from capacitor trip units in each breaker panel.

Indications/control	:	110 Volt DC from secondary of PT.
Heaters and alarm	:	220 Volt DC from LV switchboard.
Auxiliary Contacts	:	Provision for remote indication as required

The relay shall preferably be triple pole type and have positive action without chatter.

4.8 Meters & Selector Switches

The meters to be provided on switchboard shall be as specified below:

4.8.1 Ammeter and Voltmeter

The ammeter and voltmeter shall be moving iron spring controlled having front dimensions of 144 x 144 mm. Voltmeters shall have measuring range of 0-15 kV and ammeters measuring range shall be as shown on the drawings. Ammeters and voltmeters shall conform to BSS accuracy class 1.5 and suitable for connection to the secondary of PTs and CTs installed on the switchboard.

4.8.2 Selector Switches

Ammeter selector switch shall be R-Y-B-OFF and voltmeter selector switch RY-YB-BR-OFF. The selector switches shall be complete with front plate and operating lever.

4.8.3 kWh and kVarh Meters

Kilowatt-hour (kWh) and Kilo volt ampere-hour (kVARh) meters shall

be suitable for 3 phase 3 wire 50 cycles balanced and unbalanced loads. The kWh meter shall also be provided with maximum demand indicator and built in switch for operation as per WAPDA requirements.

4.8.4 Alarm Indication

On occurrence of any fault in the system and subsequent tripping of circuit breakers audio alarm shall be provided on the Switchboard. Push buttons shall be provided on Panel for independent resetting of the audio alarm and fault-indicating lamp. At least two potential free contacts rated 10 Amp. AC or DC shall be available for remote connection.

4.9 Tools

One complete set of tools for routine operation setting and maintenance of MV switchboard including protective relays as recommended by manufacturer of each component shall be furnished within the price quoted for the MV switchboard. Switchboard shall be provided with independent set of tools placed in suitable box. The bidder shall furnish details of tools with his offer.

5.0 INSTALLATION

The MV switchboard shall be installed at location shown on the drawing. The cable trenches shall be constructed as part of civil works. The Contractor shall co-ordinate with the civil works for providing and openings, holes, etc., in time to avoid and breakage/damage to completed works. In case the provisions in civil works for installation of electrical equipment are not made or made incorrect, the same shall be rectified by the Contractor at his own cost and to the satisfaction and approval of Engineer.

The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material approved by the Engineer. All installation materials for physically erecting the switchboard such as bolts, nuts, washers, supporting steel, etc. shall be provided and installed by the Contractor. The switchboard shall be installed upright and in level and shall be firmly and rigidly bolted on the floor and concrete supports. All wiring external from MV switchboard to alarm indication control unit protection interlock circuits and for auxiliary power supply for heaters, etc., will be furnished and installed by the Contractor in consultation with the Engineer.

The switchboard shall be erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. And safety locking of meters relays, etc., provided by the manufacturer for safe transport shall be released only after the switchboard is

erected in position.

Necessary provision shall be made in the MV switchboard for incoming/outgoing cables and installation of cable termination kits, keeping in view both cable and switchboard manufacturer's recommendations. The cable armour shall be connected to the earth system.

The switchboard body shall be connected to earth as per instructions given in section "Earthing" of these Specifications. The switchboard shall be tested and commissioned in the presence of the Engineer. The tests to be carried out shall be as recommended by the international standard to which the switchboard is manufactured and/or as recommended by manufacturer» but as a minimum the tests given in section "Testing" of these Specifications shall be carried out.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include design supplying, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

6.2 Medium Voltage Switchboard

6.2.1 Measurement

Measurement shall be made for the complete job of MV Switchboard including all mounting, installation and operational accessories acceptably supplied as a complete job.

6.2.2 Payment

Payment shall be made for the total number of jobs measured as provided above at the Contract unit price each and shall constitute full compensation for supplying, installation, testing and commissioning of the MV switchboard including all mounting, installation and operational accessories.

SECTION - 13

LOW VOLTAGE SWITCHBOARDS, MAINTENANCE BY-PASS SWITCH, POWER FACTOR IMPROVEMENT PLANT AND BUS TIE DUCT

1.0 SCOPE OF WORK

The work under this section consists of design, manufacturing, fabricating, supplying, installing, testing, and commissioning of all material and services of the complete LV (LV) (415 Volt) switchboard, Maintenance By-Pass Switch (MBS), Power Factor Improvement (PFI) Plant and Bus Tie Duct (BTD) for indoor installation as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical equipments and power & control cables layout with the Engineer and co-ordinate at site with other services for exact locations and positions of the electrical lines and equipments.

The LV (415 Volt) switchboards, MBS, PFI Plant and BTD with all other required accessories shall also comply with the General specifications for Electrical Works Section-8001 and with other relevant provisions of the Tender Documents.

2.0 GENERAL

2.1 Low Voltage (415 Volt) Switchboard

The LV (415 Volt) switchboard shall be sheet steel fabricated. The LV (415 Volt) switchboard shall be free standing cubicles on floor.

The free standing cubicles shall be modular in design with facility and provisions for expansion/ addition of additional cubicles in future

These shall be suitable for indoor installation on cable trenches. The LV (415 Volt) switchboard shall be totally enclosed, dust and damp proof. The LV (415 Volt) switchboard shall be complete in all respects with material and accessories, factory assembled, tested and finished according to the Specifications and to the normal requirements.

All components of LV (415 Volt) switchboards shall be installed on a common mounting plate inside the enclosure. The enclosures of LV (415 Volt) switchboards and Bus Tie Duct shall be provided with rubber gasket and a lockable hinged door with cam fastener. The switching lever of the Main incoming Air Circuit Breaker (ACB)/Moulded Case Circuit Breaker (MCCB) of LV (415 Volt) switchboards shall be accessible from outside of the panel

doors in closed position. Switching levers of all outgoing MCCBs and MCBs shall only be accessible with the panel doors in open position.

The LV (415 Volt) switchboards shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for LV (415 Volt) switchboards to accommodate the cables and conduits may be provided. The box shall be of the same material and finish as the switchboard.

The cabling inside the switchboard shall be suitably harnessed by means of straps or cords. For the LV (415 Volt) switchboards an earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of switchboard at two points.

The LV (415 Volt) switchboards, in general, shall;

- be suitable for indoor installation & operation
- be suitable for operation and maintenance from front side
- be suitable for 415 Volt, 3 phase 4 wire, 50 Hz system
- have all components rated for insulation class of 600V min
- be designed for flush mounting of all instruments on the front
- be provided with adequate clearance from live parts so flash overs can not be caused by switching, vermin, pests, etc.
- have incoming/outgoing cable termination arrangements. The power cables shall be directly connected to the terminals of TP 500V MCCBs of current ratings of 100 Amps and above. The SP/TP MCBs and/or MCCBs of current ratings upto and including 100 Amps shall be connected to DIN rail mounted wiring terminals of appropriate ratings, numbers and sizes for the outgoing wiring cables
- be provided with name plate on the front side of door for each incoming/outgoing circuits
- be provided with pocket inside of door for safe keeping of the detailed as-built wiring/ shop diagrams of the

switchboard

- have provisions for incoming and outgoing cables entry, connections and termination arrangements from top and/ or bottom plates as per site requirements

- have all openable doors grounded with the use of flexible copper cable/strip of 10 sqmm cross-sectional area, at least

2.2 Maintenance By-Pass Switch (MBS)

The Maintenance by-pass switch shall be used for supply of power either from power transformer or DG set in case of faults in AMF Panel.

2.3 Power Factor Improvement (PFI) Plant

The Power factor Improvement Plant shall be used for improving the system power factor to keep the same within the limits as prescribed by WAPDA.

2.4 Low Voltage (415 Volt) Bus Tie Duct (BTD)

The LV (415 Volt) Bus Tie Duct shall be sheet steel fabricated. The LV (415 Volt) Bus Tie Duct shall be suitable for indoor installation. The Bus Tie Duct shall be suitable for indoor mounting on CC wall and RCC columns surfaces as shown on the drawings. The Bus Tie Duct shall be totally enclosed, dust and damp proof.

The Bus Tie Duct shall be designed to withstand a short circuit as specified for the associated LV switchboard. The current rating shall be as given in Bill of Quantities. The Bus-Tie Duct shall be three phase and neutral, rated for 415 Volt, 50 Hz system.

The LV (415 Volt) Bus Tie Duct shall be complete in all respects with material and accessories, factory assembled, tested and finished according to the Specifications and to the normal requirements.

The Contractor shall supply the bus-tie duct keeping in view all the installation, operation and maintenance factors as per site conditions and requirements and shall be solely responsible for the proper design configurations and dimensions of the bus-tie duct for complete alignment.

The LV (415 Volt) Bus Tie Duct, in general, shall;

- be suitable for indoor installation & operation

- be suitable for operation and maintenance from front/ rear sides
- be suitable for 415 Volt, 3 phase 4 wire, 50 Hz system
- have all components rated for insulation class of 600V min
- have name plates on the front & rear sides at every 5 meter
- have suitable provisions for incoming and outgoing cables entry, connections, termination arrangements as per site requirements
- have all openable doors grounded with the use of flexible copper cable/strip of atleast10 mm^2 cross-sectional area

3.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope of this Section :

IEC 947	-	Triple pole Air Circuit Breakers
BS 4752-1	-	Triple pole Moulded Case Circuit Breaker
VDE 0641	-	Single and Triple pole Miniature Circuit IEC 947 Breaker
IEC 947	-	LV Switch gear and Control gear
IEC 439	-	Factory Built Assemblies of LV Switchgear
IEC 4752	-	Switch gear and control gear for Voltages upto and including 1 kV
BS 88	-	HRC Fuses
IEC 73	-	Colors for indicator lights and push buttons.
IEC 446	-	Identification of insulated/bare conductors

4.0 MATERIAL

4.1 Low Voltage (415 Volt) Switchboard

4.1.1 Sheet Metal Work

The enclosures for the LV (415 Volt) switchboards shall be fabricated with 14 SWG sheet steel. The front doors shall be

fabricated with 12 SWG sheet steel.

The complete sheet steel metal work of the LV (415 Volt) switchboards shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint.
- Two coats of weather proof powder paint in approved colour.

4.1.2 Components

The LV switchboard shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Tender Drawings required for the satisfactory operation of the switchboard and of the electrical system.

Typical component specifications are given below:-

4.1.2.1 Bus Bars

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.1.2.2 Moulded Case Circuit Breaker (MCCB)

The MCCB shall be moulded case, triple pole, rated for 415 Volt AC. The Operating current ratings and Rupturing capacities shall be as mentioned in the relevant items of the Bill of Quantities and as shown on the drawings. The MCCBs shall have fixed Magnetic Short circuit and fixed Thermal Overload protections. All incoming Triple pole circuit breakers shall be MCCBs.

The Moulded Case Circuit Breakers shall be installed in the LV switchboards such that the Switching levers of Main Incoming MCCB and all outgoing MCCBs and MCBs shall be accessible from inside the front of the panel with the front door in closed position. Circuit numbers and designation on all circuits shall be clearly marked to facilitate connection and maintenance.

4.1.2.3 Miniature Circuit Breaker (MCB)

The MCBs shall be Single pole 250 Volt and Triple pole 415 Volt of current ratings as shown on the drawings. These shall have fixed magnetic short circuit and fixed thermal overload protections. The Single pole and Triple pole miniature circuit breakers shall have a 10,000 Amperes short circuit breaking capacity as per International standards IEC 157 Category P2.

The Miniature Circuit Breakers shall be installed such that their switching levers are accessible through the front plate inside the switchboards for operations. Circuit Numbers and Designation on all circuits shall be clearly marked to facilitate connection and maintenance. These Circuit Breakers shall be suitable for working on lighting and power circuits.

4.1.2.4 Air Break Magnetic Contactors

The contactors shall be air break, triple pole, 415 Volt suitable for the type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with 230 Volt, AC single phase operating coil, and minimum two normally open (NO) and two normally closed (NC) auxiliary contacts wired upto terminals. The number of working auxiliary contacts shall be provided according to the system requirements.

4.1.2.5 Push Buttons

Push buttons shall be momentary make break contact type (normally open/normally close). These shall be suitable for flush mounting on switchboard, plastic faceplate etc. Push buttons shall have round/square head. These shall be of red color for 'ON' and green color for 'OFF' operations.

4.1.2.6 AC Voltmeters

AC Voltmeters shall be digital type and shall be suitable

for flush mounting on front door of the switchboards. The front dimensions shall be 96 mm Wide and 48 mm high. The voltmeters shall have 3-1/2 digit, 0.55-inch display. The AC digital voltmeters shall have measuring range of 0 to 1999 Volt AC. It shall be suitable for power supply of 110/220 Volt AC ±10% at 50/60 HZ.

4.1.2.7 Ammeters

AC Ammeters shall be digital type and shall be suitable for flush mounting on front door of the switchboards. The front dimensions shall be 96 mm wide and 48 mm high. The Ampere meters shall have 3-1/2 digit, 0.55-inch display. The AC digital voltmeters shall have measuring ranges as shown on the drawing and given in the Bill of Quantities. It shall be suitable for power supply of 110/220 Volt AC ±10% at 50/60 Hz.

4.1.2.8 Voltmeter Selector Switch

The voltmeter selector switch shall be complete with front plate, grip handle, and RY-YB-BR-OFF-RN positions.

4.1.2.9 Ampere meter Selector Switch

The ampere meter selector switch shall be complete with front plate, grip handle, and R-Y-B-OFF positions.

4.1.2.10 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base, 230-Volt neon lamp and shall have rosettes of suitable colour.

4.1.2.11 Current Transformers

Air-cooled, ring type current transformers shall be provided having transformation ratio as indicated on the drawings. The current transformers shall be of suitable burden having accuracy class 1.0 and have 5 amps secondary.

4.1.2.12 Line up Terminals

Line up terminals wherever provided for control of lighting, power and control circuits shall be suitable for voltage and size of conductors as indicated on drawings and as mentioned in the respective BOQ items. The line-up terminals shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing

clips, transparent label holder caps and label sheets with marking shall be provided.

4.2 Low Voltage (415 Volt) Bus Tie Duct

4.2.1 Sheet Metal Work

The complete enclosures for the LV (415 Volt) Bus Tie Duct shall be fabricated with 14 SWG sheet steel.

The complete sheet steel metal work of the LV (415 Volt) Bus Tie Duct shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint.
- Two coats of weather proof powder paint in approved colour.

4.2.2 Components

The LV Bus Tie Duct shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Tender Drawings required for the satisfactory operation of the Bus Tie Duct and of the electrical system.

Typical component specifications are given below:-

4.2.2.1 Bus Bars

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be painted green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.2.2.2 Insulators

The insulators for mounting of Busbars shall be suitable

for 3 phase, 4 wire, 415 Volt AC operation as shown on the drawings.

4.2.2.3 Insulating supports

The insulating supports for mounting of busbars inside the sheet steel enclosure shall be of suitable material and thickness to provide the required insulation. These shall also be suitable to withstand the physical weights of the busbars.

4.2.2.4 Nuts, Bolts and Washers

The nuts, bolts and washers for the Bus Tie Duct shall be made of galvanized steel suitable for long life operation.

4.3 Power Factor Improvement (PFI) Plant

4.3.1 Sheet Metal Work

The complete enclosures for the Power Factor Improvement Plant shall be fabricated with 14 SWG sheet steel.

The complete sheet steel metal work of the Power Factor Improvement Plant shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint
- Two coats of weather proof powder paint in approved colour

4.3.2 Components

The Power Factor Improvement Plant shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Tender Drawings required for the satisfactory operation of the Power Factor Improvement Plant and of the electrical system.

Typical component specifications are given below:

4.3.2.1 Bus Bars

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be painted green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.3.2.2 Insulators

The insulators for mounting of busbars shall be suitable for 3 phase, 4 wire, 415 Volt AC operation as shown on the drawings.

4.3.2.3 Insulating supports

The insulating supports for mounting of busbars inside the sheet steel enclosure shall be of suitable material and thickness to provide the required insulation. These shall also be suitable to withstand the physical weights of the busbars.

4.3.2.4 Nuts, Bolts and Washers

The nuts, bolts and washers for the Bus Tie Duct shall be made of galvanized steel suitable for long life operation.

4.3.2.5 Power Factor Regulator

The Power Factor Regulator shall be suitable for sensing power factor in a Three Phase unbalanced load network. The Power Factor meter shall be digital. The regulator shall have provision for Automatic cum Manual operation. The operating voltage shall be same as that for the associated LV switchboard.

The Power Factor Regulator shall be microprocessor controlled for fast computer programming at site. It shall have provisions for sensing connection errors.

4.4 Maintenance By-Pass Switch (MBS)

4.4.1 Sheet Metal Work

The complete enclosures for the Maintenance By-Pass

Switch shall be fabricated with 14 SWG sheet steel.

The complete sheet steel metal work of the Maintenance By-Pass Switch shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint
- Two coats of powder paint in approved colour

4.4.2 Components

The Maintenance By-Pass Switch shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Tender Drawings required for the satisfactory operation of the Maintenance By-Pass Switch and of the electrical system.

Typical component specifications are given below:

4.4.2.1 Bus Bars

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be painted green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.4.2.2 Insulators

The insulators for mounting of Busbars shall be suitable for 3 phase, 4 wire, 415 Volt AC operation as shown on the drawings.

4.4.2.3 Insulating supports

The insulating supports for mounting of busbars inside the sheet steel enclosure shall be of suitable material and thickness to provide the required insulation. These

shall also be suitable to withstand the physical weights of the busbars.

4.4.2.4 Nuts, Bolts and Washers

The nuts, bolts and washers for the Bus Tie Duct shall be made of galvanized steel suitable for long life operation.

4.4.2.5 Air Break Magnetic Contactors

The contactors shall be air break, triple pole, 415 Volt suitable for the type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with 230 Volt AC single phase operating coil, and minimum two normally open (NO) and two normally closed (NC) auxiliary contacts wired upto terminals. The number of working auxiliary contacts shall be provided according to the system requirements.

4.4.2.6 AC Voltmeters

AC Voltmeters shall be digital type and shall be suitable for flush mounting on front door of the switchboards. The front dimensions shall be 96 mm Wide and 48 mm high. The voltmeters shall have 3-1/2 digit, 0.55-inch display. The AC digital voltmeters shall have measuring range of 0 to 1999 Volt AC. It shall be suitable for power supply of 110/220 Volt AC $\pm$10% at 50/60 HZ.

4.4.2.7 Voltmeter Selector Switch

The voltmeter selector switch shall be complete with front plate, grip handle, and RY-YB-BR-OFF-RN positions.

4.4.2.8 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base, 230-volt neon lamp and shall have rosettes of suitable colour.

4.4.2.9 Line up Terminals

Line up terminals wherever provided for control of lighting, power and control circuits shall be suitable for voltage and size of conductors as indicated on drawings

and as mentioned in the respective BOQ items. The line-up terminals shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

5.0 INSTALLATION

5.1 Low Voltage (415 Volt) Switchboard

The location of LV switchboards is shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in coordination with other equipment.

LV switchboard for floor mounting shall be installed on already prepared CC cable trenches. The LV switchboards shall be protected to avoid any damage due to the civil work.

All loose parts dispatched separately with the switchboard shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws, nuts and bolts used for fixing the switchboard shall be galvanized.

The switchboards installation shall include connecting all incoming and outgoing cables. The cable entry in the boards shall be provided from top or bottom as required.

The switchboard body shall be connected to earth as per instructions given in section "Earthing" of these Specifications. The switchboard shall be tested and commissioned in the presence of the Engineer. The LV switchboards shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

5.2 Low Voltage (415 Volt) Bus Tie Duct (BTD)

The Bus-Tie Duct shall be installed at the locations as shown on the drawings. All installation materials steel hangers brackets supports etc. as required and recommended by the manufacturer for safe erection shall be provided and installed by the Contractor without any additional cost. The bus tie duct shall be carefully aligned and all steel supports made of bolted connections using nuts bolts washers etc. shall be provided by the Contractor. All material and accessories shall be galvanized /rustproof. The section of copper bars of the bus tie duct requiring bolting together shall be thoroughly cleaned at site. A coat of conductive oxide inhibitor compound to be applied on the surface to be connected and the sections bolted together by means of torque

wrenches using the bolts provided by the manufacturer. The bus tie duct shall be tested and commissioned in the presence of the Engineer or his representative at the manufacturer's works. After successful completion of tests the contractor shall furnish Test certificates. The bus tie duct shall be tested at site before energizing as per article “Testing” Section - 8001 of these Specifications.

5.3 Power Factor Improvement (PFI) Plant

The location of Power Factor Improvement Plant is shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in coordination with other equipment.

Power Factor Improvement Plant shall be installed on already prepared CC cable trenches. The Power Factor Improvement Plant shall be protected to avoid any damage due to the civil work.

All loose parts dispatched separately with the Power Factor Improvement Plant shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws nuts and bolts used for fixing the Power Factor Improvement Plant shall be galvanized.
The Power Factor Improvement Plant body shall be connected to earth as per instructions given in section "Earthing" of these Specifications.

The Power Factor Improvement Plant shall be tested and commissioned in the presence of the Engineer. The Power Factor Improvement Plant shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

5.4 Maintenance By-Pass Switch (MBS)

The location of Maintenance By-Pass Switch is shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in coordination with other equipment.

Maintenance By-Pass Switch shall be installed on already prepared CC cable trenches. The Maintenance By-Pass Switch shall be protected to avoid any damage due to the civil work.

All loose parts dispatched separately with the Maintenance By-Pass Switch shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws, nuts and bolts used for fixing the Maintenance By-Pass Switch shall be galvanized.

The Maintenance By-Pass Switch installation shall include connecting all incoming and outgoing cables.

The Maintenance By-Pass Switch body shall be connected to earth as per instructions given in section "Earthing" of these Specifications. The Maintenance By-Pass Switch shall be tested and commissioned in the presence of the Engineer. The Maintenance By-Pass Switch shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications for Electrical Works (Section-8001).

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include design, fabrication, supply, installation, testing, commissioning and completion for all works specified herein and/or as shown on the Tender Drawing related to the item.

6.2 Low Voltage Switchboard

6.2.1 Measurement

Measurement shall be made for the number of each type/ designations of LV switchboards acceptably supplied, installed, tested and commissioned by the Contractor as a complete job.

6.2.2 Payment

Payment shall be made for the number of each type/designations of jobs measured, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the LV switchboards, including fixing arrangement and accessories for complete installation.

6.3 Low Voltage Bus-Tie Duct

6.3.1 Measurement

Measurement shall be made for the running meters of

each type of LV bus-tie duct acceptably supplied, installed, tested and commissioned by the Contractor as a complete unit.

6.3.2 Payment

Payment shall be make for the number of running meters of each type of units measured as provided above at the Contract unit prices each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of the LV Bus Tie Duct including all installation materials such as hangers, brackets, supports, nuts, bolts, washers, sheet steel covers, ECC etc.

6.4 Power Factor Improvement Plant

6.4.1 Measurement

Measurement shall be made for the number of each type/ designations of Power Factor Improvement Plant acceptably supplied, installed, tested and commissioned by the Contractor as a complete job.

6.4.2 Payment

Payment shall be made for the number of each type/designations of jobs measured, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the Power Factor Improvement Plant, including fixing arrangement and accessories for complete installation.

6.5 Maintenance By-Pass Switch

6.5.1 Measurement

Measurement shall be made for the number of each type/ designations of Maintenance By-Pass Switch acceptably supplied, installed, tested and commissioned by the Contractor as a complete job.

6.5.2 Payment

Payment shall be made for the number of each type/designations of jobs measured, as provided above, at the Contract unit price each for design, fabricating,

supplying, installing, testing, and commissioning of the Maintenance By-Pass Switch, including fixing arrangement and accessories for complete installation.

SECTION - 14

MISCELLANEOUS ITEMS

1.0 GENERAL

The work under this section consists of supplying, installing, testing and commissioning of all material and accessories for Miscellaneous Items as specified herein and/or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact locations and positions of the Miscellaneous Items.

The Miscellaneous Items with accessories shall also comply with the General Specifications for Electrical Works Section - 1 and with other relevant provisions of the Tender Document and latest WAPDA Specifications.

The miscellaneous items as described in this section shall comply with other sections of these Specifications as applicable. No specific reference to any manufacturer has been made and the Contractor shall ensure that all the miscellaneous items be supplied/fabricated from the reputable manufacturers, who have already supplied/fabricated similar items.

2.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards/codes shall be applicable to the material specified within the scope of this Section:

BS 4934	-	Safety requirements for electric fans and regulators
BS 5060	-	Performance of circulating fans and their regulators
BS 4752	-	Switchgear & controlgear for voltages upto 1000 volt
IEC 60439	-	Factory built assemblies of LV switchgear & controlgear

3.0 MATERIAL

3.01 MCB/MCCB Enclosed in Sheet Steel Box

The single pole 250 Volts miniature circuit breakers (MCB) and triple pole 500 Volts moulded case circuit breakers (MCCB) are used for supplying single phase/three phase power to the equipment shown on the Drawings and given in the Bill of Quantities.

The MCB/MCCB shall conform to the same specifications as given in section LV distribution boards of these specifications. It shall be

installed in a 14 SWG sheet steel box of such a size which can easily accommodate the MCCB and incoming/outgoing wires or cables. Sufficient numbers of PVC connectors shall also be provided inside the sheet steel box for terminating the earth continuity conductors and neutral wires. The front plate fixed on the sheet steel box shall be of sheet steel fixed with G.I. screws having an opening for operating the ON-OFF lever of MCB/MCCB.

3.02 Ceiling Fan

Ceiling fan shall be capacitor type, suitable for 250 Volt AC. The air displacement shall be 12,000 cfm for 56" (1422 mm) sweep and 10,000 cfm for 48" (1219 mm) sweep at maximum speed. The fan motor shall be capacitor type and bearing shall be groove type to give noiseless operation.

The down rod of ceiling fans shall be appropriate length such that the ceiling fan motor and blades are minimum 12 inches below false ceiling.

3.03 Ceiling Hook for Fan

The fan hook shall be made of 16 mm diameter mild steel rod. It should be in the form of a loop about 75 mm long and about 50 mm wide. The rod should be bent to have at least 200 mm extension on both sides for tying to reinforcement steel of slab. The fan shall be deluxe model, of specified make.

3.04 Wall Bracket Fan

Fan motor shall be capacitor type and bearing shall be groove type to give noiseless operation. The fan regulator shall be built-in type with high grade steel laminations and shall have five speed marks and one "OFF" mark. The fan shall be finished in white colour, matching the ceiling and shall be of specified make.

3.05 Exhaust Fans

Exhaust fans shall be of plastic body and blades. The 6" dia fans shall have circular frame suitable for fixing in window glass. It shall have a card control shutter. The 9" and 12" exhaust fans shall have square shaped plastic body and blades. It shall be suitable for installation in wall openings. The fan shall have a card switch for reversible operation.

4.0 INSTALLATION

4.01 General

The mounting heights of all the miscellaneous items are stated on the drawings or in general notes. In case the mounting height is not mentioned, the instructions of the Engineer shall be obtained before fixing the item.

4.02 MCB/MCCB Enclosed in Sheet Steel Box

The miniature/moulded case circuit breakers (MCB/MCCB) shall be installed on 1.63 mm (16 SWG) thick sheet steel box with screws or some suitable arrangements as approved by Engineer. White face plate for sheet steel box shall be fixed by means of flat head galvanized screws sunk in the plastic plate so as to finish flush with the wall surface. The edges of the plate shall be chamfered.

4.03 Ceiling Fan

Fan hook shall be installed in the RCC ceiling and to the reinforcement before pouring of concrete. The installation of fan shall include fixing of blades, down-rod, clamp, canopy, including testing and commissioning.

The down rod shall be of required length having long threads and shall be provided with check nuts to secure it firmly with the clamp and with the body of the fan. A split pin shall be provided both at the fan body end and at the clamp for safety. Any scratches on the body of the fan or fan rod appearing during installation shall be cleaned and painted properly with the same quality paint as provided by the manufacturer.

Wiring between the ceiling rose and the fan terminals shall be three core 1.5 mm^2 PVC insulated, PVC sheathed flexible cable.

4.04 Wall Bracket Fan

Wall bracket fan shall be installed on wall at locations shown on the drawings as per manufacturer's recommendations. Wiring between wall fan point and fan shall be with 3 core 1.5 mm^2 PVC insulated, PVC sheathed flexible cable.

4.05 Exhaust Fans

The exhaust fans shall be installed in window glass or in wall openings as required.

5.0 MEASUREMENT AND PAYMENT

5.01 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein, as shown on the Tender

Drawings and given in the Bill of Quantities related to the item.

5.02 MCB/MCCB Enclosed in Sheet Steel

5.02.1 Measurement

Measurement shall be made for the number of each item acceptably supplied and installed by the Contractor as a complete unit.

5.02.2 Payment

Payment shall be made for the number of units measured as provided above at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and completion of each item including sheet steel outlet box, plate and accessories as required.

5.03 Ceiling Fans

5.03.1 Measurement

Measurement shall be made for each type of Ceiling fan & accessories acceptably supplied and installed by the Contractor as a complete unit.

5.03.2 Payment

Payment shall be made for the number of units measured as provided above at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of Ceiling fans including mounting, accessories such as nuts, bolts, hooks, down rod of appropriate length etc. and wiring between ceiling rose and fan terminals complete in all respects.

5.04 Wall Bracket Fans

5.04.1 Measurement

Measurement shall be made for each type of wall Bracket fan & accessories acceptably supplied and installed by the Contractor as a complete unit.

5.04.2 Payment

Payment shall be made for the number of units measured as provided above at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting,

testing and commissioning of wall Bracket fans including mounting, accessories such as nuts, bolts, hooks, etc. and wiring between ceiling rose and fan terminals complete in all respects.

5.05 Exhaust Fans

5.05.1 Measurement

Measurement shall be made for each type of Exhaust fan & accessories acceptably supplied and installed by the Contractor as a complete unit.

5.05.2 Payment

Payment shall be made for the number of units measured as provided above at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of Exhaust fans including mounting, accessories such as nuts, bolts, etc. and wiring between ceiling rose and fan terminals complete in all respects.

SECTION - 15

LOW VOLTAGE DG SET & AUTO MAINS FAILURE/ STARTUP (AMF/ATS) PANEL AND SYNCRONIZING PANEL

1.0 DESCRIPTION

The work under this section consists of supplying, installation, testing & commissioning of all material & accessories with one (01) year of warranty from the date of installation after successful testing & commissioning for the complete Diesel Generators of Prime rating (at 50^0C), duly to be established by the manufacturers derating curves, losses and efficiencies of the engine, alternator and DG Set including but not limited to power cables, Automatic Mains Transfer Switch/Automatic Main Failure Switch Panel, LV Switchgear, fuel tanks (including day and underground storage tanks), control panels, canopy, all accessories as specified here-in, and given in the Schedule of Prices.

The Diesel Generator (Prime rating) set shall be a standard design in accordance with the latest applicable International Standards of a reputed manufacturer, who shall have similar units in operations for similar applications and field conditions.

The DG set shall be of prime rated duty and suitable for indoor/ outdoor (as applicable) installation. It shall be capable for unbalanced loads up to 30% of actual load and for continuous part load operation. The set shall be capable of starting and operating at the rated output as per the climatic conditions (typical range given in the following table) and at an altitude of the site of installation (given level of the site of installation in meters above mean sea level). The power rating shown in the relevant section of Schedule of prices (bill of quantities) is the power rating required to be delivered to load by the diesel generator set after applying all de-rating factors relevant to the site.

The table below shows the ambient temperatures (see definition (1) and the relative humidity rates to which the equipment can be submitted according to the category they belong; the later may be stated by the particular specifications.

Climatic Conditions

Category	**I**		**II**		**III**	
Rated operating range (2)	T1: +15ºC	T2: +30ºC	T1: -5ºC	T2: +45ºC	T1: -25ºC	T2: +55ºC
Maximum operating limits (3)	T3: +5ºC	T4: +40ºC	T3: -10ºC	T4: +60ºC	T1: -15ºC	T2: +60ºC
Maximum relative humidity	75% at +23ºC		80% at +23ºC		100% at +45ºC	
Operating location example	Air conditioned room		Non air conditioned room		Outdoor	

1. Ambient temperature (IEC 60441-02-06)

   Temperature determined within specified conditions of the air which surrounds the whole equipment.

2. Rated operating range:

   Range of values at which equipment performs within specifications.

3. Maximum operating limits:

   Range of values at which equipment can still work without deterioration or degradation of its operating qualities.

The DG set ratings must be substantiated with manufacturer's standard published data. The Diesel Generator set after reducing the power absorbed by the auxiliaries, shall deliver rated power output under the site conditions. All auxiliaries, accessories and connections between systems along with all necessary cables, fittings, hardware, etc., for complete installation of Diesel engine, Generator, control panel, including fuel & oil storage, exhaust system, etc., shall be furnished by the manufacturer.

The engine shall be directly coupled to the generator, and shall have a rated speed of 1500 rpm. The set shall be capable of sustaining without damage, 25% over speed under any abnormal operating condition.

The engine-generator set shall be mounted on suitable rigid steel base frame with vibration isolators. Heavy duty lifting eyes and/or jacking screws shall be provided on the skid. The foundation bolts and all other material/hardware for complete installation of the set, as required, shall be furnished with the set. Any excessive torsional vibration shall be avoided for both engine and alternator. The set shall be suitable for full load starting. When the generator is operating at no-load, the application of full load current, taking into account the surge due to starting of equipment, should be possible with maximum transient voltage drop of 15% of the rated voltage. The time taken to restore the generator voltage to 97% of rated value should not exceed 1.5 seconds. The set shall be capable for starting and accepting full load within 15 seconds after receipt of starting signal. The Manufacturer shall submit the equipment layout and other installation details along with the bid.

The details and technical data concerning Diesel Generator set shall be submitted with tender bid. Where required the documents from the manufacturer shall be furnished in support of the information furnished.

The alternator and engine shall be as follows:

Alternator Make/Brand:

Siemens, Newage/Stamford/Cummins, Lorrey-Sommer, Cater Pillar/ Olympian or approved equivalent.

Diesel Engine Make/Brand:

Volvo, Perkins, Cummins, Mitsubishi, John Deere, Cater Pillar or approved equivalent.

Operating Console:

DeepSea, Power Wizard, APM, Intli Compact, DataCom or equivalent

Warranty

The DG Sets shall be supplied from the manufacturers/authorized agents or firms having strong local presence duly authorized by the manufacturer for sales, services and after sales back up support system and facilities along with suitable full time operation and maintenance experience with Pakistan.

The manufacturer/ authorized agent shall also have adequate maintenance facilities in the vicinity of Project with mechanically qualified and experienced personnel trained for operation and on-site maintenance of the equipment & materials offered by the Manufacturer in his bid.

To verify the capability of after sales service backup support locally in Pakistan, following shall be furnished by the contractor with duly verifiable documentary evidence from the supplier:

1) Complete company profile of the supplier, in house testing facilities, testing procedures, testing equipment/tools details.
2) Valid Nomination letter/dealership certificate from the DG set manufacturer for the supplier.
3) Successfully completed project reference list of the DG sets clearly indicating the project names, rating of the DG sets & quantity supplied alongwith the satisfactory performance certificates from the customers/authorities.
4) List of projects for which the supplier already providing O&M services alongwith customer satisfactory operational certificates for O&M.

The projects for which certificates shall be provided must be comparable in terms of quantities of the DG sets maintained.

The DG sets supplier /authorized agent/assembler shall be responsible for providing one (01) year of standard warranty and during the warranty period the supplier /authorized agent/assembler of the DG sets shall be fully responsible for replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through the manufacturer/authorized agents under the supervision of the contractor.

The involvement of the manufacturer/authorized agent for maintenance/replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacturer recommended methodology/components installation is not followed.

Undertaking in this regard shall be submitted by the contractor as well as manufacturer/authorized agent/assembler to the Client.

2.0 APPLICABLE STANDARDS/CODES

The Diesel Engine and Generator set shall conform to the following standards as applicable.

ISO3046	-	(Reciprocating internal combustion engines)
BS 4999	-	General Requirements for Rotating Electrical Machines.
DIN EN 12285-2;2005	-	Horizontal Steel Tanks for the Storage above Ground of Petroleum Products in Liquid Form.

For other equipment and materials related to the Diesel Generator set, the Manufacturer shall follow relevant international standards.

3.0 MATERIAL REQUIREMENTS

3.1 Diesel Engine

3.1.1 General

The Diesel Engine shall be four strokes, compression ignition, suitable for Emergency supply duty. Starting shall be through motor operated

electric starter. The engine shall be equipped with an alternator type automatic charging system to charge the batteries during running of engine. The engine shall be provided with required auxiliaries, guarantees of fuel consumption, acceptance tests, torsional vibration characteristics.

3.1.2 Air Intake

Air intake shall be through turbo charger and equipped with dry type filter. Suitable attenuators shall be installed to reduce noise at the air inlet. The filter assembly shall be constructed of non-corrosive materials.

3.1.3 Engine Cooling

Engine shall have a forced air draft, water cooled radiator supplied with a core guard. Cooling system shall have an engine driven centrifugal pump for cooling water circulation. Cooling shall be thermostatically controlled. An engine shut down timer shall be provided to keep the engine running on no-load after any operation of set, so that the engine is sufficiently cooled to start again instantly, if required, without rise in temperature above safe limits. The radiator shall be designed to cool the engine at specified output in ambient temperature upto maximum value. Radiator flexible ducting, flange and all necessary ductwork, flexible connections, fittings and supports shall be supplied to extend from the radiator to the exhausts louvers so that hot air from the radiator escapes freely to the outside of the building.

3.1.4 Engine Lubrication

A gear type positive pressure lubrication pump shall be provided with efficient filtration arrangement for the lubrication system. A 230Volt AC mains-operated heater with thermostat shall be provided in the crankcase. The heater shall be designed for automatic switching to ensure that temperature of oil is maintained for proper operation of the engine.

3.1.5 Speed Governor

The speed governor shall be electronic or digital complying with the requirements BS ISO 3046 or latest applicable international standard. Governor shall regulate engine speed so as to maintain the generator frequency within ±2% of the rated frequency. Stable engine speed shall be attained within 15 seconds after the engine has been started. Stable engine speed shall be restored within 10 seconds of any sudden change in load, from no load to full load. During this change of load or surge, the speed shall not vary by more than ±5% of the rated speed. Means shall be provided on the engine to shut down the engine automatically in the event that the engine speed exceeds the "shutdown" speed.

3.1.6 Fuel System

Engine shall operate on Commercial High-Speed Diesel oil. A fuel oil strainer/filter shall be provided in the fuel line along with a water

separator. Fuel system for Diesel engine shall not require any priming. The fuel system shall comprise;

- Fuel storage tank(s)
- Day Tanks
- Fuel transfer pumps
- Piping

The fuel day tank shall have capacity to store fuel oil for twenty four (24) hours continuous operation of the set at the rated output. The tank shall have level switch for monitoring low fuel level in the tank. The low-level switch shall provide an annunciation and prevent starting of set and to stop the set when the fuel in day tank is at this level. The tank shall be provided with overflow, vent, supply and discharge valves, inspection cover, drain valve and glass sight gauge.

The fuel day tank shall be designed, fabricated and finished in accordance with the requirements of DIN EN 12285-2;2005 - Horizontal Steel Tanks for the Above Ground Storage of Petroleum Products in Liquid Form. The fuel day tank shall be incorporated in the steel base frame of the DG set. The structural steelwork shall be protected from corrosion.

The fuel piping to be furnished shall include fuel supply pipe from tank to the set, over flow pipe from the set to the tank, level indicator, fuel cap with breather, drain pipe from the tank.

Drain Line: The day tank drain tank shall be accessible and equipped with a shut off valve. Self supporting day tank shall be arranged to allow drainage into a 305mm high bucket. The local fuel fill port on the day tank shall be provided with a screw on cap.

3.1.8 Radiator Exhaust Duct

The radiator exhaust duct shall provided for exhaust of hot air through DG set radiator. The radiator exhaust shall be designed and routed in such a way so as to give minimum resistance to airflow.

3.1.9 Exhaust System

Exhaust system shall be equipped with a **HEAVY DUTY RESIDENTIAL** type silencer complete with muffler, exhaust manifold, flexible connector, exhaust elbow, exhaust pipe, rain cap, and associated fittings. This exhaust line shall be adequately covered with insulation material over its entire length i.e. from the engine to the termination point at rain cap. All supports for exhaust system shall be furnished. Hangs and supports shall be provided for the silencer such that essentially no load is transmitted to the engine.

3.1.10 Battery

Heavy-duty maintenance free lead acid batteries shall be provided with the set and mounted on the skid. The fully charged batteries shall be furnished with the set and connected with the help of heavy duty interconnecting cables.

The batteries shall be of adequate ampere-hour rating/capacity to satisfy the following requirements:-

a. Crank the engine at firing speed for at least 15 seconds.
b. If the engine does not start on the first attempt, crank the engine two more times for the above duration at an interval of 30 seconds between each cranking operation.

3.2 Alternator

3.2.1 General

The alternator shall be synchronous. The alternator shall be capable of carrying, continuously 10% over load of rated output with the field set for normal rated load excitation for 1 hour in every 12 hours operation.

The alternator shall be rated as follows:

Capacity	:	As stated in BoQ
Voltage	:	400/230 V
Phases	:	3Phase, 4 wire, grounded neutral
Frequency	:	50 Hz
Power Factor	:	0.8 lagging

3.2.2 Excitation

Excitation shall be from brushless rotating diodes mounted on the main shaft for 3-phase full wave rectification.

3.2.3 Windings

Alternator windings shall have Class H insulation and shall be impregnated for tropical use. The temperature rise of winding under normal operating conditions and at rated load shall not exceed the limits specified for Class-B insulation. Anti-condensate heaters shall be provided for windings. The heaters shall be thermostatically controlled for switching **ON** after the set has stopped. The thermostat range shall be adjustable and set to prevent overheating of windings. For protection of windings from damage due to overheating, thermistors shall be embedded to stop the set in case the temperature of winding rises above the safe value.

3.2.4 Deviation Factor

The deviation factor of the open-circuit line to line terminal voltage shall not exceed 0.10.

3.2.5 Voltage Regulation

Voltage regulator shall be solid state with provision for manual setting. Regulator shall be so designed to protect the exciter when the set is running at reduced speed during starting or idling of the prime mover.

Voltage regulation shall be ± 2.5% from no-load to full load. Transient voltage drop shall be less than 15% at full load and 0.8 power factor. Time required to restore to steady state conditions after transient voltage fluctuation shall not exceed 10sec.

3.2.6 Short Circuit Capability

Generator shall be capable of withstanding without injury, a 30 seconds three phase short circuit at its terminals when operating at rated output and power factor with fixed excitation.

3.2.7 Temperature Rise

Alternator temperature rises at continuous rating in an ambient of 52 degree C shall not exceed 70 degree C by resistance measurement on the field. The exciter temperature rise shall not exceed 52 degree C by resistance measurement on field or armature when the main generator is on continuous rating.

3.2.8 Vibration and Balance

The vibration level of the alternator when coupled to the engine shall not exceed the ISO Specifications or equivalent.

3.2.9 Bearings

The bearings shall preferably be grease lubricated and anti-friction type and shall be selected to provide for long trouble free service.

3.3 Indication/Metering Panels

3.3.1 General

The indication/metering panel shall be designed for front access, completely assembled, wired and tested. The control panels shall conform to the constructional requirements as per international standards and norms.

The panel shall incorporate protection and control equipment, measuring instruments, control and instrument transformers, voltage regulator, governor controls, battery charger, indicating lamps, etc. Engraved nameplates of stainless steel shall be provided on all panels for clearly identifying panels and devices mounted inside of panels. Standard nameplate with black lettering shall be provided.

Cables and capillary tubing shall be tagged with a neoprene disc or approved equivalent, stamped with the cable number or tube function for easy identification.

3.3.2 Moulded Case Circuit Breakers

The Four pole moulded circuit breaker shall be provided with the set. The circuit breaker shall have the Thermal over current and short circuit releases as below:

Ith = 60 to 100% of Current rating

Isc = 50 kA (min)

The circuit breaker shall be mounted in a vibration isolated sheet steel box with adequate access for incoming and out going cables.

3.3.3 Magnetic Contactors

The contactors shall be four pole, 400 V AC duty cycle-3. The main contacts shall be silver tipped, but type with double break per pole. Each contactor shall be provided with 230V AC single phase operating coil,and minimum two normally open and two normally closed auxiliary contacts wired upto terminals. But if more number of working auxiliary contacts are required then, these shall be provided according to the system requirements.

3.3.4 Battery Charger

Multi stage intelligent (Digital Microprocessor based with a communication port RS 485) high efficiency battery charger with automatic charging stage selection, capable of charging of a wide range of batteries, when engine is not running. The charger shall be fully capable to recharge a completely discharge battery within four hours at boost/maximum charge. The charger shall be of constant voltage and constant current with maximum current been drawn during charge recovery phase. The charger should automatically return to float/trickle mode when charging is complete.

The charger should have following safety features:

- Input under voltage protection
- Input over voltage protection
- Battery charge over voltage protection
- Battery output over current protection
- Short Circuit protection
- Battery temperature compensation with over temperature protection
- Reverse Polarity protection
- Automatic power derating at high ambient temperatures

Applicable Standards for Battery Charger:

- BS EN 61000 (Electromagnetic compatibility)
- BS EN 60950 (Electrical safety)
- BS EN 60068 (Temperature, Vibration, Humidity and Shock)
- BS EN 60529 (degree of Protection)

3.3.5 Instruments and Controls

i. Ammeter (measuring as required)
ii. Ammeter Phase selector switch
iii. Voltmeter (0-500 volt AC)
iv. Voltmeter phase selector switch

v. Frequency meter
vi. Start / stop key switch
vii. Battery condition voltmeter
viii. DC Voltmeter for batteries
viii. Tachometer for Engine speed in Revolutions Per Minute (RPM)
ix. Lube oil pressure in PSI
x Lube oil temperature in Degrees Celsius
xi. Engine water temperature in Degrees Celsius
xii. Engine operation/ running time in hours

3.5 Safety Devices

3.5.1 Following safety devices shall be provided. The audible alarm shall operate on any fault condition and shall be resetable manually and automatically through a timer after 15 minutes whichever is earlier:

A = Alarm **SD** = Shutdown **TD** = Adjustable Time Delay

i)	Engine Over speed	**A**	**SD**	
ii)	Low lube oil pressure	**A**	**SD**	
iii)	High water temperature	**A**	**SD**	
iv)	Over voltage	**A**	**SD**	**TD** (0-30 Sec.)
v)	Under voltage	**A**		
vi)	Short circuit and tripping of circuit breaker.	**A**	**SD**	**TD** (0-1 min.)
vii)	Low level in fuel storage tank	**A**	**SD**	**TD** (0-5 min.)
viii)	Winding temperature high	**A**	**SD**	**TD** (0-2 min.)
ix)	Over crank	**A**	**SD** (After THREE Successive crankings)	
x)	Low crankcase oil level	**A**		
xi)	High crankcase oil level	**A**		
xii)	Charging alternator failure	**A**		
xiii)	Charger failure	**A**		

For all shut down conditions, the set shall lockout and it shall not be possible to re-start it unless manually reset after the cause of fault has been removed.

3.5.2 **Generator Electrical Protections:**

Following electrical protections shall be provided in the generator:

1. High AC voltage shutdown	12. Reverse Power shutdown
2. Low AC voltage shutdown	13. Reverse VAR shutdown
3. Over frequency shutdown:	14. Under voltage shutdown:
4. Under frequency shutdown/warning	15. Over voltage shutdown:
5. Over Current warning/Shutdown:	16. Low and high battery voltage warning
6. Loss of sensing voltage shutdown	17. Weak battery warning
7. Field overload shutdown	18. Fail to start (over crank) shutdown
8. Over load (kW) warning	19. Reverse power protection

9. Short circuit protection:	20. Smart starting system
10. Digital Voltage Regulator	21. Battery monitoring system
11. PMG Excitation	

3.6 **Auto-Mains Failure/Transfer (AMF/ATS) Panel**

The AMF/ATS shall be floor mounted front access, completely assembled, wired and tested. The control panel shall conform to the constructional requirements as stated in these specifications for LV switch boards.

The AMF/ATS shall incorporate automatic changeover system, which will be designed for the following functions:

a) To start the set immediately when the main supply fails

b) To start the set within the 0 to 1 minutes (adjustable) whenever the main supply voltage drops to 360 volts or rise to 440 volts. The setting voltages shall be adjusted within -5 % and + 5% respectively for the lower & upper ranges.

c) To transfer the load from Generator to main supply whenever the main system voltage returns between 90% to 110% of its rated value and persists for at least 3 minutes.

d) To make two successive attempts, in case the set fails to start in the first and second attempt.

e) The system shall provide for immediate transfer of load to the generator, after the rated speed and voltage have been achieved. The Generator should start immediately when the main supply fails

f) The system shall be self resetting after each cycle of operation. To start the set immediately when the main supply fails

g) Two normally open potentially free contacts shall be provided which shall close when the set is started with the operation mode selector switch in auto or manual position. The contacts shall be wired upto the terminals block in control panel.

h) A four position selector switch shall be provided for selecting the operation mode i.e. Automatic-Manual-Test-stop/ Maintenance mode to facilitate the following operation:-

i) **Automatic**
As described in a to d.

ii) **Manual**

Manual starting of the set and load transfer from normal to standby and vice versa.

iii) **Test**

Testing the changeover operation when so desired and also

for starting and running the set without interrupting the normal operation. In case of failure of main supply, the set shall automatically revert to automatic mode of operation.

iv) **Stop/Maintenance**

Provision shall be made to isolate the system for trouble shooting and maintenance without interruption of mains power supply. The set shall not be capable of starting in this condition.

3.7 Terminal Blocks and Terminals

Terminal blocks for control wiring shall be General Electric Type Eb stud terminal blocks or approved equivalent. Terminal studs and wires shall be numbered or otherwise marked in accordance with the applicable schematic and wiring diagrams.

Terminal blocks shall be arranged with sufficient room for each connection of incoming cables. Parallel rows of terminal blocks shall be spaced at least 150mm (6") apart.

Blocks shall be mounted in vertical columns along the sides of cubicles or on vertical panels specially provided for terminal blocks. 20% spare blocks distributed over the columns of terminal blocks shall be provided.

Terminals shall be suitable for screw terminals and shall be sized according to the wire being terminated.

Provisions shall be made to terminate and ground the overall copper shields of all incoming cables by a suitable method approved by the Engineer.

3.8 Component Wiring

All internal wiring shall be in accordance with IEC or VDE Standards with annealed copper conductor, thermo-plastic insulated with an overall flame-retardant braid. Wire sizes for control wiring in no case shall be smaller than 2.5 mm2. The wire ends shall be permanently fitted with compression type connectors before attaching to terminal studs.

Wiring between terminals of various devices shall be point to point. All internal wiring shall be neatly trunked in wiring troughs bound and anchored.

All groups of bundled conductors to hinged doors and panels shall use extra-flexible wire arranged so that a twisting rather than a bending motion is imparted to the moving conductor bundle. Each bundle shall be anchored to the fixed member at the opposite end of the hinge axis to the anchoring point on the moving member so that the moving bundle length is the maximum available without loops.

All wires shall be identified at both ends according to the schematic diagram.

4.0 SPECIFICATIONS OF FUEL TANK, WEATHER PROOF, SOUND ATTENUATED CANOPY AND FOUNDATION PAD

4.1 Fuel Tank

Supply & Installation of backup fuel storage tank, complete with filling cap, vent & suction pipe, minimum 5mm thick, MS sheet and inspection man hole complete in all respect.

4.2 Weather Proof and Sound Attenuated Canopy

Sound and weather proof canopy suitable for the Diesel Generating sets. The canopy shall attenuate the sound level to below 85dB at a distance of 1 meter or less than 75dB at a distance of 3 meters from it. Textured insulation materials, Comprising of fire retardant resin, organic glass/rock fiber to ensure uniform long lasting absorption of sound. The canopy shall be constructed with weather proof corrosion resistant material and shall be modular in design. All sheet components pre-treated with cold fast prior to powder coating. All gas kits/joints be of Edpm (**ethylene propylene diene monomer** (M-class) rubber). The canopy shall be suitable for tropical climates.

a) The enclosure shall allow easy access to the engine, alternator, and radiator filler cap, lube oil filling, filter replacement and control cubicle for easy maintenance purposes.

b) Hinged and lockable doors all around canopy for easy access to D.G. set for routine maintenance and major over hauling.

c) At least 1 foot clearance between the DG Set and Canopy shall be maintained from sites/directions.

d) The enclosure shall be designed to be water and weather- proof.

e) The intake area for air must be 1.8 times the size of radiator.

f) The enclosure base frame should be designed with supports for easy transferred using forklift and crane.

g) Canopy shall be capable of anti-corrosion to withstand high humidity.

h) Proper grouting of both generator and canopy.

i) The thickness of sheet for canopy body must be 4mm (minimum) whereas thickness of and door sheet 2mm (minimum).

j) Glass wool will be of pure fiber.

k) The canvas is to be place between radiator and the canopy that can be easily removed during troubleshooting.

l) GENSET control panel should be visible from outside the canopy by means of plan glass.

m) 4 Nos. Canopy lifting eyes arrangement from top of canopy.

n) Sufficient air intake through Acoustic Louvers from both side & control panel side.

o) Duly painted with good quality water proof and weather proof paint. Painted with 2 coats of zinc oxide primer and finishing with 2 coats of Syntactic Enamel (Burger/ICI) paint.

4.3 Foundation Pad for DG Set

a) Fabrication of RCC Foundation suitable for genset operating weight complete in all respects, foundation to be made according to generator size and should have all required sleeves for piping, conduiting etc. as per specifications.

b) The pad should be at least 12 inches (300mm) height from and extend at least 6 inches (150 mm) beyond the skid on all sides.

c) The weigh (W) of the foundation should be at least 2 times (and up to 5-10 times) the weight of the set itself to resist dynamic loading. (The weight of fuel in a sub-base fuel tank should not be considered to be contributing to the weight required of a vibration isolating foundation even through the isolators are between the tank and the generator set).

d) The foundation should extend at least 6 inches (150mm) beyond the skid on all sides. This determines the length (l) and width (w) of the foundation.

e) The foundation should be reinforced concrete with a 28-days compressive strength of at least 3000 psi

4.4 Tests:

4.4.1 General

The set furnished by the Contractor under this Contract shall be subject to tests in the shop and at site in the presence of the Engineer for conformity to requirements of the Specifications.

4.4.2 Diesel Engine

All mechanical parts shall be run under simulated operating conditions at the Manufacturer's works.

All tests shall be conducted in accordance with the appropriate codes for testing. The tests to be carried out shall include, but not be limited to, the following:

i) Dynamic balancing together with over speed tests of the generator exciter and rectifiers.

ii) Bench testing of all accessories.

iii) Zero load operation of the diesel engine assemblies to test the following:

- Vibration.
- Lubricating system.
- Fuel system.

- Governor system.
- Temperature control system.
- Over speed trip.
- Individual accessories.

The diesel engine and AC generator shall be test-run continuously for 24 hours to ensure smooth running and satisfactory operation of the machines and accessories. The above tests will be witnessed by the Engineer.
The contractor shall state in his proposal the performance and reliability tests to be carried out in the Works.

Tests on the unit shall not be less than the minimum requirements of ISO standard Practices for equipment.

4.5 Generator

4.5.1 General

The set furnished by the Contractor under this Contract shall be subject to tests in the shop and at site in the presence of the Engineer for conformity to requirements of the Specifications.

4.5.2 Routine Tests

Routine tests on the generator shall be performed at the manufacturing works/workshop of the DG Set manufacturer/Supplier. Routine tests shall include:

a) Resistance of armature and field windings
b) Polarity of field coils
c) Check of mechanical balance
d) Check of no-load field current or exciter field current
e) Voltage balance
f) Phase sequence
g) No-load saturation curve
h) Insulation and high potential tests
i) Over speed test at 125% speed for 1 minute
j) Load Tests (24 hours)

1. Continuous thirty minutes heat run at 25 percent load rating
2. Continuous three hour heat run at 50 percent load rating
3. Continuous eight hour heat run at 75 percent load rating
4. Continuous twelve hour heat run at 100 percent load rating
5. Continuous thirty minutes heat run at 110 percent load rating

Fuel, water and electric power required for "Performance Tests" shall be provided by the Contractor

Where the generator is not completely assembled in the factory, tests (d) to (i) above inclusive may be carried out with the generator coupled to Engine Test (a) to (d) shall also apply to the exciter.

4.5.3 Type Tests

The generator shall have the following tests performed, if required:

a) Short circuit saturation curve.
b) Temperature test.
c) Segregated losses.
d) Voltage deviation factor.
e) Three phase line to line short circuit test at any convenient voltage in the 0.4 to 0.5 p.u. volts.

4.5.4 Characteristics Test Curves

Following completion of type tests, Manufacturer shall provide characteristics curves of the brushless excitation system. These curves shall show:

a) Exciter field amps and volts versus generator line current at 0.80 Pf. and maximum and minimum temperature rises.

b) Exciter field amps and volts versus generator line current at 1.0 Pf and maximum and minimum temperature rises.

c) As for (a) above, but with one diode failed.

The above six curves shall be plotted from no-load to maximum rated load at rated generator voltage. Following approval of curves by the Engineer, they shall be incorporated by the Manufacturer into the Emergency Diesel Generating Set Maintenance Manual.

4.5.5 Performance Tests

At the conclusion of installation of the Emergency Diesel Generating Set at site, commissioning tests shall be carried out by the Contractor/Manufacturer to demonstrate the satisfactory operation of the equipment and to verify the guaranteed performance figures of the diesel unit. The tests shall comprises:

1. Preliminary tests on individual components.

2. Continuous one-hour heat run at 50 percent load rating in parallel with the system.

3. Continuous one-hour heat run at 75 percent load rating in parallel with the system.

4. Continuous four-hour heat run at 100 percent load rating in parallel with the system.

5. Part load heat runs to demonstrate satisfactory operation and establish fuel consumption at the respective loads.

6. The tests shall also include:

   a) Performance of Governing characteristics and protective systems.

   b) Starting characteristics of the units. The units shall start at least five (5) times in six (6) consecutive starting attempts.

   c) Starting power requirements to demonstrate the ability of the machine to start the specified number of times without need to recharge the batteries.

The instrumentation supplied as standard with the equipment will be used during the commissioning tests for measurement of voltage, frequency, temperatures, pressures, etc. normally recorded during commercial operation. Additional instruments required for the measurement of electrical output, fuel flow, vibrations, etc. shall, at no extra charge, be provided by the Contractor.

Tests to be carried out manufacturer's work and at the site shall be to the satisfaction of the Engineer. Seven copies of test certificates shall be forwarded to the Engineer immediately following each test. The site test report shall include a list of final settings and adjustments carried out during commissioning.

If the tests show that the set does not reasonably comply with Bid, the Contractor/Manufacturer shall, at his own expense, make all necessary corrections to the unit. Additional tests shall then be made to demonstrate the effectiveness of these corrections. Until the necessary corrections have been made, the conditions of the contract shall not be considered fulfilled.

Fuel, water and electric power required for "Performance Tests" shall be provided by the Contractor.

Seven (7) copies of the Final Performance Test Report shall be submitted to the Engineer not later than one (1) month after completion of the performance tests.

4.6 Diesel Generator Set

4.6.1 Measurement

Measurement shall be made for one No. of diesel generator set (as per rating mentioned in BOQ), alongwith all its allied accessories acceptably supplied and installed by the Contractor as a complete job.

4.6.2 Payment

Payment shall be made for one No. of DG Set alongwith all its allied accessories, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the of diesel generator set (as per rating mentioned in BOQ), including fixing arrangement and accessories for complete installation.

SUPPLY, INSTALLATION AND TESTING

SCHEDULE OF TECHNICAL DATA TO BE FILLED IN FOR EVERY TYPE/RATING OF DG SETS AND SEALED/STAMPED BY THE MANUFACTURER- (MANDATORY)

Sr. No	Data Required	Data To Be Submitted (By Bidder)
1	**ENGINE**	
	Manufacturer's Name/ Country of Origin	
	Model	
	Maximum Engine Rating -(BHP)	
	Continuous Output Rating -(BHP)	
	Derating Factor:	
	(i) For Altitude of 1250 meters above MSL	
	(ii) For inlet Air Temperature of	
	(iii) Others if any	
	Engine Rating at Site-(BHP)	
	Period of maximum Engine Rating in Hours	
	Operating speed-RPM	
	Piston Speed (m/s)	
	Bore & Stroke-Inches	
	No. of cylinders	

	Arrangement of Cylinders (in line/v)	
	Engine Capacity-Cu.in./cc	
	Compression Ratio	
	Coupling Type	
	Mounting Arrangement	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	Cooling System	
	Ignition System	
	Overload Capability	
	Governor Type And Make	
	Efficiency at 0.85 pf %	
	At 25% of rated load	_
	At 50% of rated load	_
	At 75% of rated load	_
	At 100% of rated load	_
	Lube oil consumption (Liters/hr)	
	At 0% of rated load	_
	At 25% of rated load	_
	At 50% of rated load	_
	At 75% of rated load	_
	At 100% of rated load	_
	Specific Fuel consumption (Liters/hr)	
	At 0% of rated load	_
	At 25% of rated load	_
	At 50% of rated load	_
	At 75% of rated load	_
	At 100% of rated load	_
	Lubrication system nominal oil pressure (kg/cm^2)	
	Lubrication system minimum oil pressure (kg/cm^2)	
	Lubricating oil Sump capacity (ltr.)	
	Radiator capacity (ltr.)	
	Compusion air intake at 50 Hz (cm^3)	
	Engine heat radiation (K cal/min.)	
	Exhaust gas temperature at manifold, deg C.	
	Exhaust gas rate (ltr/sec.)	
	Starting system voltage (v)	
	Specific Feature if any	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
2	**GENERATOR**	
	Manufacturer's Name/ Country of Origin	
	Model	
	Design Rating -(KVA)	
	Continuous Output Rating -(KVA)	
	Net electrical Output at site -(KVA)	
	Rated Voltage-volts	
	Power Factor	
	Speed-(RPM)	
	Frequency-Hz	
	Type designation	
	Time delay	
	(i) Manufacturer	
	(ii) Type designation	
	Timing	
	(i) Manufacturer	
	(ii) Type designation	
	Tripping	
	Insulation class	
	Stator Rotor Exciter	
	Overload Capability %	
	Harmonic Content %	
	Temperature Rise ^{0}C	
	Voltage Regulation	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	Type	
	Regulator	
	Regulation %	
	Voltage Dip %	
	Response Time (Sec)	
	Frequency Regulation -%	
	Deviation Factor %	
	Efficiency at 0.85 pf % At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	
	Exciter	
	Type	
	Rated Voltage-Volts	
	Full load current -Amps.	
	Radio Frequency Interference	
	Telephone interference factor	
	Charge Capacity	
	Batteries Type Rating-AH	
	Noise output level of Set (dB) At 0 % of rated load At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	De-rating Factor	
	For Altitude of given height in meters above MSL of the site of installation	
	For ambient temperature of	
	others ,if any	
	Special features, if any	
3	**ACCESSORIES**	
	(Contractor to state if any of the following accessories will be supplied - give details) Crankcase Heater Automatic water Makeup System Ducting for radiator Exhaust System Silencer Fuel Day Tank Fuel Piping System Fuel pump	
	Meters/Gauges to indicate: Engine speed in rpm Lube oil Pressure in Bars Lube oil temperature in ^{0}C Engine running hours in hrs. Battery Charging current in Amps.	
	Alarm/Indicating lamps for Engine Overspeed Low lube oil pressure High engine water temperature Over voltage Under voltage Short-circuit/tripping of main circuit breaker low fuel level	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	High fuel level Winding temperature high Over cranking Low oil level High oil level Charging alternator failure	
	Safety devices for instantaneous shut down due to Engine over speed Low lube oil pressure High water temperature shut down	
	Safety devices for adjustable delayed shut down, through shut down timer, due to: Over voltage Short circuit/tripping of main circuit breaker Low fuel oil in tank Winding temperature high	

Note: To be filled for each rating of DG Set from the Manufacturer.

STRATEGIC PLANNING & IMPLEMENTATION UNIT (SP & IU),
PGDP ENVIRONMENT PROTECTION DEPARTMENT (EPD)
GOVT OF PUNJAB.

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS
AND PREPARATION OF BIDDING DOCUMENTS FOR
3 PILOT PLANTS OF WASTEWATER IN PUNJAB

APPENDIX-A
TENDER DRAWINGS

FOR

WASTEWATER TREATMENT PLANT

(CHAK 191, CHAK 2KB, SAR KALAN VILLAGE)

APRIL, 2025

NATIONAL ENGINEERING SERVICES
PAKISTAN (PVT) LTD LAHORE

STRATEGIC PLANNING & IMPLEMENTATION UNIT (SP & IU), PGDP
ENVIRONMENT PROTECTION DEPARTMENT (EPD) GOVT OF PUNJAB.

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

CHAK 191
LIST OF DRAWINGS

SR. NO.	DRAWING NO.	TITLE
01	4695/11/C/2J100	GENERAL NOTES & LEGEND OF WASTE WATER TREATMENT PLANT
02	4695/11/C/2J101	LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP
03	4695/11/C/2J102	SEWAGE TREATMENT PLANT SETTLER PLAN AND SECTION
04	4695/11/C/2J103	SEWAGE TREATMENT PLANT ANAEROBIC FILTER PLAN AND SECTION
05	4695/11/C/2J104	SEWAGE TREATMENT PLANT DISINFECTION TANK PLAN AND SECTION
06	4695/11/C/2J105	CHEMICAL ROOM PLAN & SECTIONS
07	4695/11/C/2J106	SEWAGE TREATMENT PLANT PLAN OF FISH POND
08	4695/11/C/2J107	SEWAGE TREATMENT PLANT FISH POND SECTION A-A
09	4695/11/C/2J108	SEWAGE TREATMENT PLANT DETAIL OF VALVE CHAMBER NO-2
10	4695/11/C/2J109	DETAIL OF OFFICE BUILDING
11	4695/11/C/2J110	WATER SUPPLY OF STAFF BUILDING
12	4695/11/C/2J111	SEWERAGE & ROOF DRAINAGE OF STAFF BUILDING
SCADA		
13	4695/166/C/1S001	CCTV SYSTEM OF WASTE WATER TREATMENT PLANT CHAK 191
SOLAR SYSTEM		
14	4695/165/BQ001	SOLAR SYSTEM AND CABLE TRENCH LAYOUT OF WWTP CHAK 191
ELECTRICAL		
15	4695/161/TD/5E001	LEGEND GENERAL NOTES ROD TYPE & BORE TYPE EARTHING DETAILS
16	4695/161/TD/5E002	EXTERNAL ELECTRIFICATION LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP CHAK 191
17	4695/161/TD/5E003	10M HIGH OCTAGONAL CONICAL LIGHTING POLE WITH SINGLE ARM BRACKET
STRUCTURE		
18	4695/TD/166/2/G01	TYPICAL SOLAR PANEL FRAMING FOR ELEVATED STRUCTURE

LEGEND:

PROPOSED FORCEMAIN

PROPOSED HDPE PIPE

WWTP BOUNDARY

ROAD

COLLECTION CHAMBER

EXISTING NULLAH

NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL PIPE DIAMETERS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
4. THE CONTRACTOR SHALL CARRY OUT COMMISSIONING OF WWTP AS PER ENGINEERING STANDARDS TO MEET THE TREATED EFFLUENT QUALITY PARAMETER (PEQS/WHO) TO COMPLETE SATISFACTION OF THE ENGINEER.
5. THE CONTRACTOR SHALL PROVIDE TRAINING TO THE O&M AGENCY FOR REPAIR AND MAINTENANCE OF THE PROPOSED WWTP AND ASSOCIATED WORKS.
6. ALL MATERIALS, WORKMAN SHIP AND TESTING SHALL BE IN ACCORDANCE WITH ENGINEERING STANDARDS, MATERIALS, SPECIFICATION, DRAWINGS AS APPROVED BY THE ENGINEER.
7. STRICT COMPLIANCE TO HEALTH, SAFETY, ENVIRONMENTAL AND COVID MANAGEMENT PLANS SHALL BE OBSERVE BY THE CONTRACTOR.
8. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF ALL ELECTRO-MECHANICAL COMPONENTS BEFORE EXECUTION FOR APPROVAL OF THE ENGINEER.
9. ANY DEFECT /SHORT COMING OR COMPLAINTS LODGED DURING DEFECT LIABILITY PERIOD OR INCLUDED IN THE PUNCH LIST SHALL BE RECTIFIED BY THE CONTRACTOR.
10. THE CONTRACTOR SHALL PREPARE AS-BUILT DRAWINGS OF THE COMPLETE WWTP & ITS ALLIED COMPONENTS ON AUTOCAD AND GIS SOFTWARES, (MENTIONING CONSTRUCTION/ INSTALLATION TIME, SIZES, THICKNESS, DIAMETER, MATERIAL, LENGTH, DEPTH ETC.) AND EDITABLE COPIES SHALL BE HANDED OVER TO THE ENGINEER, TO HIS ENTIRE SATISFACTION.

ABBREVIATION

(AF)	ANAEROBIC FILTER
(DT)	DISINFECTION TANK
D	DIAMETER
mm	MILLIMETER
NSL	NATURAL SURFACE LEVEL
PGL	PROPOSED GROUND LEVEL
FFL	FINISH FLOOR LEVEL
RL	ROAD LEVEL
BL	BED LEVEL
PCC	PLAIN CEMENT CONCRETE
RCC	REINFORCED CEMENT CONCRETE

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
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CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

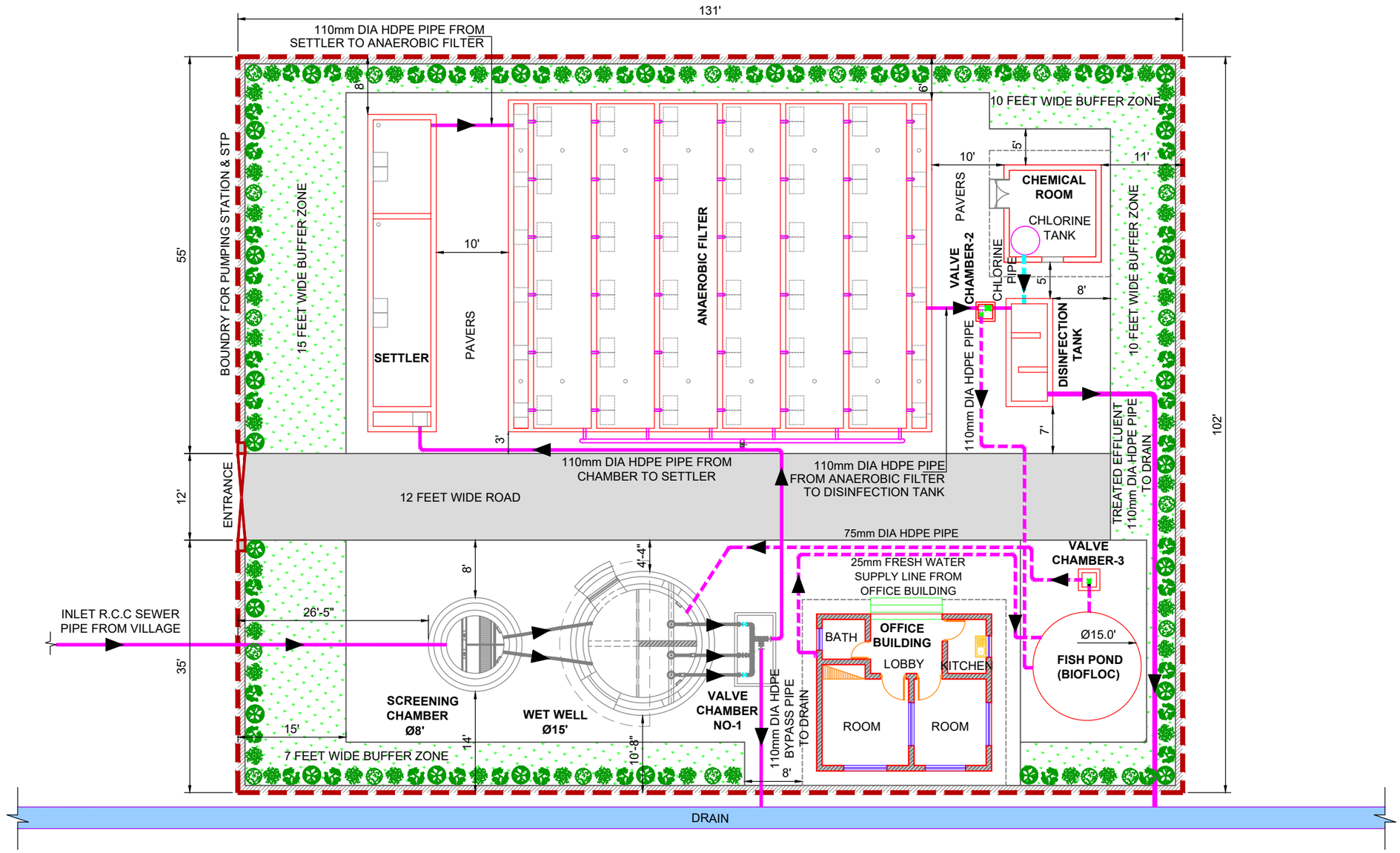
CHAK 2KB
GENERAL NOTES & LEGEND OF WASTE WATER TREATMENT PLANT

DATE: SEPTEMBER, 2024

DRAWING No.: **4695/11/C/2J100**

SCALE: NTS

REV.: 0



LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP

N

CLIENT: Strategic Planning & Implementation Unit (SP & IU) Environment Protection Department (EPD) Govt of Punjab.	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.	04			DRAWN: RIZWAN
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		02			RECOMMENDED:
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PROJECT: Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

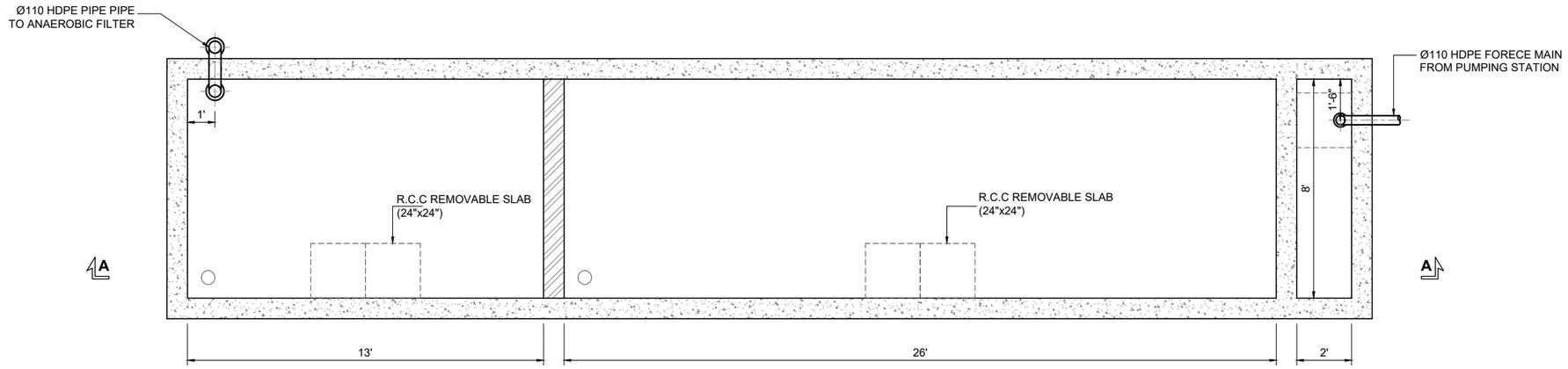
CHAK 191
LAYOUT PLAN OF WASTE WATER TREATMENT PLANT

SCALE: 1"=16'

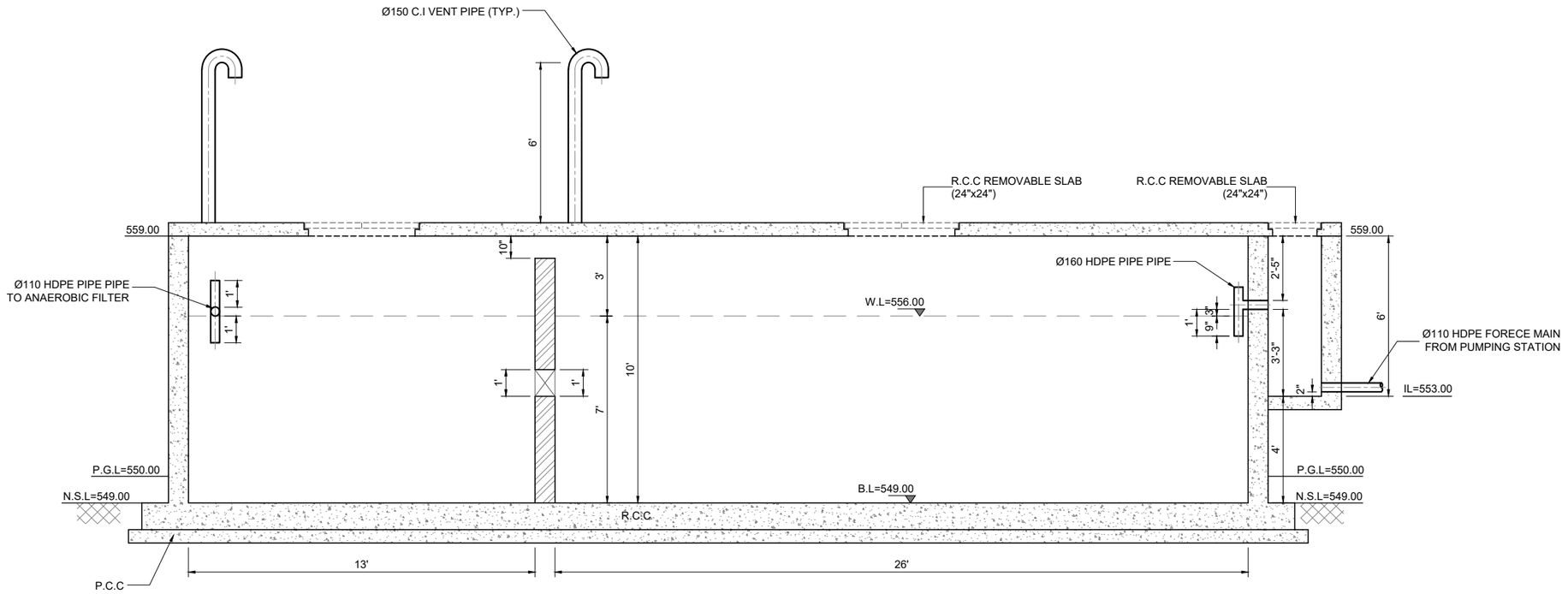
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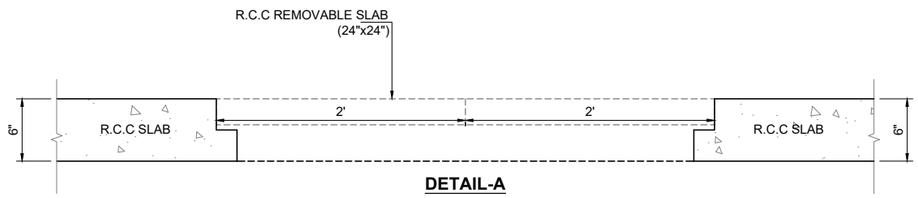
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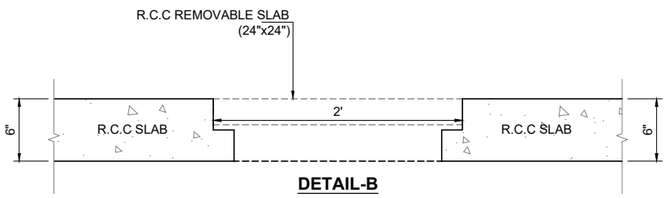
PLAN OF SETLLER



SECTION A-A



DETAIL-A



DETAIL-B

NOTES

1. ALL DIMENSIONS ARE IN FEET AND PIPE DIAMETERS ARE IN MILLIMETRES UNLESS OTHER SPECIFIED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

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PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

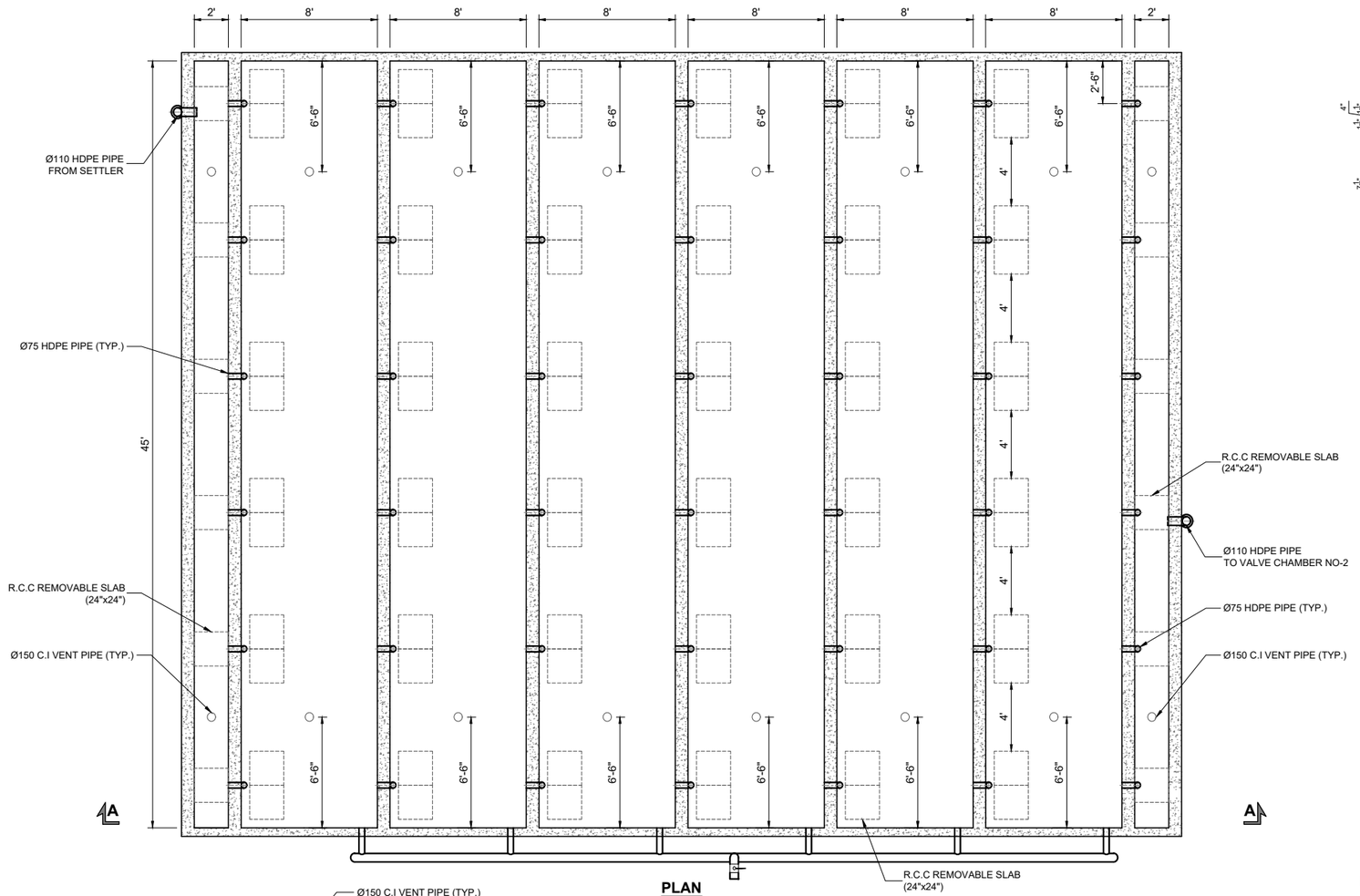
SEWAGE TREATMENT PLANT
SETTLER PLAN AND SECTION

SCALE: 1"=50'

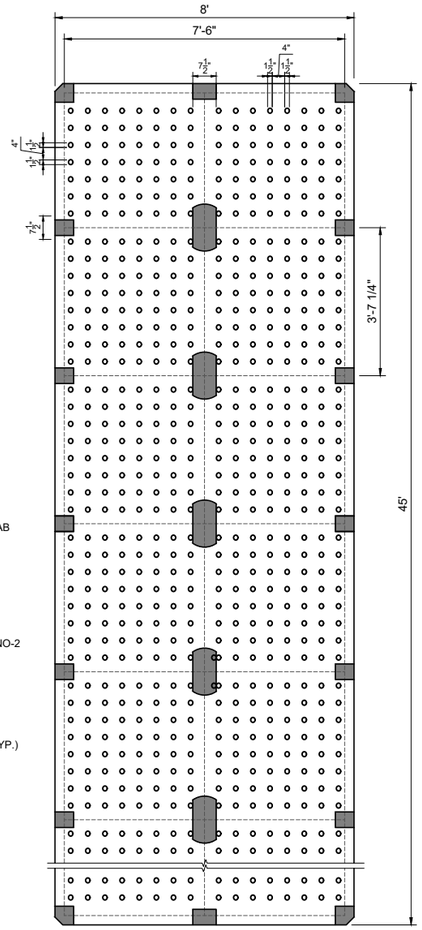
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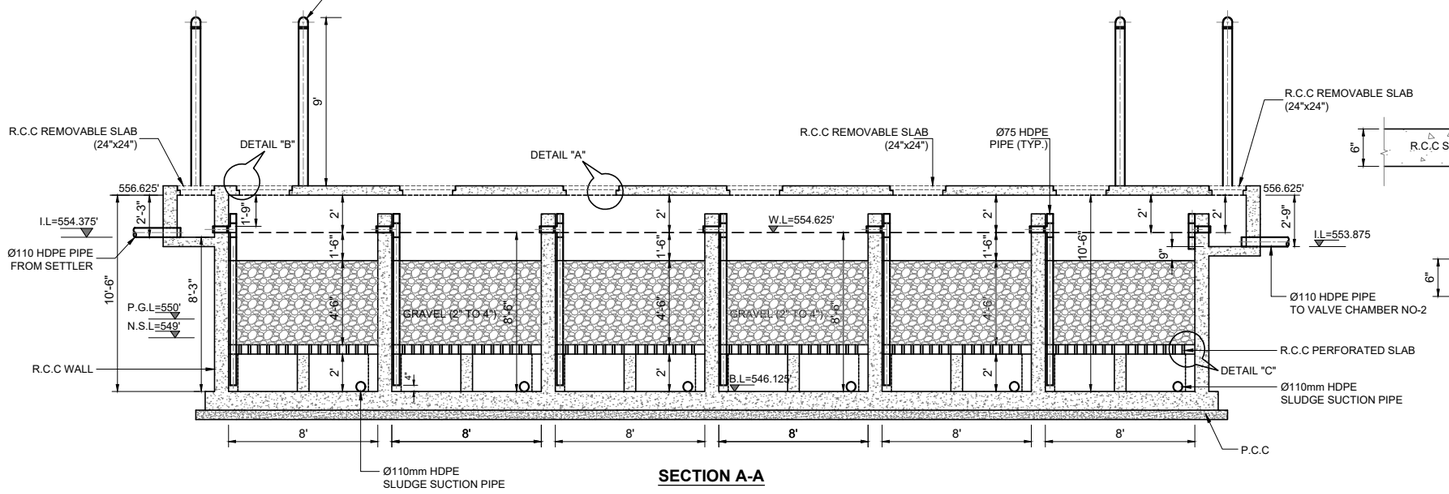
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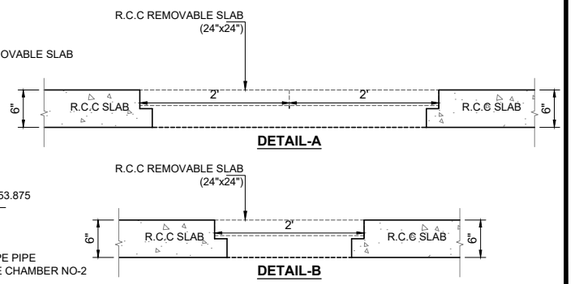
PLAN



DETAIL-C
PERFORATED INTERMEDIATE SLAB (TYP.)



SECTION A-A



DETAIL-A

DETAIL-B

NOTES

1. ALL DIMENSIONS ARE IN FEET AND PIPE DIAMETERS ARE IN MILLIMETRES UNLESS OTHER SPECIFIED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

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03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

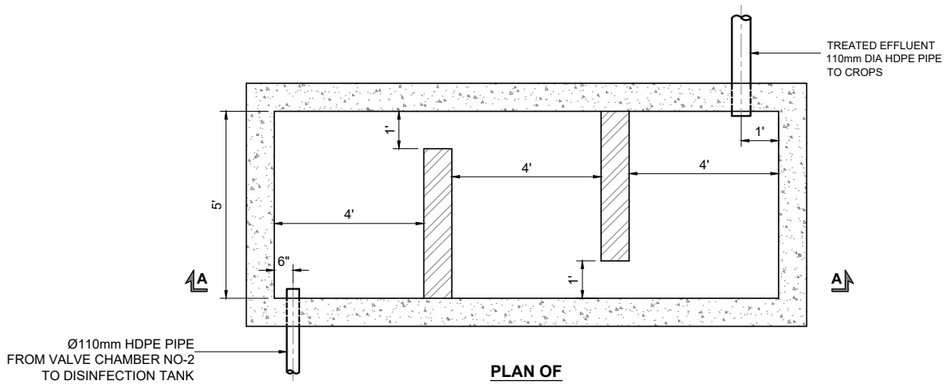
SEWAGE TREATMENT PLANT
ANAEROBIC FILTER
PLAN AND SECTION

SCALE: 1"=100'

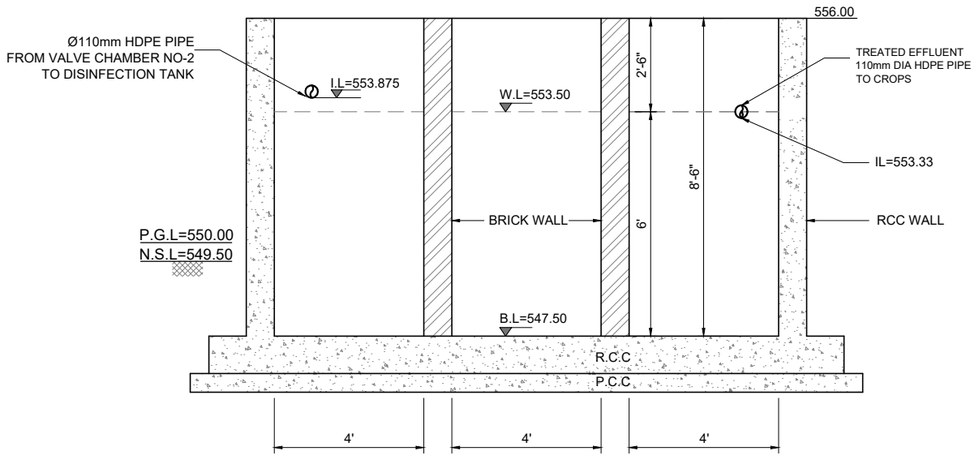
DATE: SEPTEMBER, 2024

DRAWING No.: **4695/11/C/2J103**

REV.: 0



PLAN OF
DISINFECTION TANK



SECTION A-A

NOTES

1. ALL DIMENSIONS ARE IN FEET AND PIPE DIAMETERS ARE IN MILLIMETRES UNLESS OTHER SPECIFIED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

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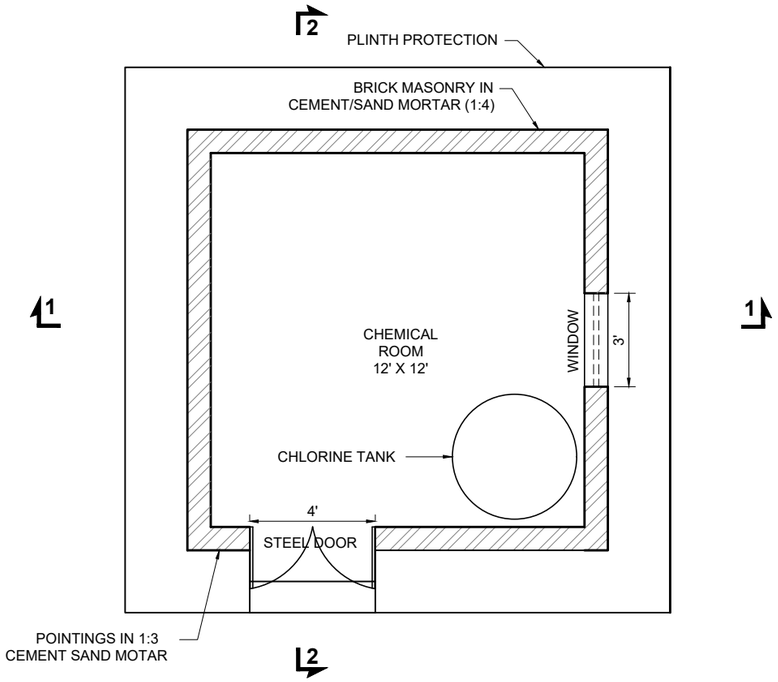
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PROJECT

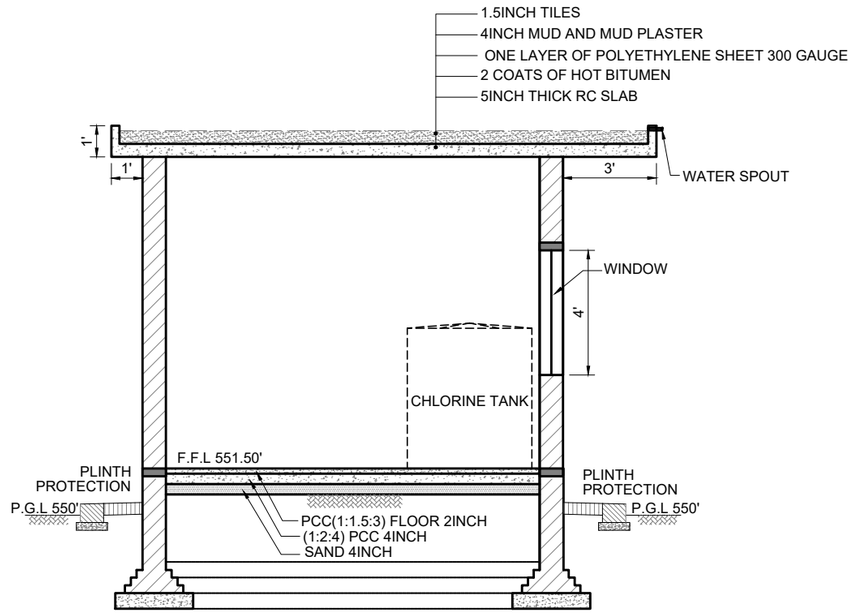
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

SEWAGE TREATMENT PLANT
DISINFECTION TANK
PLAN AND SECTION

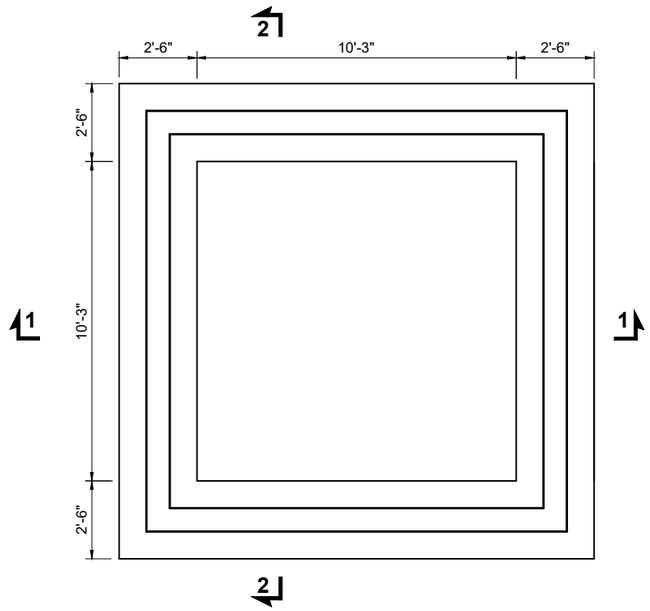
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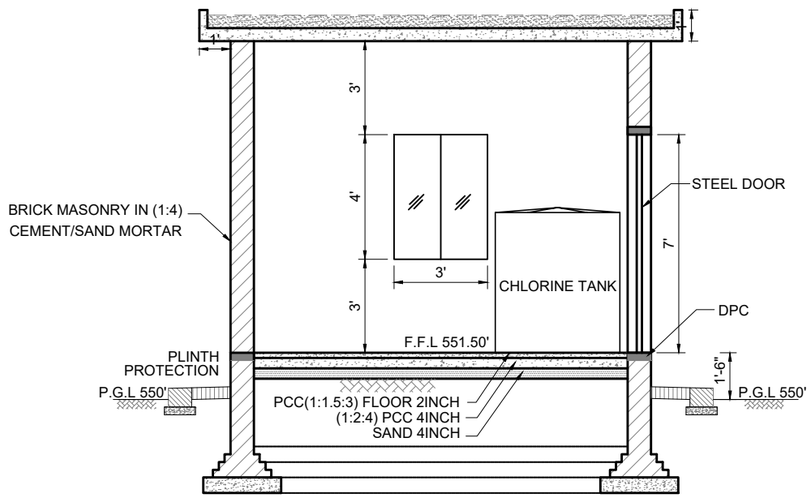
PLAN



SECTION 1-1



FOUNDATION PLAN



SECTION 2-2

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CONSULTANT

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REV.	DATE	DESCRIPTION	APPROVED
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02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

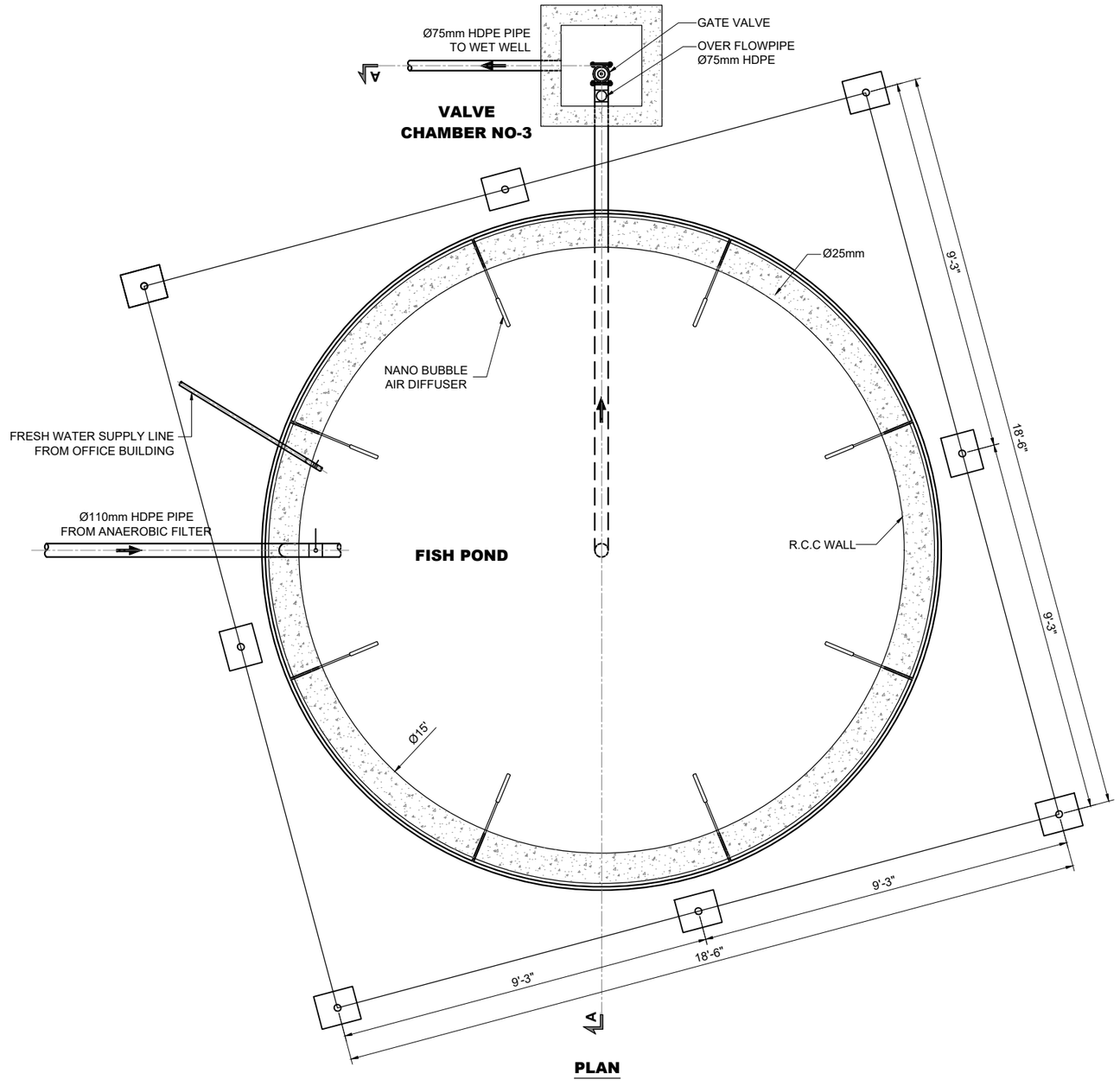
CHEMICAL ROOM PLAN & SECTIONS

SCALE 1"=60'

DATE SEPTEMBER, 2024

DRAWING No. **4695/11/C/2J105**

REV. 0



PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

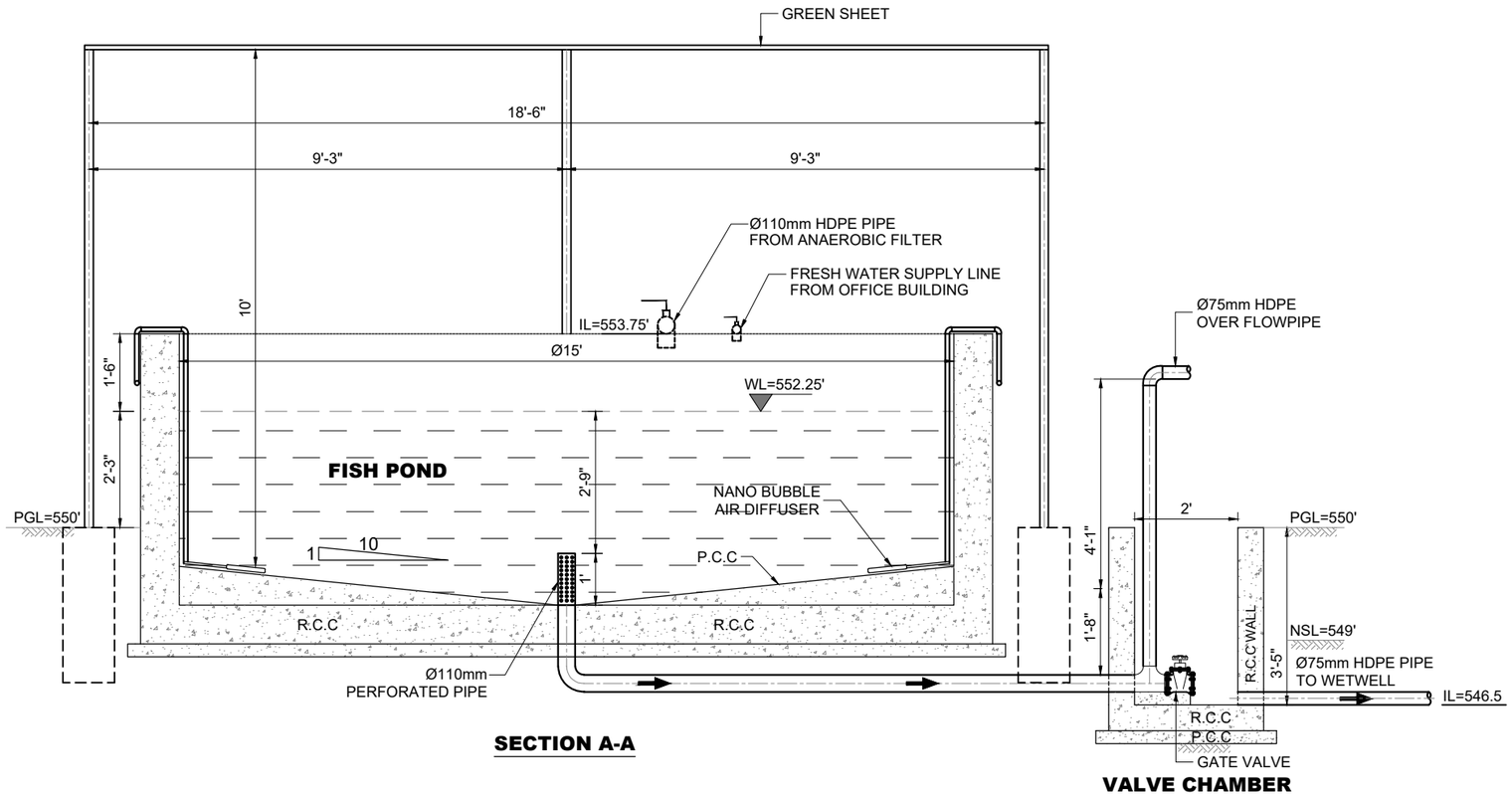
SEWAGE TREATMENT PLANT
PLAN OF FISH POND

SCALE: 1"=50'

DATE: SEPTEMBER, 2024

DRAWING No.: **4695/11/C/2J106**

REV.: 0



NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
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02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

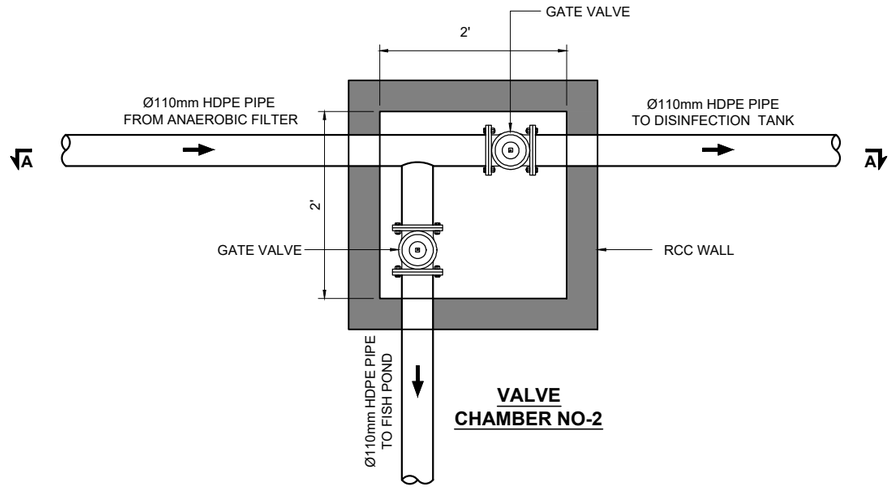
SEWAGE TREATMENT PLANT
FISH POND
SECTION A-A

SCALE: 1"=50'

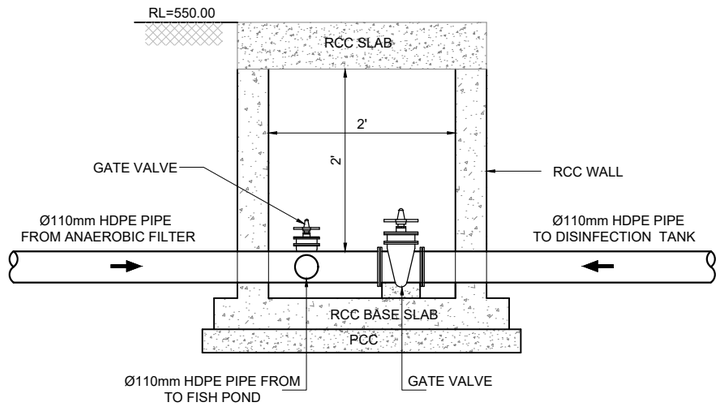
DATE: SEPTEMBER, 2024

DRAWING No.: **4695/11/C/2J107**

REV.: 0



VALVE CHAMBER NO-2



SECTION A-A

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

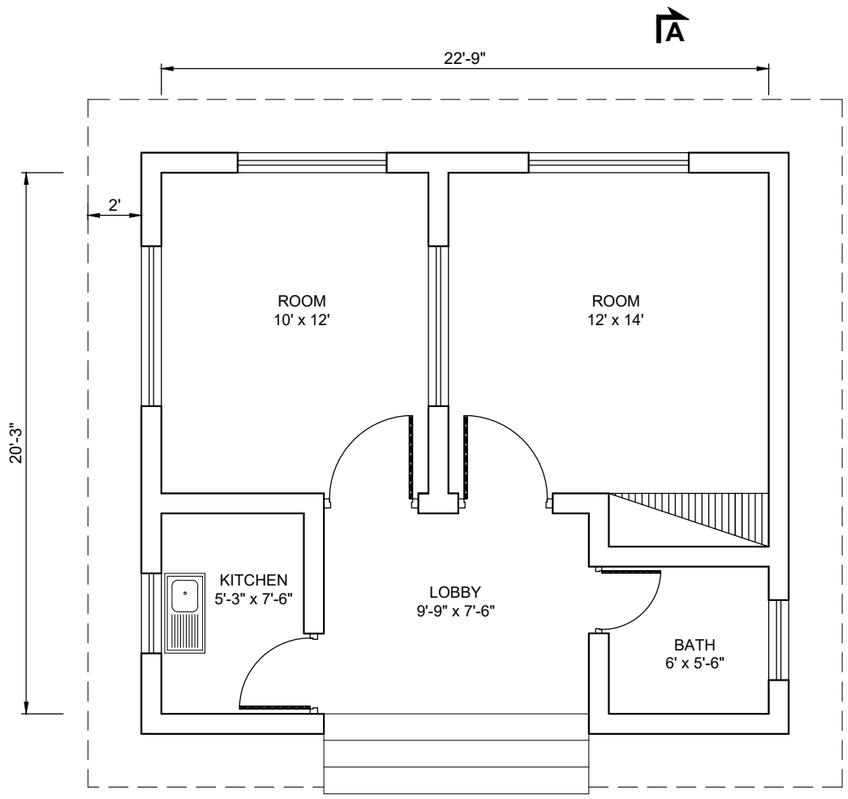
SEWAGE TREATMENT PLANT
DETAIL OF VALVE CHAMBER NO-2

SCALE: 1"=20'

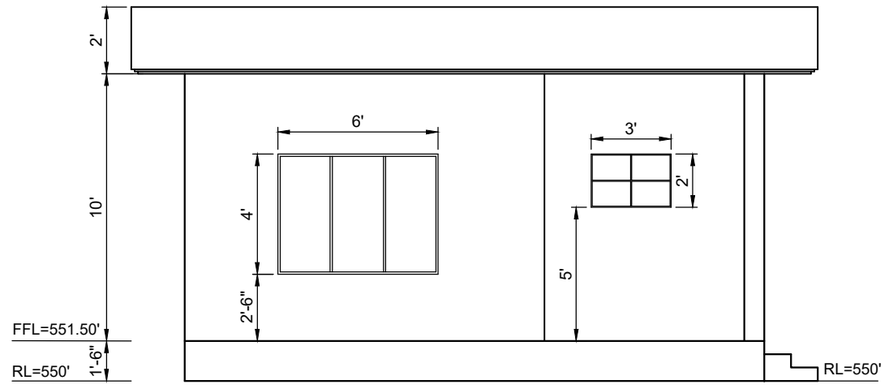
DATE: SEPTEMBER, 2024

DRAWING No.: **4695/11/C/2J108**

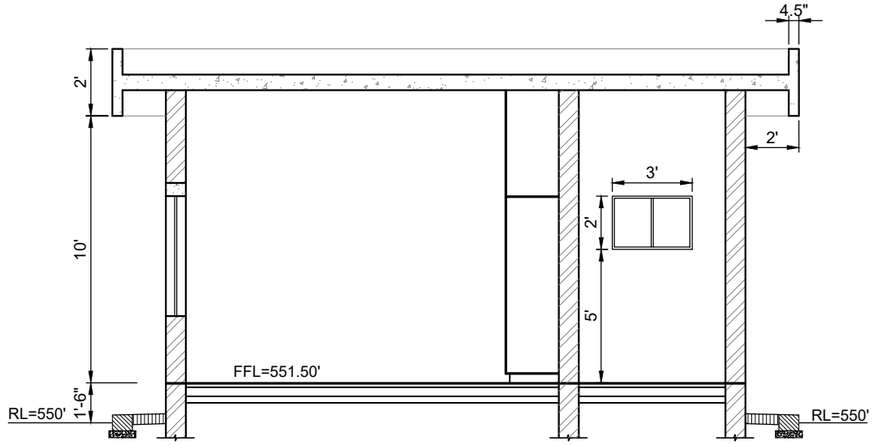
REV.: 0



STAFF BUILDING



SIDE ELEVATION



SECTION A-A

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

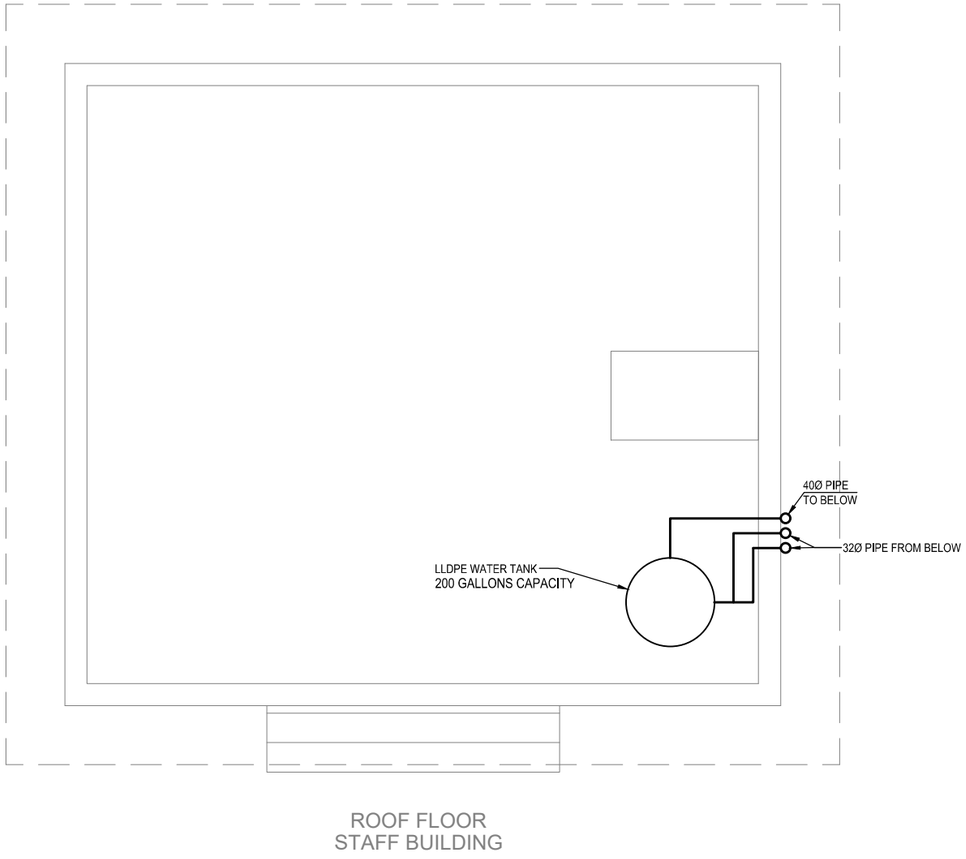
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

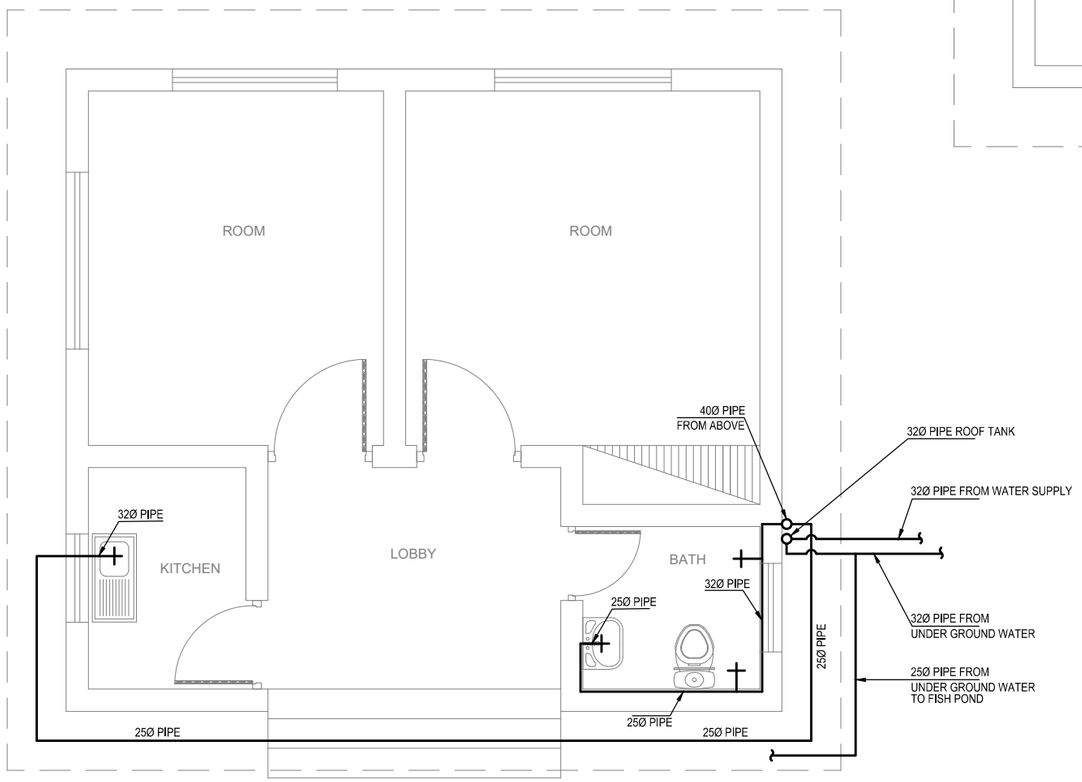
DETAIL OF OFFICE BUILDING

DATE	DRAWING No.	REV.
SEPTEMBER, 2024	**4695/11/C/2J109**	0

SCALE 1"=70'



ROOF FLOOR
STAFF BUILDING



GROUND FLOOR
STAFF BUILDING

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

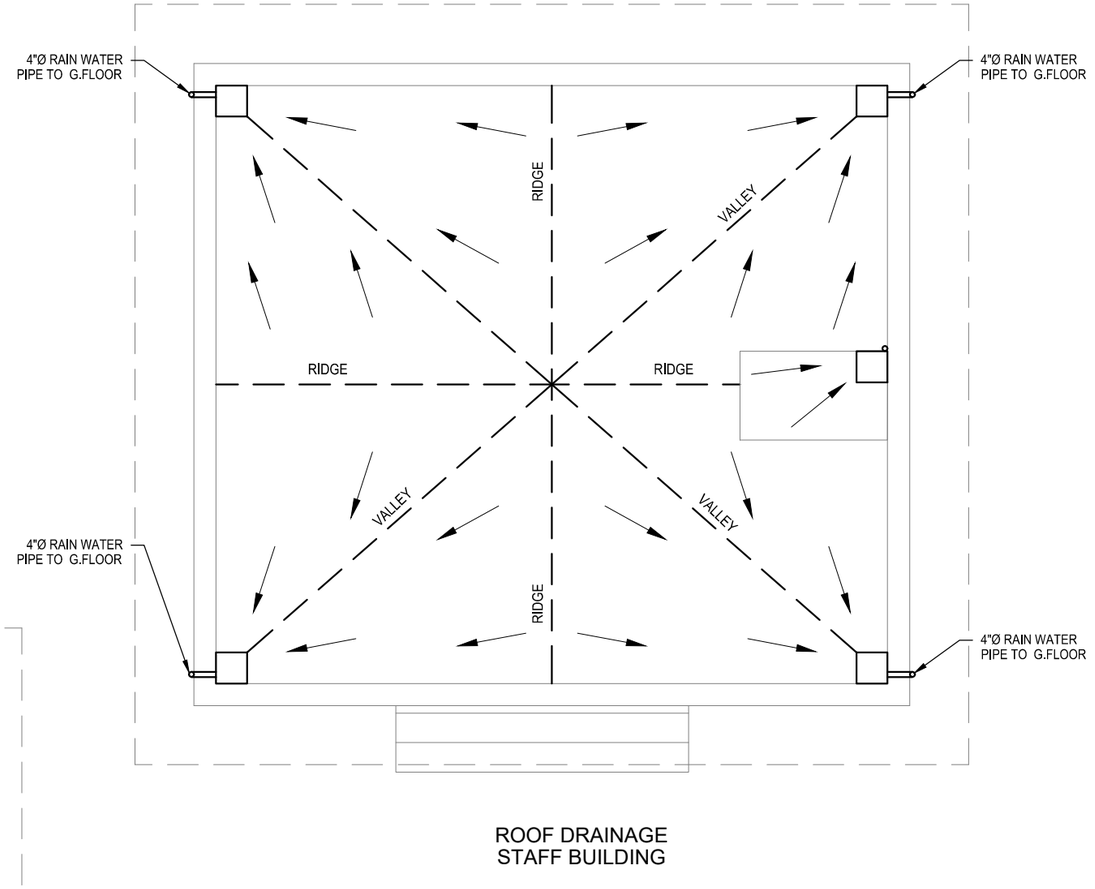
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

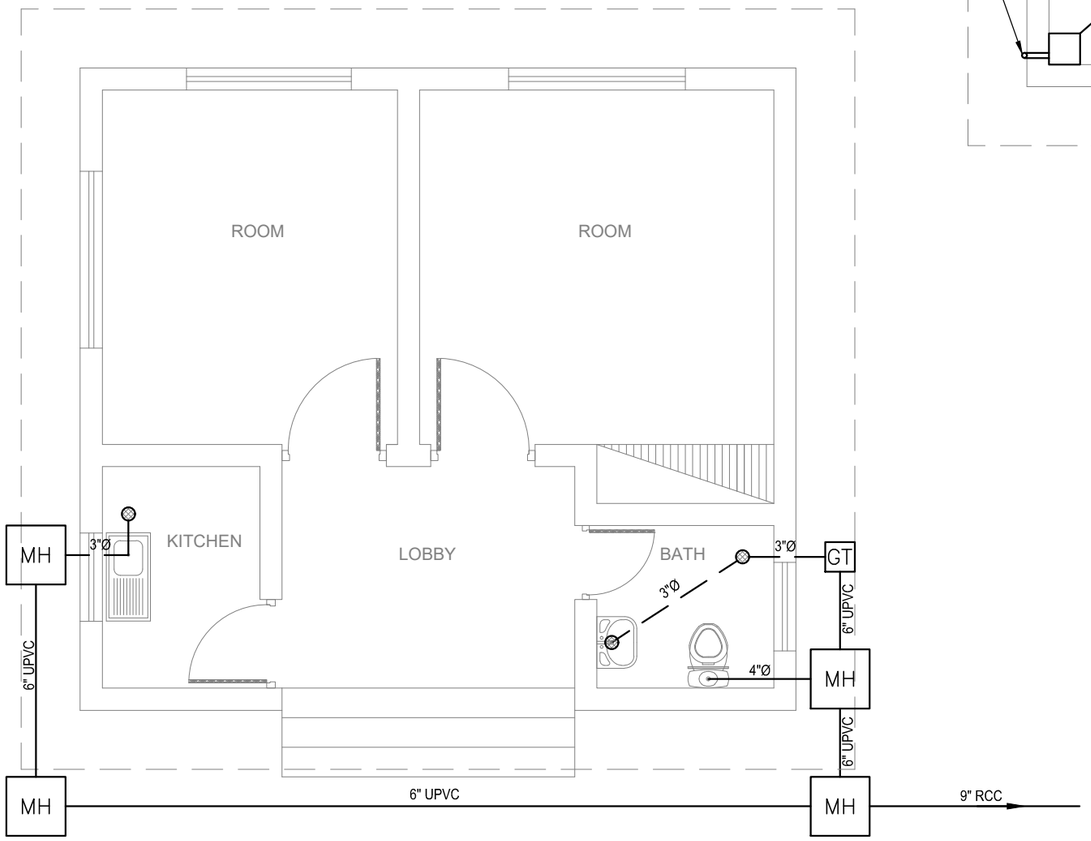
WATER SUPPLY OF STAFF BUILDING

DATE	DRAWING No.	REV.
SEPTEMBER, 2024	**4695/11/C/2J110**	0

SCALE 1"=60'



ROOF DRAINAGE
STAFF BUILDING



SEWERAGE
STAFF BUILDING

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

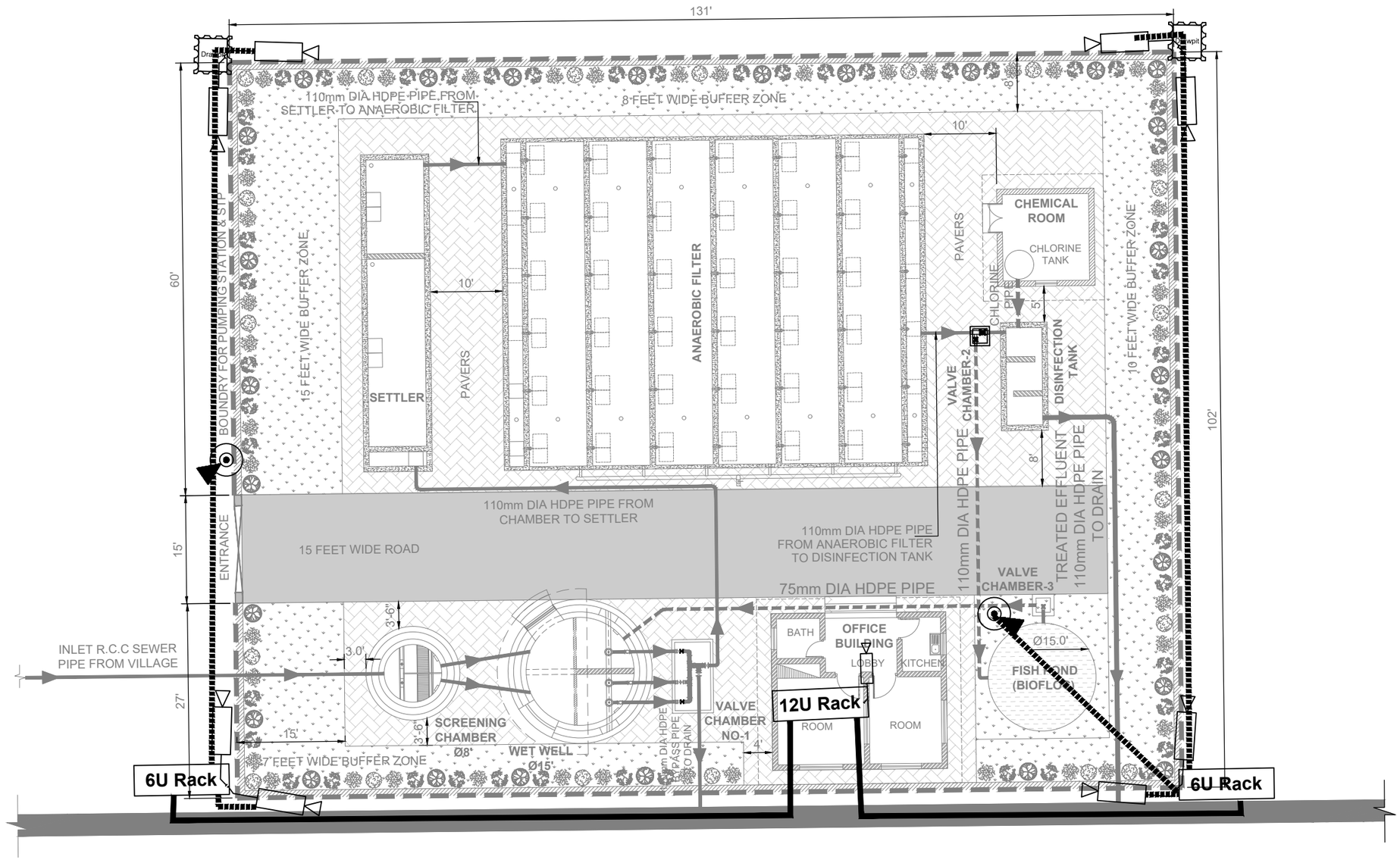
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

SEWERAGE & ROOF DRAINAGE OF STAFF BUILDING

DATE	DRAWING No.	REV.
SEPTEMBER, 2024	**4695/11/C/2J111**	0

SCALE 1"=60'



LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP

LEGEND

Sr.No	ITEM	SYMBOL	QUANTITY
1	FIXED CAMERA		09
2	PTZ CAMERA		02
3	6U RACK	6U Rack	02
4	12U RACK	12U Rack	01
6	DUCT		85Meter
7	CAT-6		165Meter
8	OPTICAL FIBER		60Meter
9	DRAWPIT	Drawpit	02

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

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04			
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RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

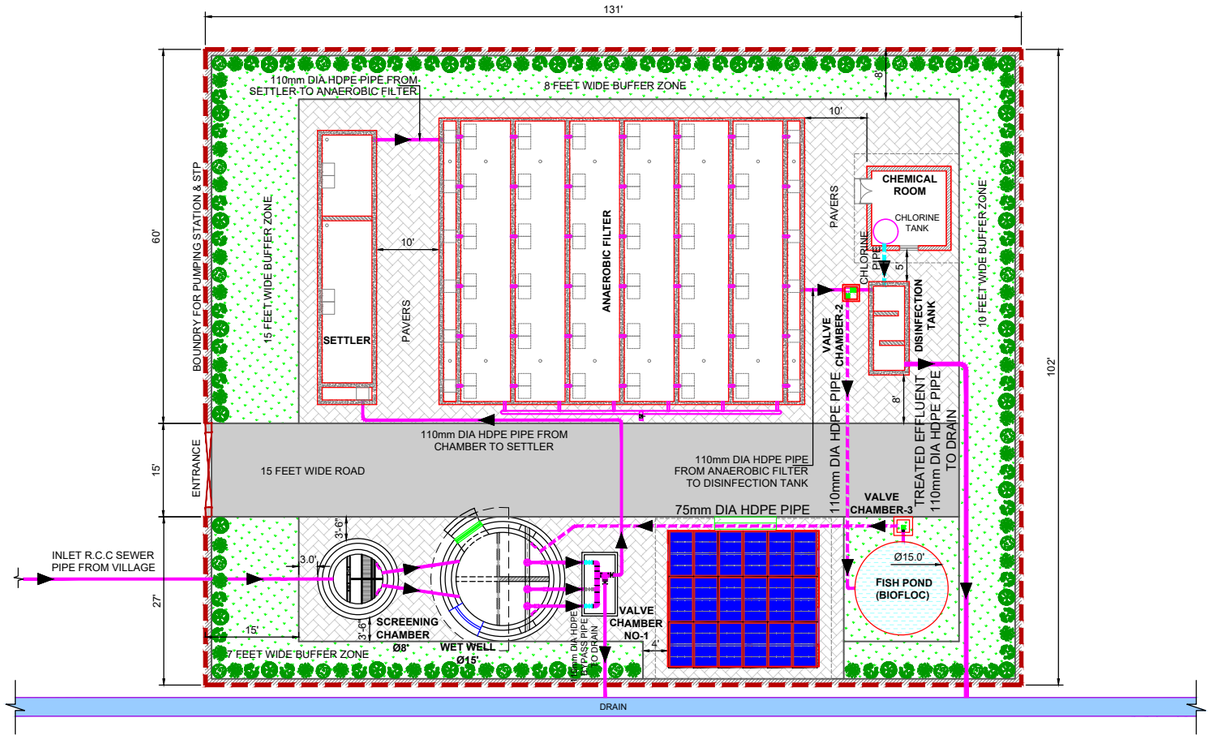
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

DRAWING

CHAK 191
LAYOUT PLAN OF CCTV SYSTEM

DATE	DRAWING No.	REV.
SEPTEMBER, 2024	4695/166/C/1S001	0

SCALE: 1"=42'



LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP

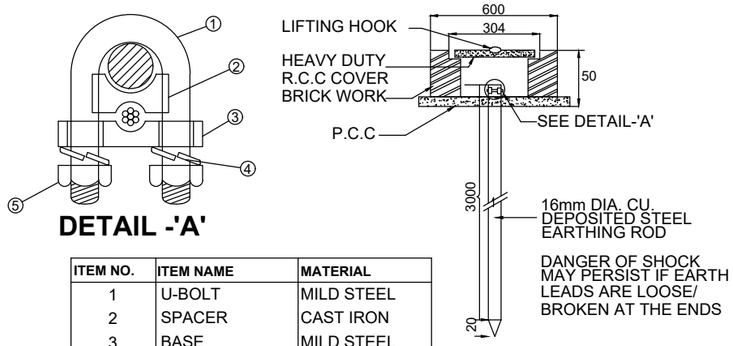
CLIENT	CONSULTANT			PROJECT	SOLAR SYSTEM AND CABLE TRENCH LAYOUT OF WWTP CHAK 191
Strategic Planning & Implementation Unit (SP & IU) Environment Protection Department (EPD) Govt of Punjab.	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.			Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab	DATE: SEPTEMBER, 2024 · DRAWING No.: 4695/165/BQ001 · REV.: 0 · SCALE: 1"=25'

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	RIZWAN
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

GENERAL NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ITEMS OF BILL OF QUANTITIES AND TECHNICAL SPECIFICATION
2. THIS DRAWING SHALL BE COORDINATED WITH OTHER DISCIPLINES WORKS FOR ROUTING, SPACING AND INSTALLATIONS
3. THE MINIMUM SIZE OF THE PVC CONDUIT SHALL BE 25mm (1") DIA.
4. LIGHT CIRCUIT WIRING SHALL BE WITH 3x2.5 mm Sq & LIGHT POINT WIRING SHALL BE WITH 3x1.5 mm. Sq SINGLE CORE STRANDED CU. PVC CABLES
5. ALL POWER SOCKETS (15/20Amp) SHALL BE WIRED WITH 3x6mm.Sq LIGHT PLUG (10/13Amp) SOCKETS FIRST POINT SHALL BE WIRED WITH 3x4mm.Sq & 10Amp. SOCKETS POINT TO POINT WIRED WITH 3x2.5mm. Sq STRANDED CU. PVC CABLES
6. ALL SINGLE CORE WIRES SHALL HAVE THE FOLLOWING COLOURS.
   PHASE WIRES..... RED, YELLOW & BLUE
   NEUTRAL WIRES.....BLACK
   C.P.C.....GREEN/YELOW (AS PER B.O.Q)
7. THE WIRING SHALL BE STARTED ONLY AFTER THE CONDUIT SYSTEM IS COMPLETELY INSTALLED AND ALL OUTLET BOXES ETC. ARE FIXED IN THEIR POSITIONS.
8. ALL POWER/LIGHT PLUG SOCKETS WIRING SHALL BE SEGREGATED AND HAVE INDEPENDENT WIRES RIGHT FROM MINIATURE CIRCUIT BREAKERS IN DISTRIBUTION BOARD.
9. ACTUAL LOCATION OF ALL OUTLETS MUST BE VERIFIED BY THE CONTRACTOR SITE ENGINEER BEFORE INSTALLATION COMMENCES
10. THE MOUNTING HEIGHT OF THE SOCKET OUTLETS SHALL BE MINIMUM 300mm (FFL)
11. THE MOUNTING HEIGHT OF THE LIGHTING SWITCHES SHALL BE MINIMUM 1200mm (FFL)
12. NO LUBRICATION EXCEPT AS RECOMMENDED BY MANUFACTURER SHALL BE USED ON WIRES FOR REDUCING FRICTION. NO OIL OR SOAP OF ANY KIND WILL BE ALLOWED ON WIRES FOR THIS PURPOSE.
13. THE CONTRACTOR SHALL SUBMIT CONDUITS LAYOUT PLAN BASED UPON THE ELECTRIFICATION DRAWINGS FOR THE APPROVAL OF ELECTRICAL ENGINEER, BEFORE POURING OF ROOF SLABS, WALL AND COLUMNS.
14. ALL THE ELECTRICAL WORKS SHALL BE EXECUTED IN STRICT ACCORDANCE WITH THE PROJECT SPECIFICATION
15. THE ELECTRICAL EQUIPMENT SHALL BE SUPPLIED FROM APPROVED MANUFACTURER AS PER APPLICABLE STANDARDS AND CODES

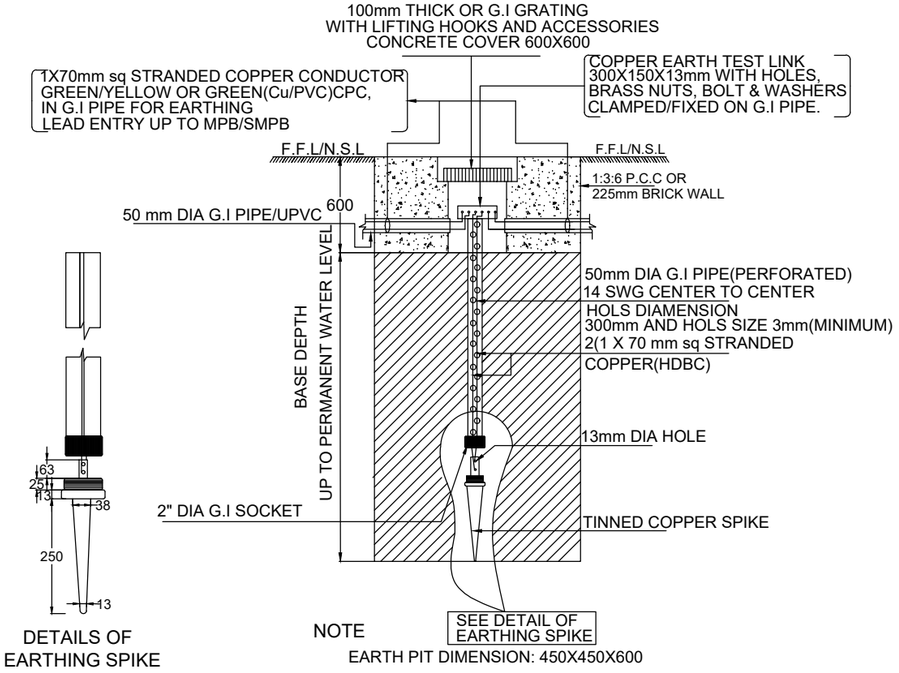
ROD TYPE EARTH POINT DETAIL FOR DB,S



DETAIL -'A'

ITEM NO.	ITEM NAME	MATERIAL
1	U-BOLT	MILD STEEL
2	SPACER	CAST IRON
3	BASE	MILD STEEL
4	SPRING WASHER	CARBON STEEL
5	NUT	MILD STEEL

BORE TYPE EARTHING DETAIL



DETAILS OF EARTHING SPIKE

NOTE
EARTH PIT DIMENSION: 450X450X600

NOTES

1. THIS DRAWING IS FOR INDICATIVE DESIGN MODEL AND SHOULD BE READ IN CONJUNCTION WITH SPECIFICATIONS AND ITEMS OF BILL OF QUANTITIES.
2. EARTH BORE SHALL BE MADE AT 2000MM (2M) AWAY FROM FOUNDATION/STRUCTURE.
3. DISTANCE BETWEEN TWO EARTH BORES SHALL NOT BE LESS THAN 3000MM (3M)
4. CONNECTION SHALL BE BOLTED WITH THIMBLES, BRASS NUTS, BOLTS/WASHER ETC.
5. CONTRACTOR SHALL MEASURE EARTHING RESISTANCE IN THE PRESENCE OF SITE ENGINEER, FOR FINAL ACCEPTANCE.
6. THE VALUE OF EARTH RESISTANCE SHALL BE INCORPORATED IN FINAL AS-BUILT DRAWINGS.
7. THE LOCATION OF MAIN PANEL BOARD & DISTRIBUTION BOARDS IS TENTATIVE & SHALL BE FINALIZED AS PER SITE CONDITION / REQUIREMENTS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

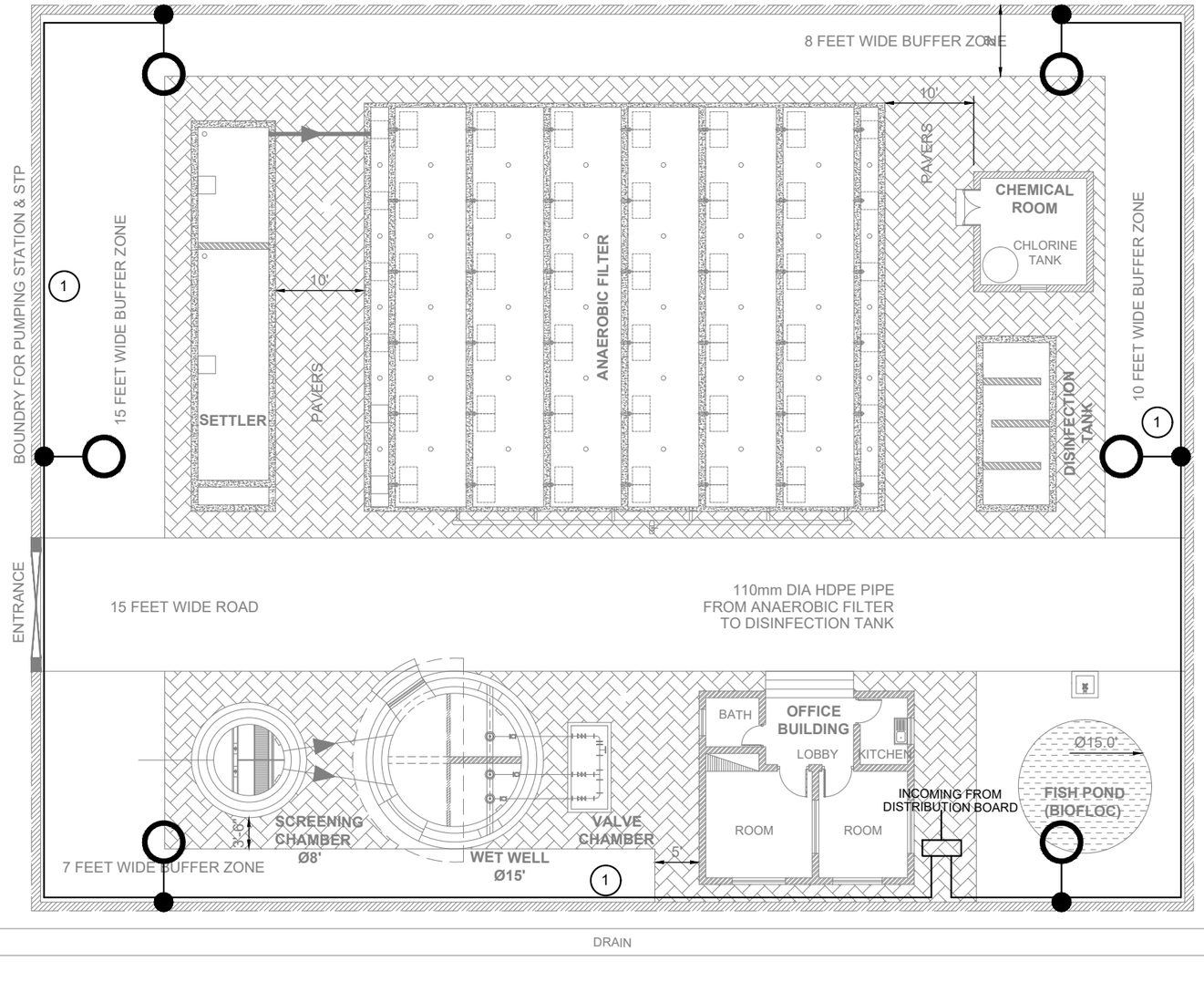
REV.	DATE	DESCRIPTION	APPROVED
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02			
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DRAWN	SA
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

LEGEND GENERAL NOTES ROD TYPE & BORE TYPE EARTHING DETAILS

DATE: SEP, 2024
DRAWING No.: **4695/161/TD/5E001**
SCALE: N.T.S.
REV.: 0



LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP

LEGEND:-

SYMBOL		DESCRIPTION
●–○		10 METER HIGH SINGLE ARM OCTAGONAL CONICAL POLE WITH 90W LED LIGHT

① 4 CORE 10 Sq.mm Cu./PVC/PVC+
1 Core 10 Sq.mm Cu./PVC AS CPC
IN PVC PIPE 100mm Ø CLASS "B"

CLIENT
Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

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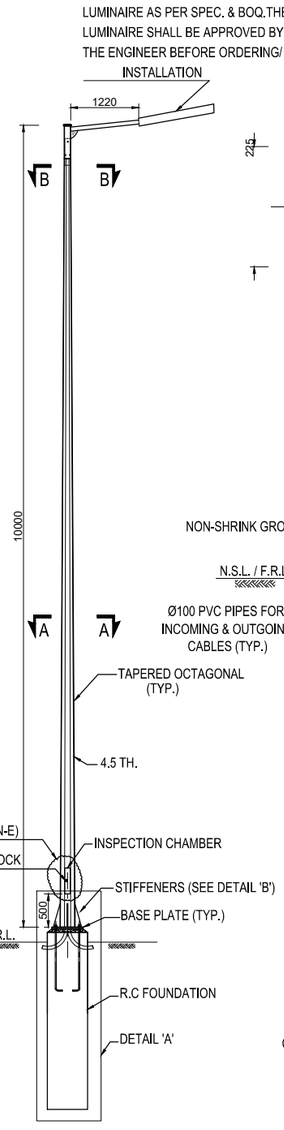
REV.	DATE	DESCRIPTION	APPROVED
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03			
02			
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DRAWN	SA
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

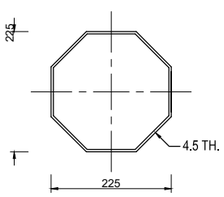
PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

CHAK 191
EXTERNAL ELECTRIFICATION
LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP

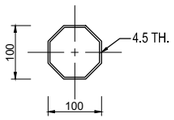
DATE: SEP, 2024
DRAWING No.: **4695/161/TD/5E002**
SCALE: N.T.S.
REV.: 0



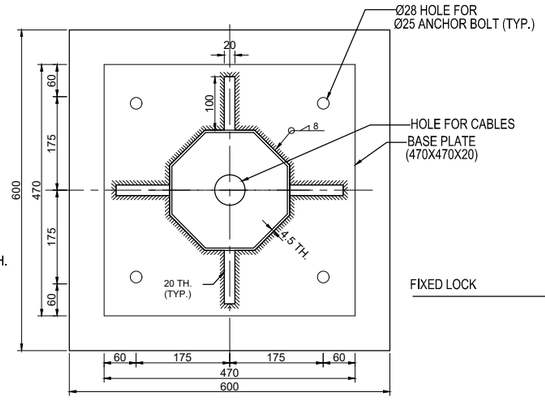
SINGLE LUMINAIRE HOT DIP GALVANIZED STEEL OCTAGONAL POLE



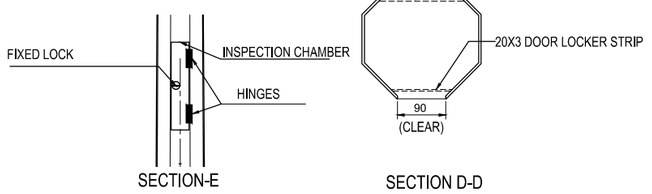
SECTION A-A



SECTION B-B

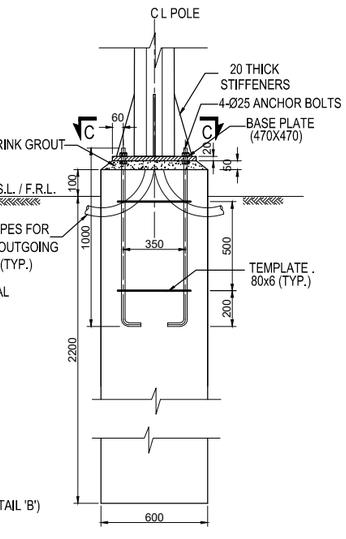


SECTION C-C

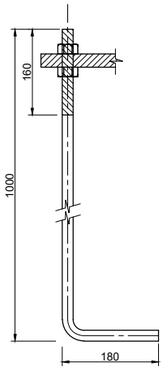


SECTION-E

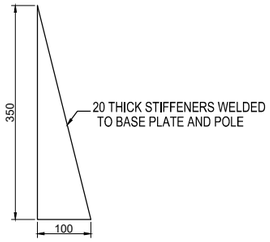
SECTION D-D



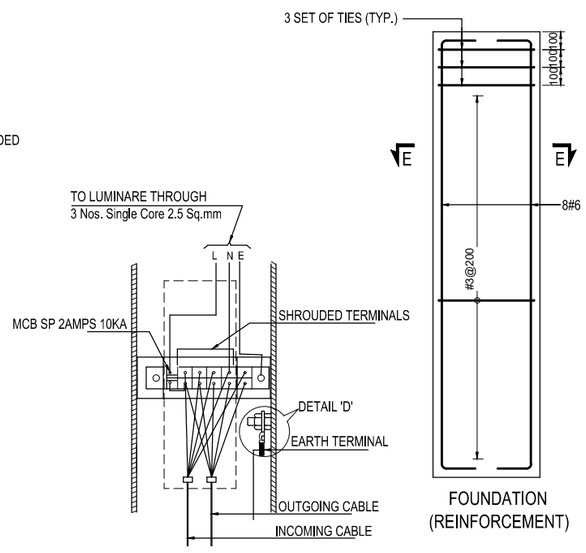
DETAIL-A (CONCRETE OUTLINE)



ANCHOR BOLT

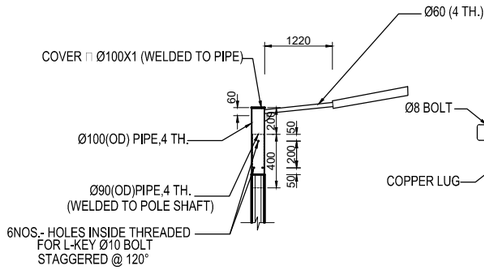


DETAIL-B

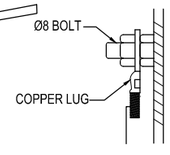


DETAIL OF INSPECTION CHAMBER

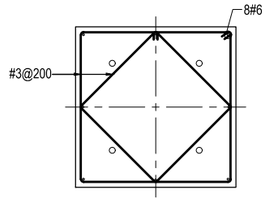
FOUNDATION (REINFORCEMENT)



DETAIL-C



DETAIL-D



SECTION E-E

NOTES

1. FOR GENERAL NOTES REFER DRAWING NO. G001.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. UNLESS OTHERWISE NOTED, CONCRETE SHALL BE CLASSIFIED AS FOLLOWS.
   CONCRETE CLASS 28 DAYS (15x30 CM) CYLINDER STRENGTH Kg/sq. Cm
   REINFORCED A 210 (3000 psi)
4. THE STEEL FOR POLE & BASE PLATE SHALL BE OF YIELD STRENGTH OF 350MPa(50Ksi). & SHALL CONFORM TO ASTM A36 STEEL.
5. THE ANCHOR BOLTS SHALL CONFORM TO ASTM A307.
6. ALL WELDING SHALL CONFORM TO THE APPLICABLE PROVISIONS OF A.W.S (AMERICAN WELDING SOCIETY) CODE.
7. HOT DIP GALVANIZATION SHALL CONFORM TO BS EN ISO 1461 (IN SIDE & OUT SIDE) OR IN ACCORDANCE WITH ASTM A123 AND A325.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department
(EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
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DRAWN	SA
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

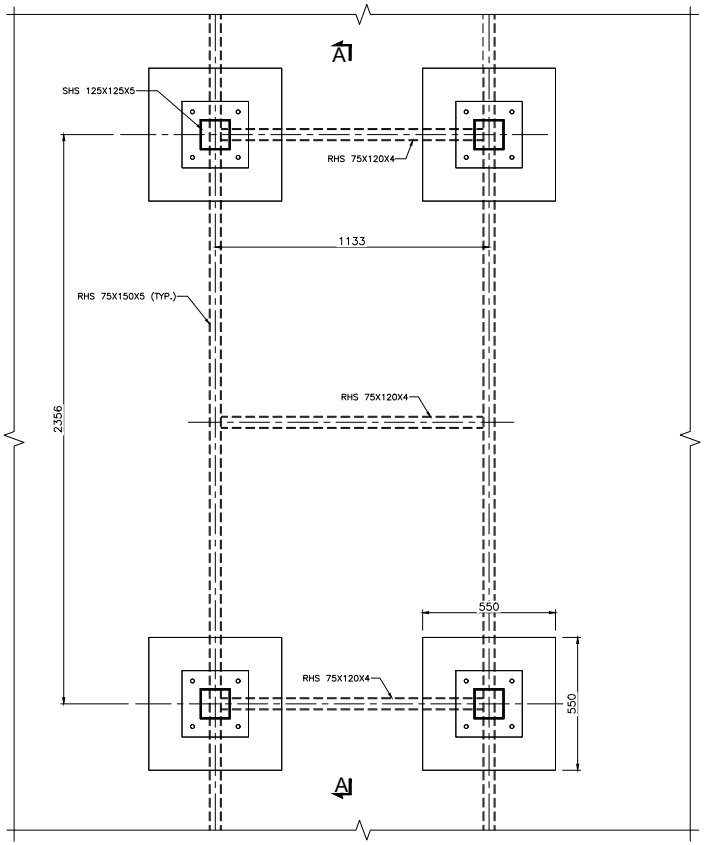
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

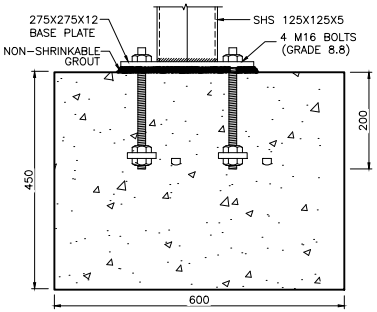
10M HIGH OCTAGONAL CONICAL LIGHTING POLE WITH SINGLE ARM BRACKET

N.T.S.

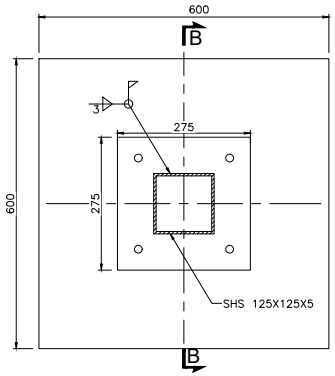
DATE	DRAWING No.	REV.
SEP, 2024	**4695/161/TD/5E003**	0



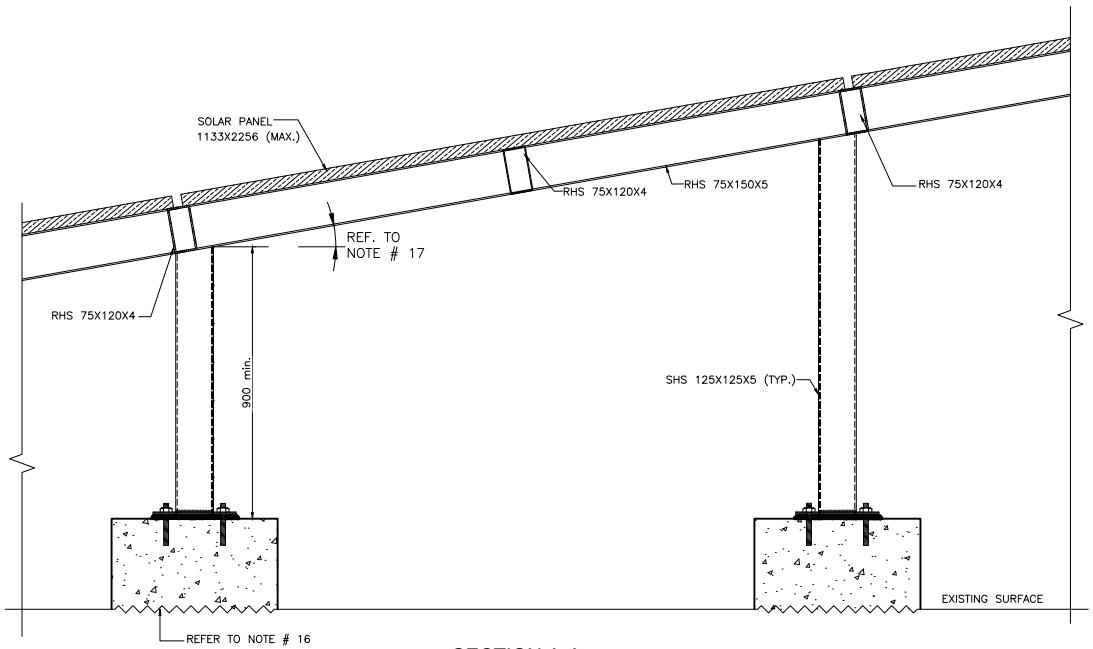
TYPICAL STRUCTURAL FRAMING PLAN



SECTION B-B



CONCRETE BLOCK DETAIL



SECTION A-A

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETER.
2. ALL CONNECTIONS TO BE DESIGNED AND DETAILED BY CONTRACTOR.
3. ALL STEEL GRADE SHALL HAVE MINIMUM YIELD STRENGTH OF 250 Mpa.
4. ALL WELD SHALL BE OF E70XX ELECTRODE.
5. ALL STEEL STRUCTURE AND ANCHOR BOLTS SHALL BE HOT DIP GALVANIZED (MIN 85 MICRON).
6. ALL NUT BOLTS SHALL BE OF STAINLESS STEEL MATERIAL (NON-METALLIC, GRADE A325 ANTI-THEFT).
7. IT IS ASSUMED THAT THE EXISTING ELEVATED SURFACE OR ROOF IS ADEQUATE TO BEAR THE LOADINGS FROM STRUCTURAL FRAMING OF SOLAR PANEL.
8. MINIMUM CLEARANCE OF PV MODULE SHALL BE 6 FEET ABOVE THE ROOF LEVEL.
9. TWO DRAINAGE CLIPS SHALL BE PROVIDED FOR EACH MODULE IN THE LAST/LOWEST ROW OF THE MODULES IN A SHED.
10. ALL BEAM TO BEAM & BEAM TO COLUMN CONNECTION ARE FULLY WELDED CONNECTION WHICH IS HAVING AT LEAST 4MM THICKNESS.
11. NON-SHRINKAGE GROUT OF AT LEAST 20MM THICKNESS SHALL BE PROVIDED UNDER ALL BASE PLATES.
12. ANCHOR BOLT (GRADE A490) SHOULD PROJECT A MINIMUM OF 3 THREADS ABOVE THE FULLY ENGAGED NUT(S).
14. CONTACTOR TO ENSURE THAT THE EXISTING DRAINAGE CHARACTERISTICS OF THE ROOF TOP ARE NOT COMPROMISED.
15. A PROTECTION MAT OF APPROVED TYPE SHALL BE PROVIDED BETWEEN ROOF TOP LAYER AND MOUNTING STRUCTURE/CONCRETE BLOCKS.
16. EXISTING SURFACE TO BE ROUGHENED & APPLY EPOXY CHEMICAL PRIOR TO CASTING OF NEW CONCRETE.
17. REFFER TO SIMMULATION REPORT FOR ANGLE .
18. COMMENCEMENT OF WORK SHOULD BE CARRIED OUT AFTER CLEARING OF SITE .

CONCEPTUAL DESIGN

CLIENT	Strategic Planning & Implementation Unit (SP & IU) Environment Protection Department (EPD) Govt of Punjab.	CONSULTANT	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.	PROJECT	Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab Staff Building & Chemical Room at Chiniot
				DWG. TITLE	**Typical Solar Panel Framing for Elevated Structure**
				SCALE	
				DATE	SEPTEMBER, 2024
				DRAWING No.	**4695/TD/166/2/G01**
				REV.	0

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	SOHAIB
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

STRATEGIC PLANNING & IMPLEMENTATION UNIT (SP & IU), PGDP
ENVIRONMENT PROTECTION DEPARTMENT (EPD) GOVT OF PUNJAB

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

CHAK 2KB
LIST OF DRAWINGS

SR. NO.	DRAWING NO.	TITLE
01	4695/11/C/2J100	CHAK 2KB GENERAL NOTES & LEGEND OF WASTE WATER TREATMENT PLANT
02	4695/11/C/2J101	CHAK 2KB LOCATION PLAN OF WASTE WATER TREATMENT PLANT
03	4695/11/C/2J102	CHAK 2KB PROCESS FLOW DIAGRAM OF WASTE WATER TREATMENT PLANT
04	4695/11/C/2J103	CHAK 2KB BLOWUP LAYOUT PLAN OF WASTE WATER TREATMENT PLANT
05	4695/11/C/2J104	CHAK 2KB HYDRAULIC PROFILE OF WASTE WATER TREATMENT PLANT
06	4695/11/C/2J105	CHAK 2KB ANAEROBIC POND PLAN & SECTION B-B
07	4695/11/C/2J106	CHAK 2KB FACULTATIVE POND PLAN & SECTION C-C
08	4695/11/C/2J107	COLLECTION CHAMBER PLAN & SECTION
09	4695/11/C/2J108	COLLECTION CHAMBER & ANAEROBIC POND CONNECTION
10	4695/11/C/2J109	INTERCONNECTION ANAEROBIC POND TO FACULTATIVE POND
11	4695/11/C/2J110	OUTLET FROM FACULTATIVE POND
12	4695/11/C/2J111	CHEMICAL ROOM PLAN & SECTION
13	4695/11/C/2J112	SEWAGE TREATMENT PLANT DISINFECTION TANK PLAN AND SECTION
14	4695/11/C/2J113	CHEMICAL ROOM PLAN & SECTIONS
15	4695/11/C/2J114	SEWAGE TREATMENT PLANT PLAN OF FISH POND
16	4695/11/C/2J115	SEWAGE TREATMENT PLANT FISH POND SECTION A-A
17	4695/11/C/2J116	DETAIL OF STAFF BUILDING
18	4695/11/C/2J117	WATER SUPPLY OF STAFF BUILDING
19	4695/11/C/2J118	SEWERAGE & ROOF DRAINAGE OF STAFF BUILDING
20	4695/11/C/2J005	CHAK 2KB TOPOGRAPHIC SURVEY SHEET LAYOUT PLAN
		SCADA
21	4695/166/C/1S001	CCTV SYSTEN OF WASTE WATER TREATMENT PLANT CHAK 2KB
		SOLAR SYSTEM
22	4695/165/BQ001	SOLAR SYSTEM AND CABLE TRENCH LAYOUT OF WWTP CHAK 2KB
		ELECTRICAL
23	4695/161/TD/5E001	LEGEND GENERAL NOTES ROD TYPE & BORE TYPE EARTHING DETAILS
24	4695/161/TD/5E002	EXTERNAL ELECTRIFICATION LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP CHAK 2KB
25	4695/161/TD/5E003	10M HIGH OCTAGONAL CONICAL LIGHTING POLE WITH SINGLE ARM BRACKET
		STRUCTURE
26	4695/TD/166/2/G01	TYPICAL SOLAR FRAMING FOR ELEVATED STRUCTURE

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
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02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

DATE: April, 2025

DRAWING No.:

SCALE:

REV.: 0

LEGEND:

PROPOSED FORCEMAIN

PROPOSED HDPE PIPE

WWTP BOUNDARY

ROAD

COLLECTION CHAMBER

EXISTING NULLAH

NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL PIPE DIAMETERS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
4. THE CONTRACTOR SHALL CARRY OUT COMMISSIONING OF WWTP AS PER ENGINEERING STANDARDS TO MEET THE TREATED EFFLUENT QUALITY PARAMETER (PEQS/WHO) TO COMPLETE SATISFACTION OF THE ENGINEER.
5. THE CONTRACTOR SHALL PROVIDE TRAINING TO THE O&M AGENCY FOR REPAIR AND MAINTENANCE OF THE PROPOSED WWTP AND ASSOCIATED WORKS.
6. ALL MATERIALS, WORKMAN SHIP AND TESTING SHALL BE IN ACCORDANCE WITH ENGINEERING STANDARDS, MATERIALS, SPECIFICATION, DRAWINGS AS APPROVED BY THE ENGINEER.
7. STRICT COMPLIANCE TO HEALTH, SAFETY, ENVIRONMENTAL AND COVID MANAGEMENT PLANS SHALL BE OBSERVE BY THE CONTRACTOR.
8. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF ALL ELECTRO-MECHANICAL COMPONENTS BEFORE EXECUTION FOR APPROVAL OF THE ENGINEER.
9. ANY DEFECT /SHORT COMING OR COMPLAINTS LODGED DURING DEFECT LIABILITY PERIOD OR INCLUDED IN THE PUNCH LIST SHALL BE RECTIFIED BY THE CONTRACTOR.
10. THE CONTRACTOR SHALL PREPARE AS-BUILT DRAWINGS OF THE COMPLETE WWTP & ITS ALLIED COMPONENTS ON AUTOCAD AND GIS SOFTWARES, (MENTIONING CONSTRUCTION/ INSTALLATION TIME, SIZES, THICKNESS, DIAMETER, MATERIAL, LENGTH, DEPTH ETC.) AND EDITABLE COPIES SHALL BE HANDED OVER TO THE ENGINEER, TO HIS ENTIRE SATISFACTION.

ABBREVIATION

(AP)	ANAEROBIC POND
(FP)	FACULTATIVE POND
D	DIAMETER
mm	MILLIMETER
NSL	NATURAL SURFACE LEVEL
PGL	PROPOSED GROUND LEVEL
FFL	FINISH FLOOR LEVEL
RL	ROAD LEVEL
BL	BED LEVEL
PCC	PLAIN CEMENT CONCRETE
RCC	REINFORCEMENT CEMENT CONCRETE

CLIENT

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Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

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HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

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DRAWN	RIZWAN
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RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

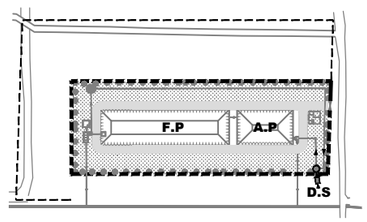
CHAK 2KB
GENERAL NOTES & LEGEND OF WASTE WATER TREATMENT PLANT

DATE: April, 2025

DRAWING No.: **4695/11/C/2J100**

SCALE: NTS

REV.: 0



KEY PLAN

E 1112534.85
N 11003104.18

E 1112534.85
N 11002603.98

500'

179'

VALVE CHAMBER NO-4

Ø15'

FISH POND (BIOFLOC)

Ø75mm HDPE PIPE

Ø75mm HDPE PIPE

Ø25mm FRESH WATER SUPPLY LINE FROM OFFICE BUILDING

40 FEET WIDE BUFFER ZONE (THICK PLANTATION)

40 FEET WIDE BUFFER ZONE (THICK PLANTATION)

Ø110mm HDPE PIPE

FACULTATIVE POND (249' x 69') TYPICAL

15 FEET WIDE PROPOSED ROAD

ANAEROBIC POND (108' x 69') TYPICAL

ENTRANCE

STAFF BUILDING

CHEMICAL ROOM

CHLORINE TANK

VALVE CHAMBER NO-3

Ø160mm HDPE PIPE

FACULTATIVE POND

26'

15 FEET WIDE EMBANKMENT (TUFF PAVER)

ANAEROBIC POND

49'

10'

COLLECTION CAMBER

DISINFECTION TANK

SCUM BOX

Ø160mm HDPE PIPE

206'

15 FEET WIDE PROPOSED ROAD

ROAD

VALVE CHAMBER NO-1

VALVE CHAMBER NO-2

Ø160mm HDPE BYPASS PIPE

Ø160mm HDPE PIPE FROM DISPOSAL STATION

40 FEET WIDE BUFFER ZONE (THICK PLANTATION)

40 FEET WIDE BUFFER ZONE (THICK PLANTATION)

Ø160mm HDPE PIPE

DISPOSAL STATION

E 1112355.85
N 11003104.18

E 1112355.85
N 11002610.18

WATER COURSE

E=1112293.823
N=11003177.739
Z=552.507

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN: RIZWAN
03				SUBMITTED:
02				RECOMMENDED:
01				CHD./VER.:

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

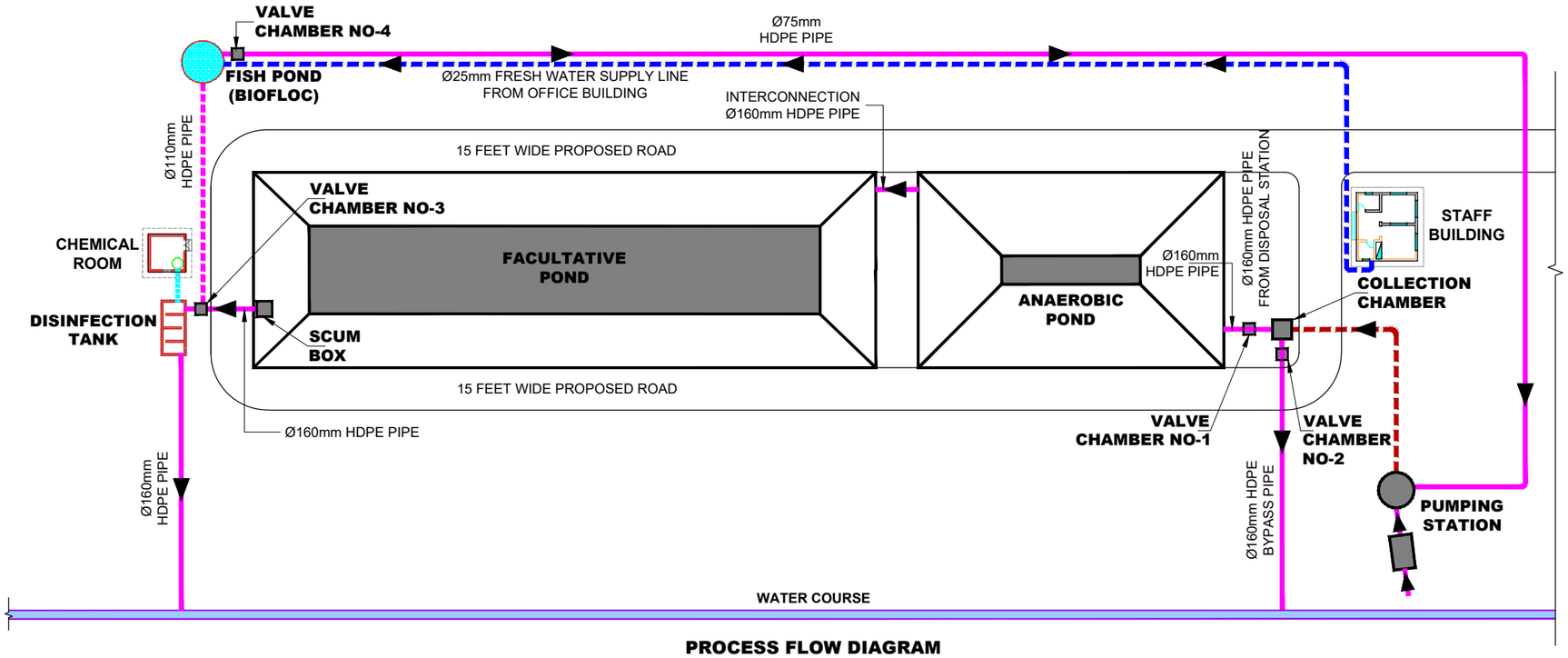
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LOCATION PLAN OF
WASTE WATER TREATMENT PLANT

SCALE: 1"=50'

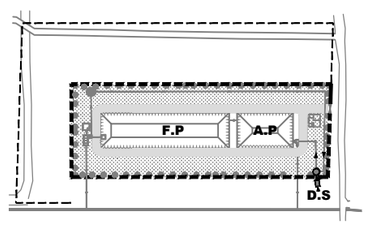
DATE: April, 2025

DRAWING No.: **4695/11/C/2J101**

REV.: 0



PROCESS FLOW DIAGRAM



KEY PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
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REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	RIZWAN
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PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

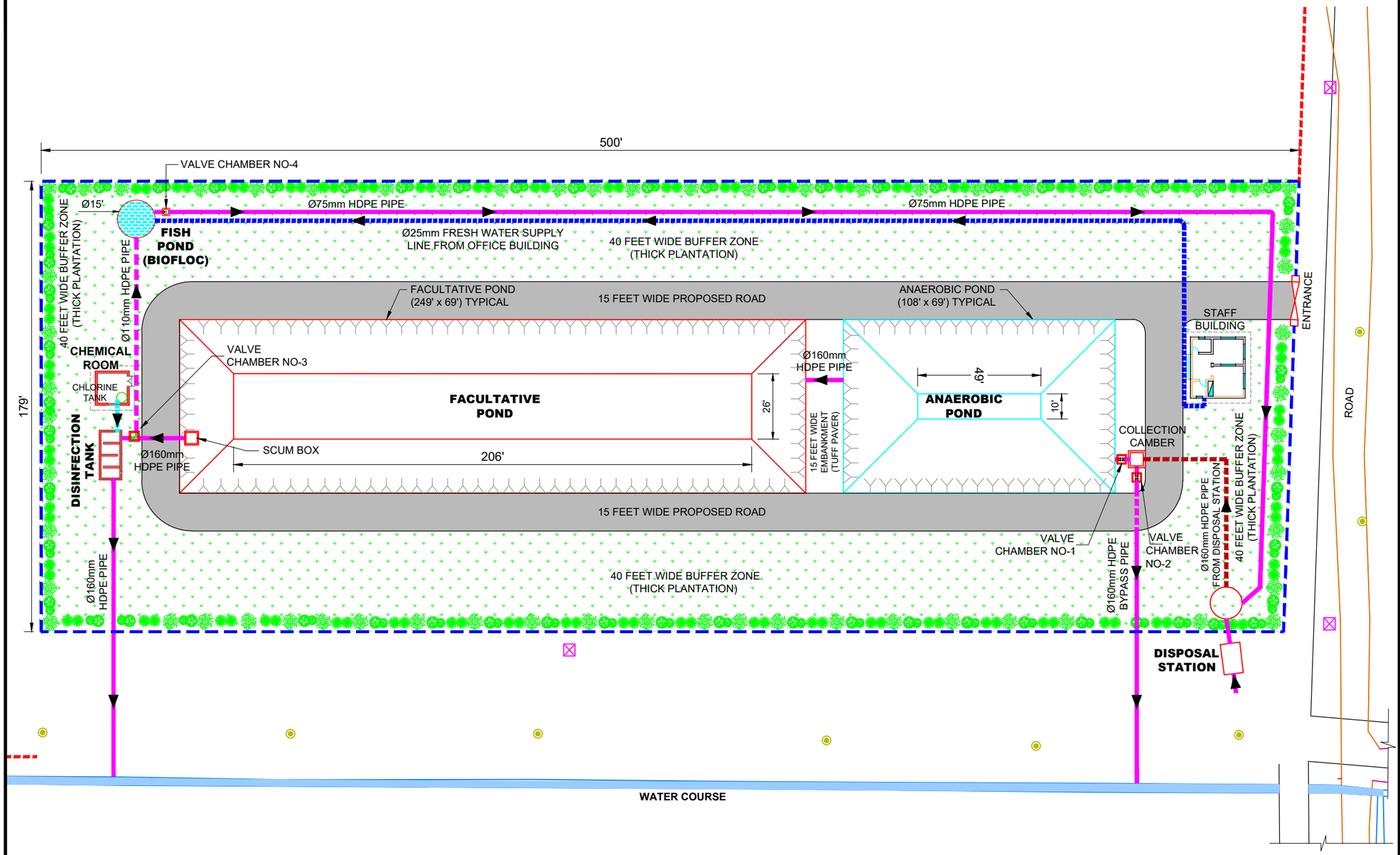
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PROCESS FLOW DIAGRAM OF WASTE WATER TREATMENT PLANT

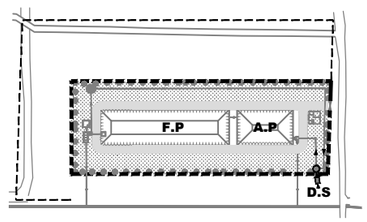
SCALE: 1"=200'

DATE: April, 2025

DRAWING No.: **4695/11/C/2J102**

REV.: 0





KEY PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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03			
02			
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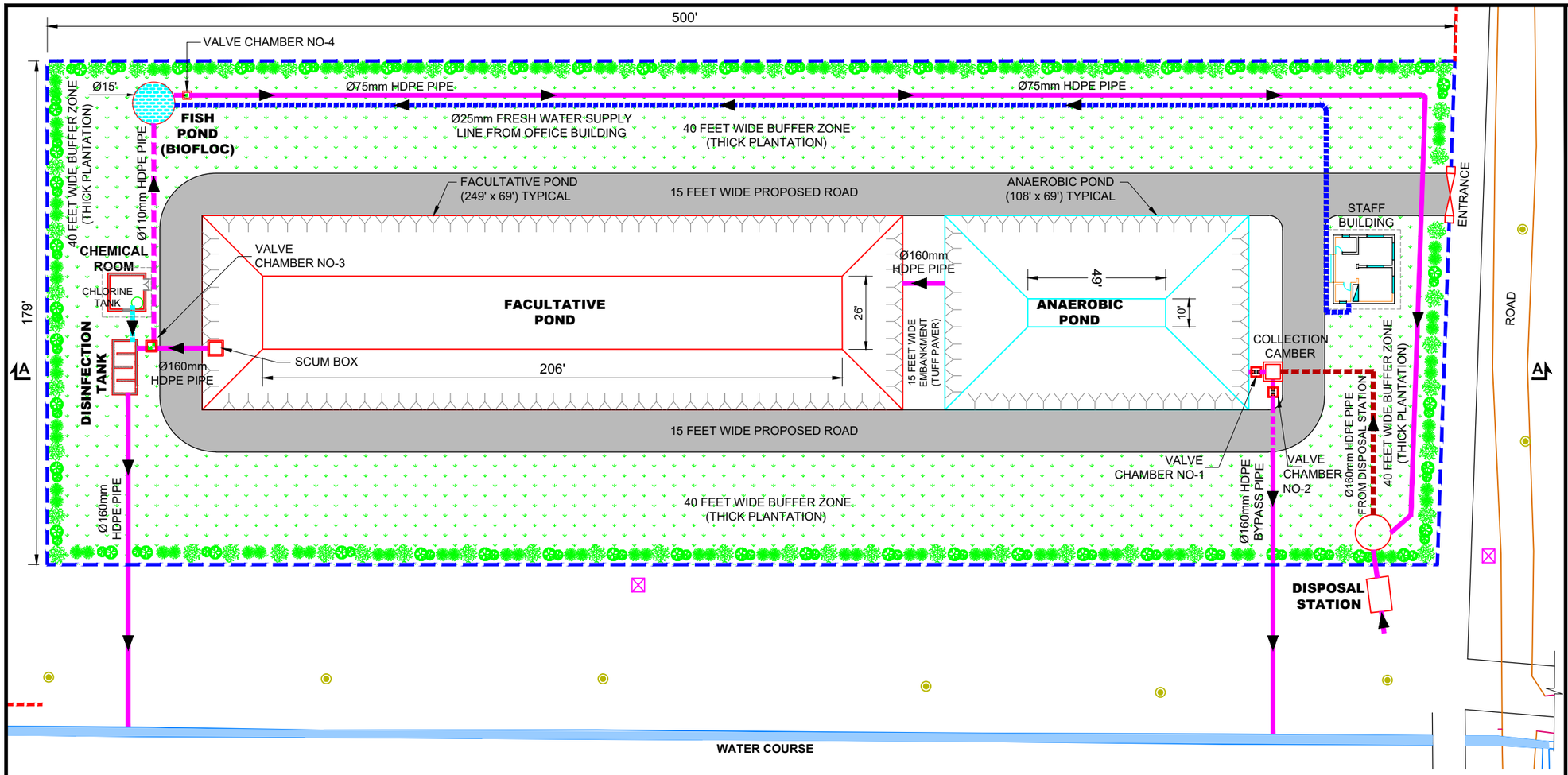
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

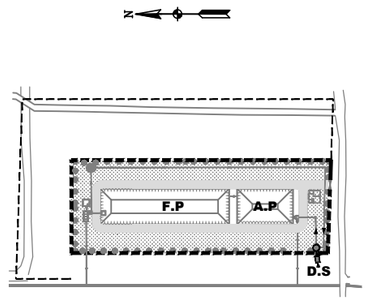
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

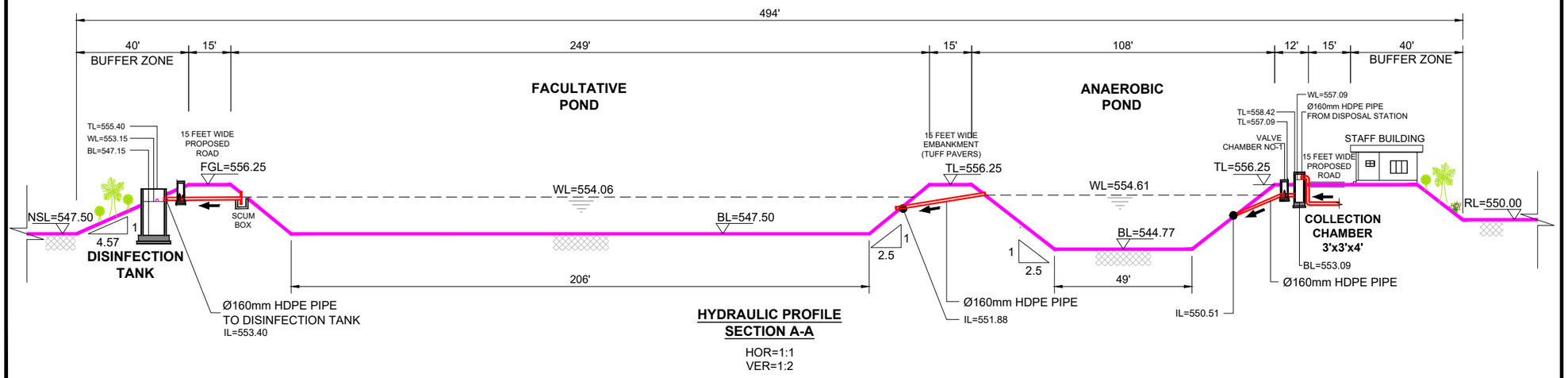
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BLOWUP LAYOUT PLAN OF WASTE WATER TREATMENT PLANT

DATE	DRAWING No.	SCALE	REV.
April, 2025	4695/11/C/2J103	1"=44'	0





KEY PLAN



HYDRAULIC PROFILE SECTION A-A

HOR=1:1
VER=1:2

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

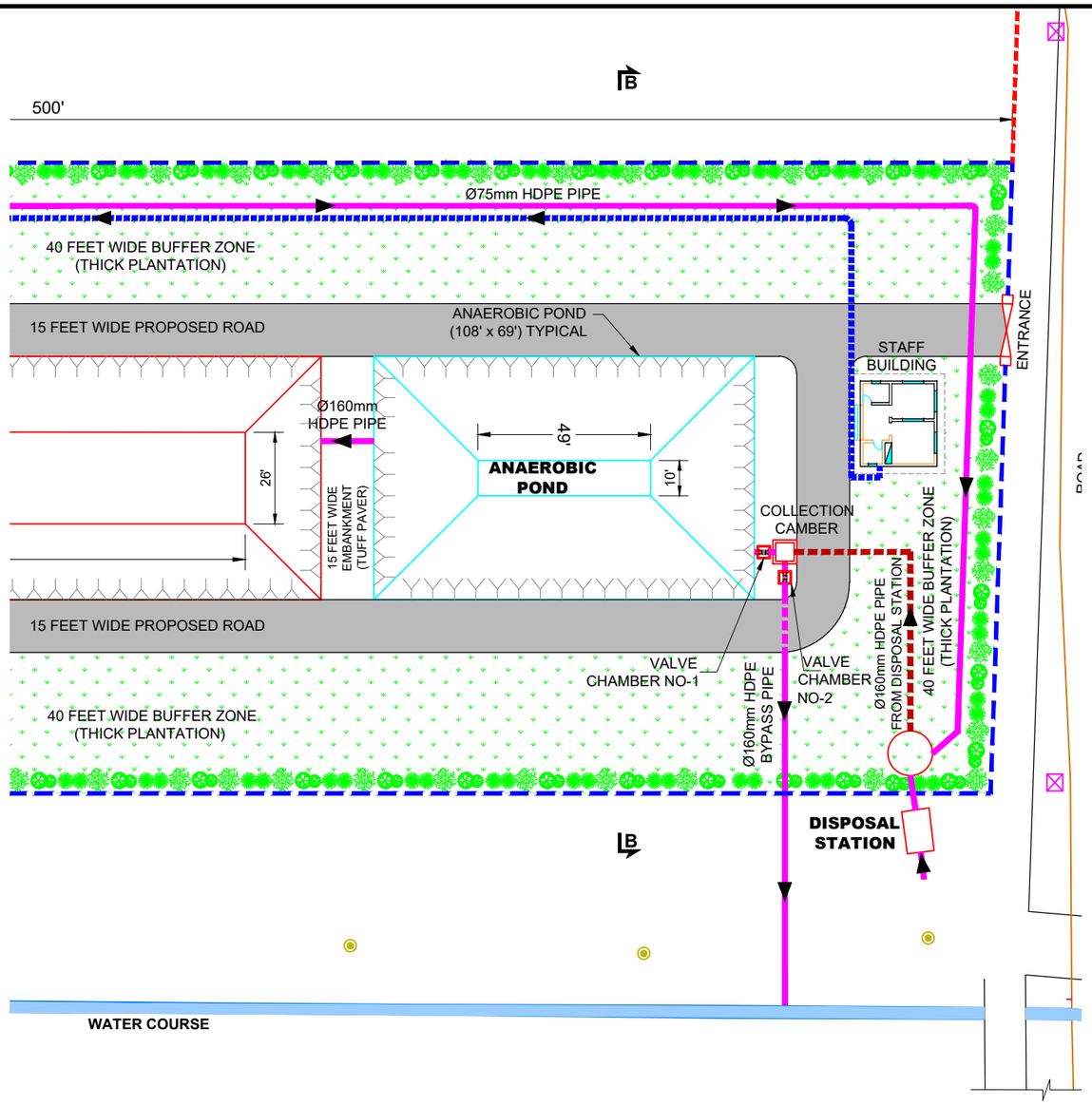
CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

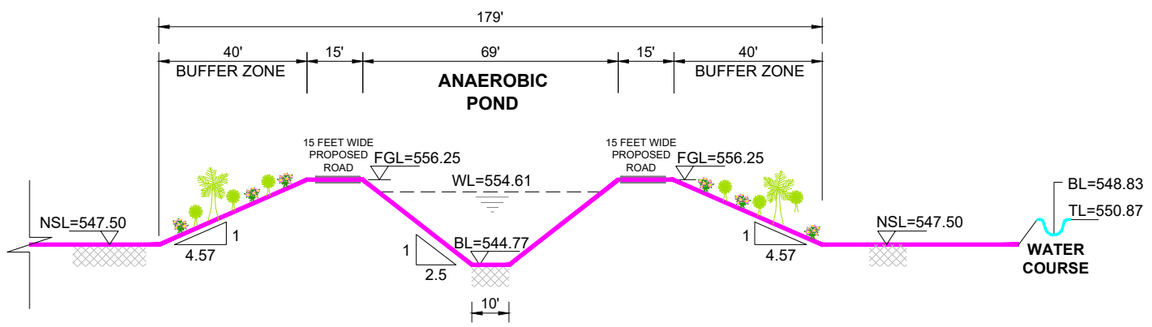
REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN: RIZWAN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

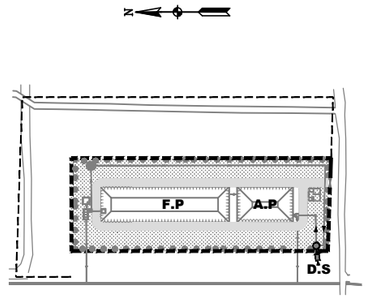
CHAK 2KB
HYDRAULIC PROFILE OF WASTE WATER TREATMENT PLANT

SCALE: 1"=42'
DATE: April, 2025
DRAWING No.: **4695/11/C/2J104**
REV.: 0





SECTION B-B
HOR=1:1
VER=1:2



KEY PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

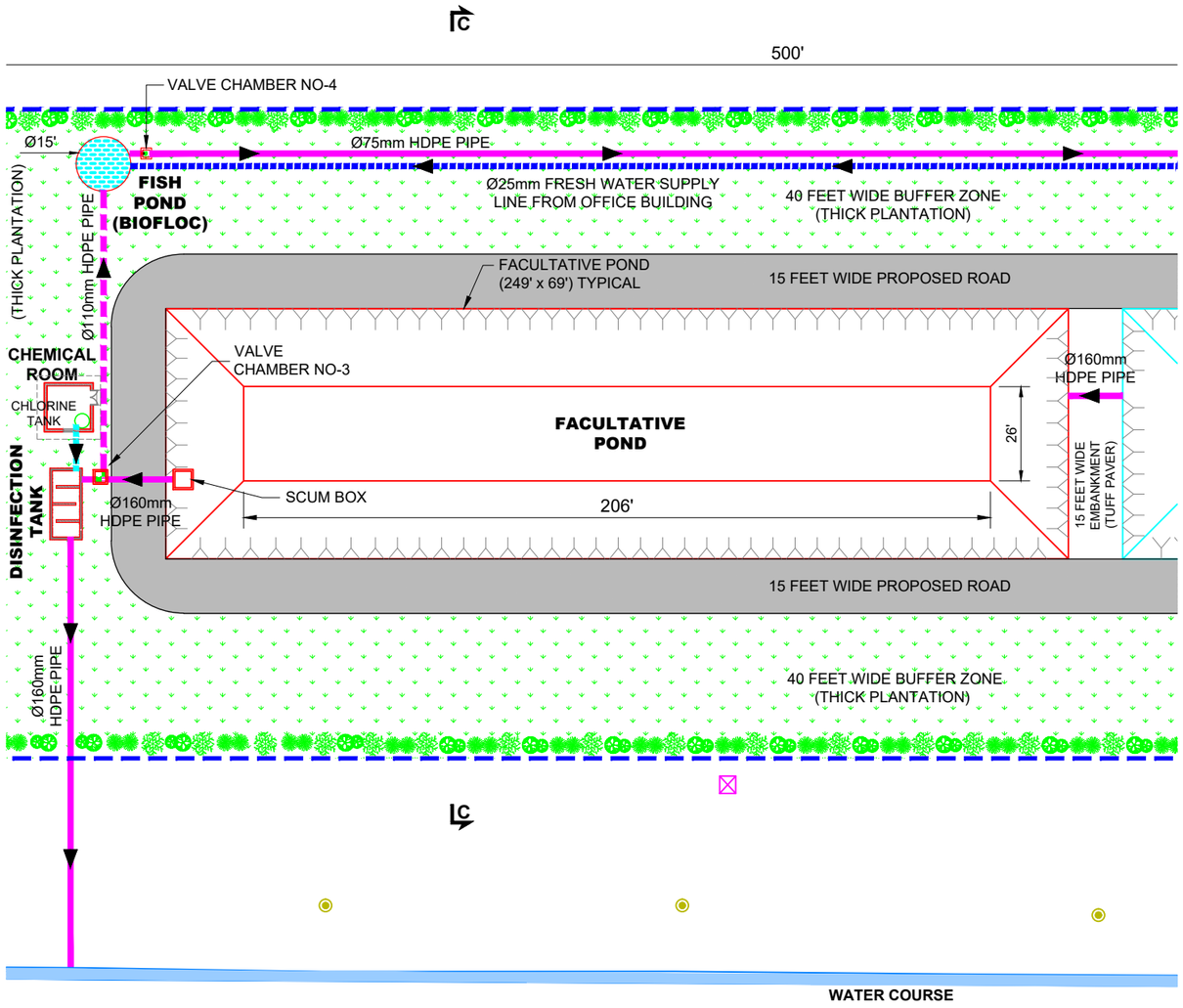
CHAK 2KB
ANAEROBIC POND
PLAN & SECTION B-B

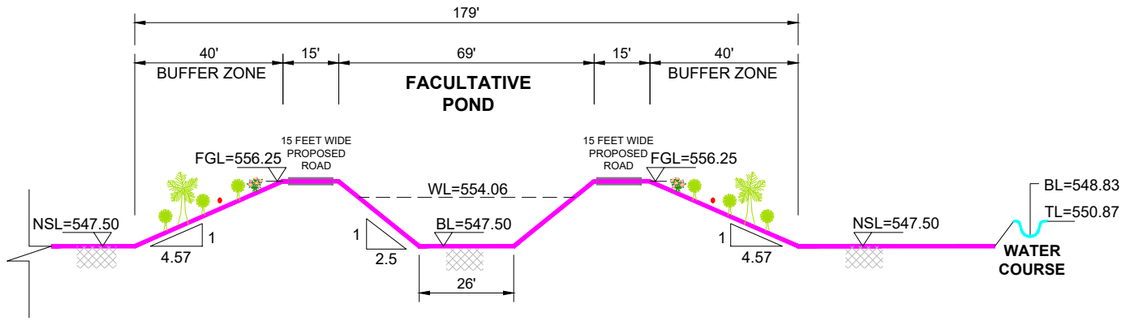
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DATE April, 2025

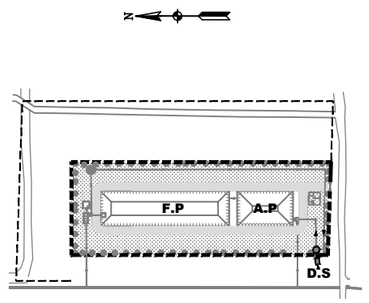
DRAWING No. **4695/11/C/2J105**

REV. 0





SECTION C-C



KEY PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

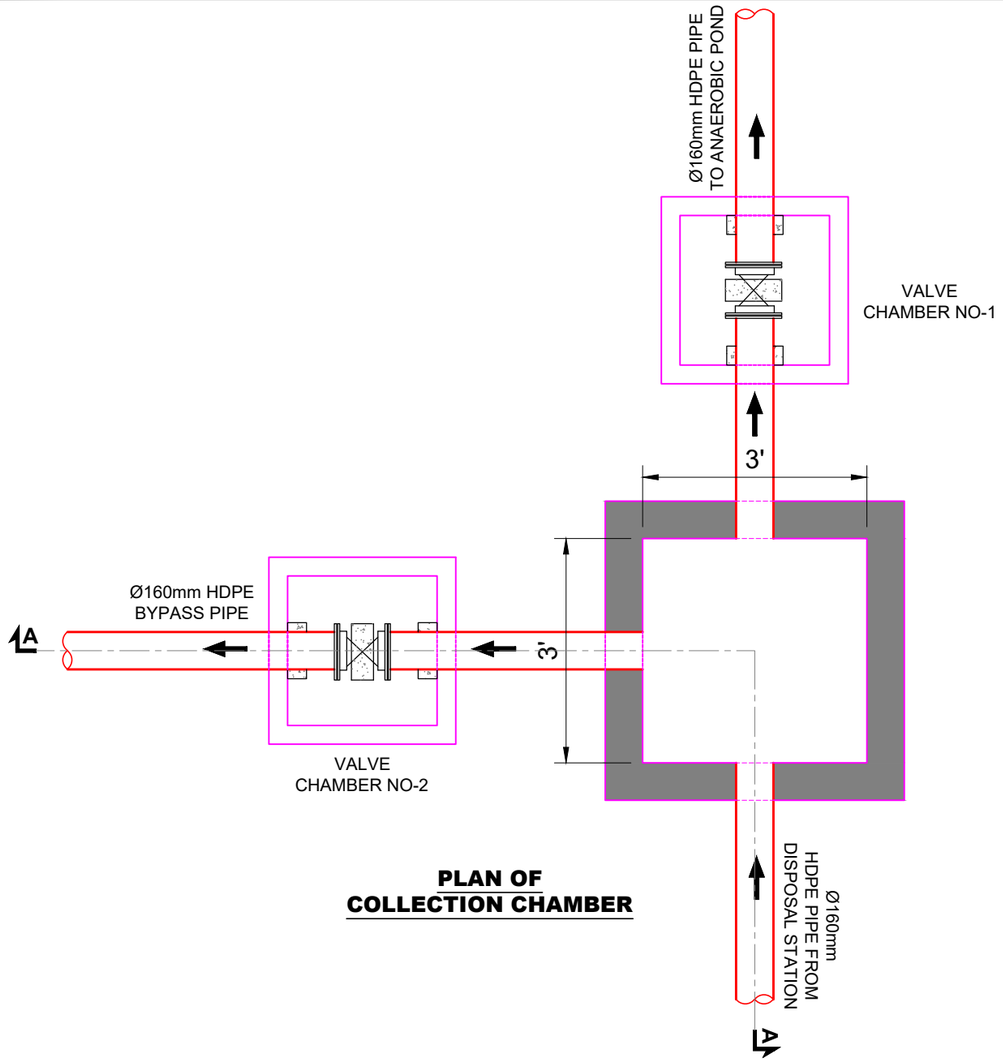
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FACULTATIVE POND
PLAN & SECTION C-C

SCALE 1"=42'

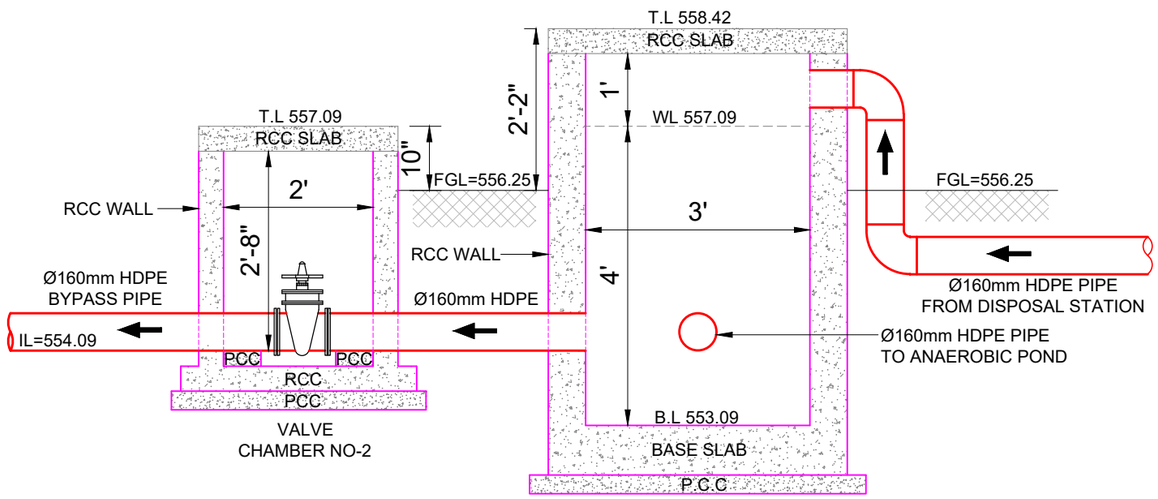
DATE April, 2025

DRAWING No. **4695/11/C/2J106**

REV. 0



PLAN OF COLLECTION CHAMBER



SECTION A-A

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

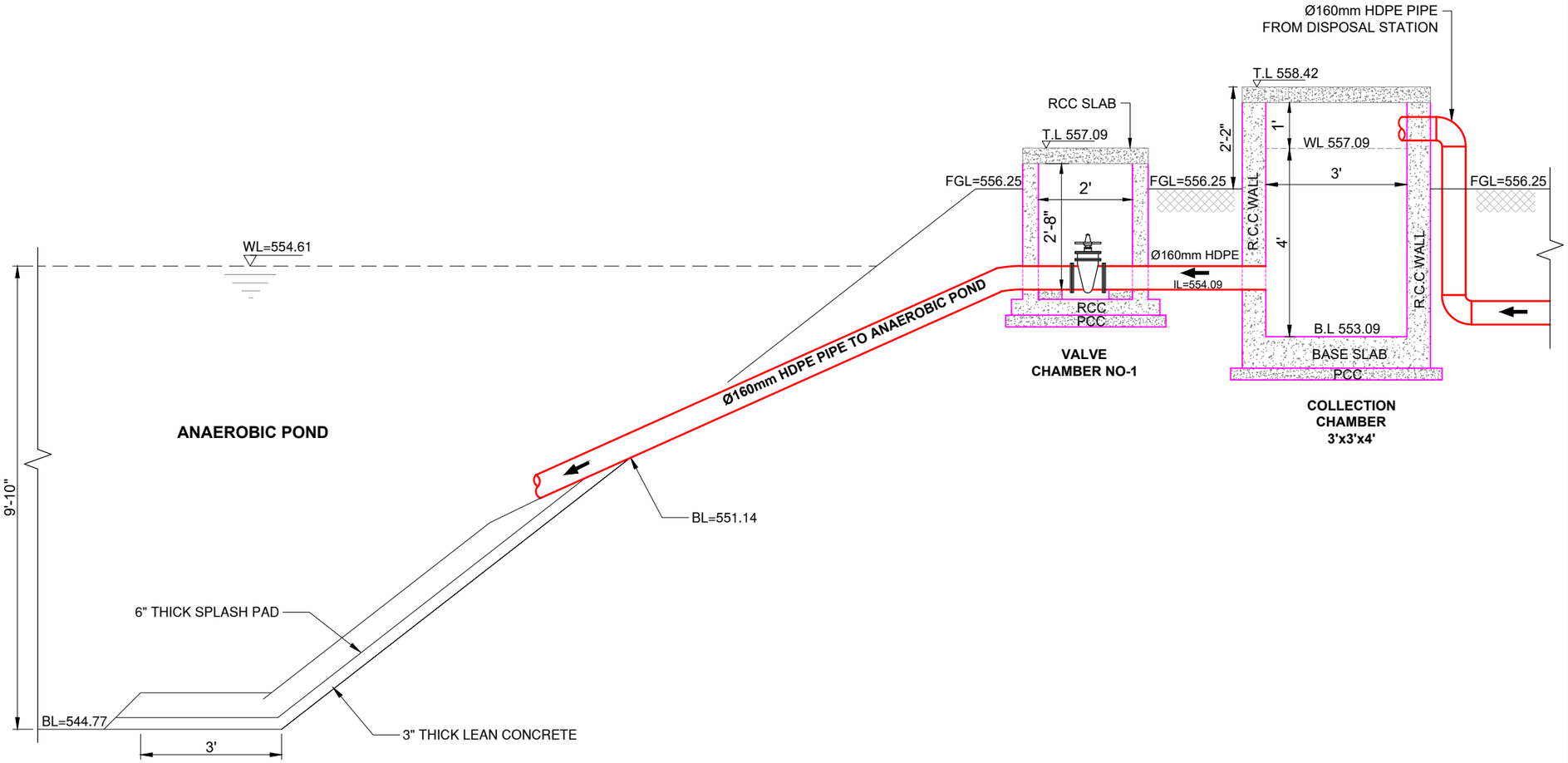
REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

COLLECTION CHAMBER PLAN & SECTION

DATE	DRAWING No.	REV.	SCALE
April, 2025	**4695/11/C/2J107**	0	1"=25'



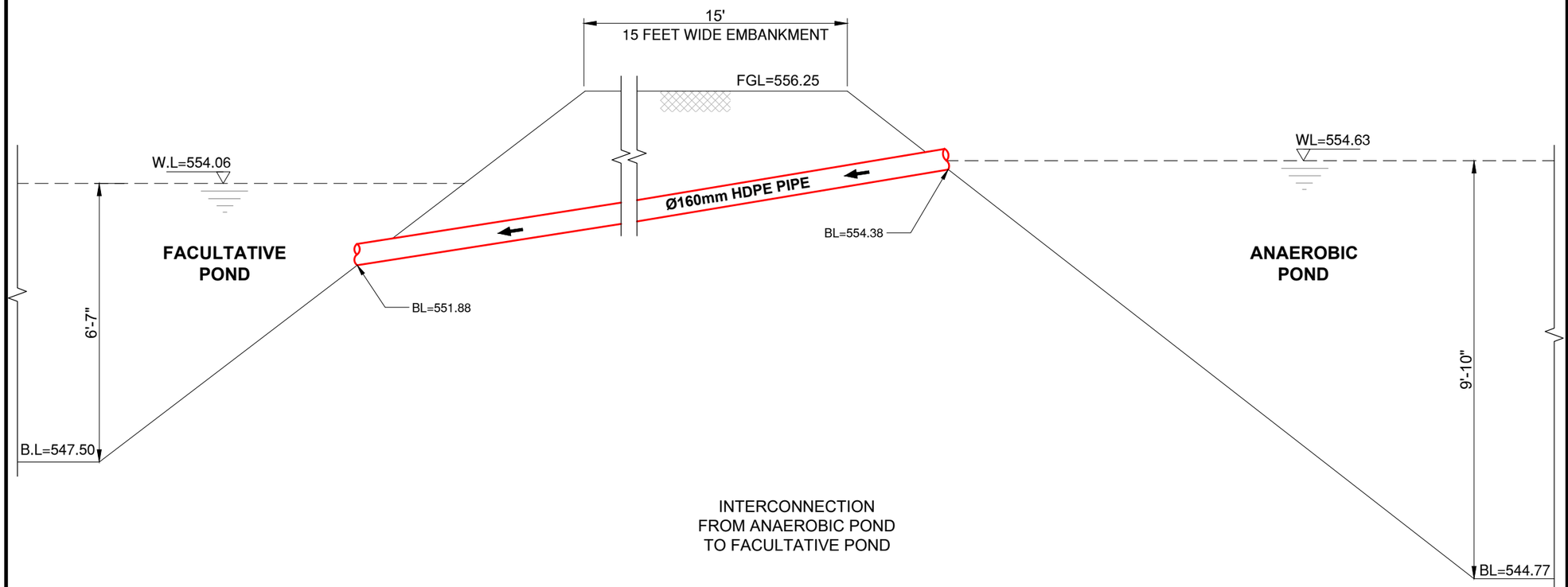
COLLECTION CHAMBER & ANAEROBIC POND CONNECTION

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT	Strategic Planning & Implementation Unit (SP & IU), PGDP Environment Protection Department (EPD) Govt of Punjab.	CONSULTANT	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.	PROJECT	Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab
				COLLECTION CHAMBER & ANAEROBIC POND CONNECTION	SCALE: 1"=30'
				DATE: April, 2025	DRAWING No.: 4695/11/C/2J108
					REV.: 0

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	RIZWAN
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	



INTERCONNECTION
FROM ANAEROBIC POND
TO FACULTATIVE POND

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

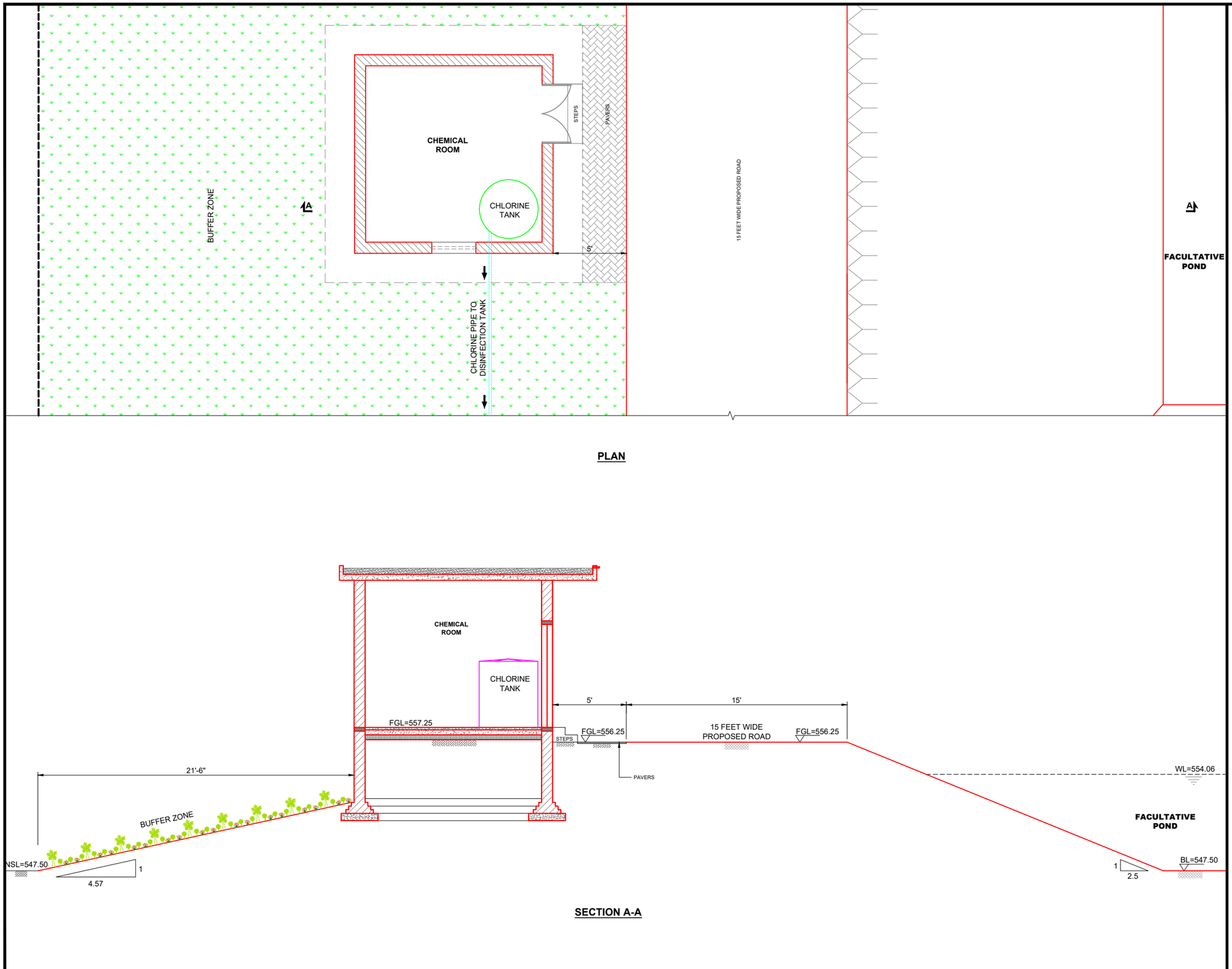
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

INTERCONNECTION ANAEROBIC POND TO FACULTATIVE POND

DATE	DRAWING No.	REV.
April, 2025	**4695/11/C/2J109**	0

SCALE 1"=7'



PLAN

SECTION A-A

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
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CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

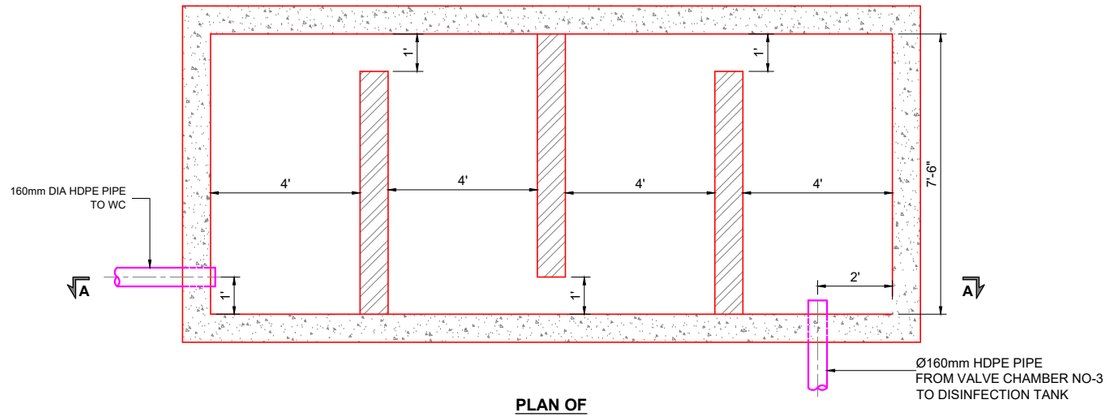
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

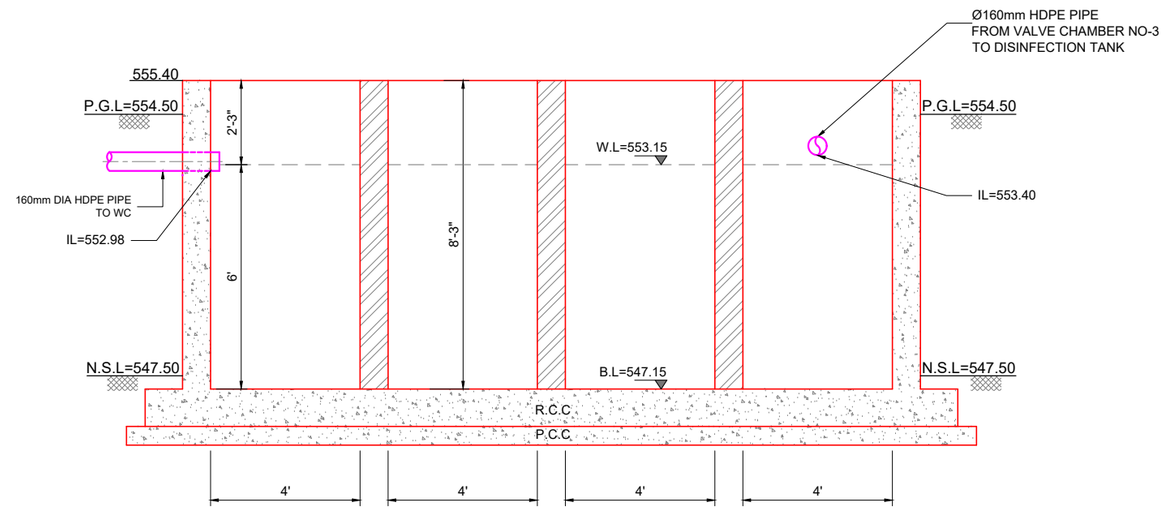
CHEMICAL ROOM PLAN & SECTION

DATE	DRAWING No.	REV.
April, 2025	**4695/11/C/2J111**	0

SCALE 1"=7'



PLAN OF
DISINFECTION TANK



SECTION A-A

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

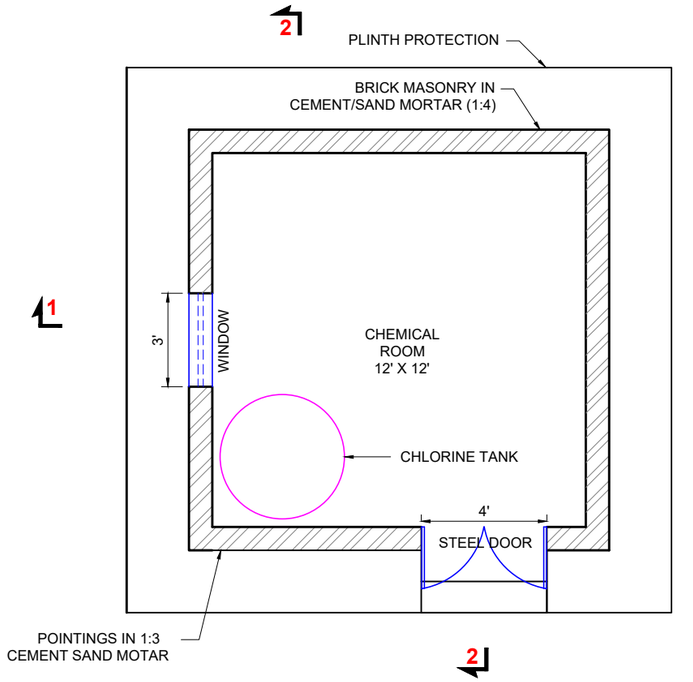
SEWAGE TREATMENT PLANT
DISINFECTION TANK
PLAN AND SECTION

SCALE 1"=50'

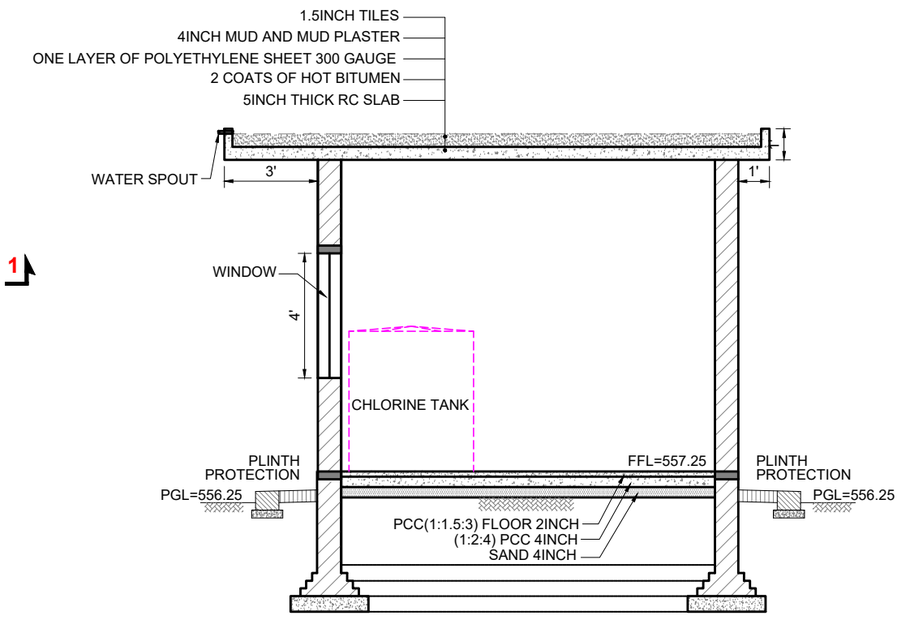
DATE April, 2025

DRAWING No. **4695/11/C/2J112**

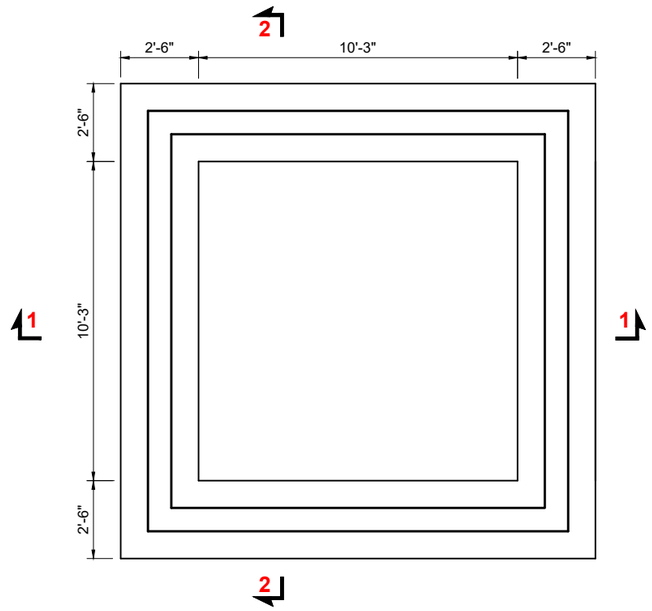
REV. 0



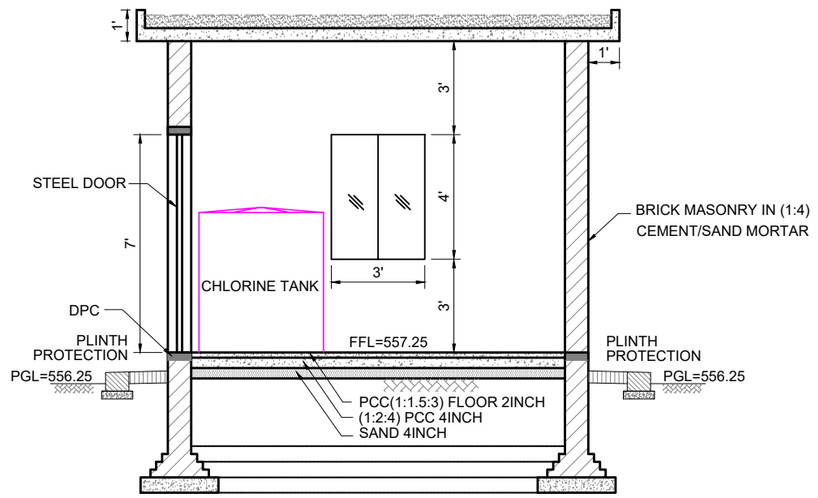
PLAN



SECTION 1-1



FOUNDATION PLAN



SECTION 2-2

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

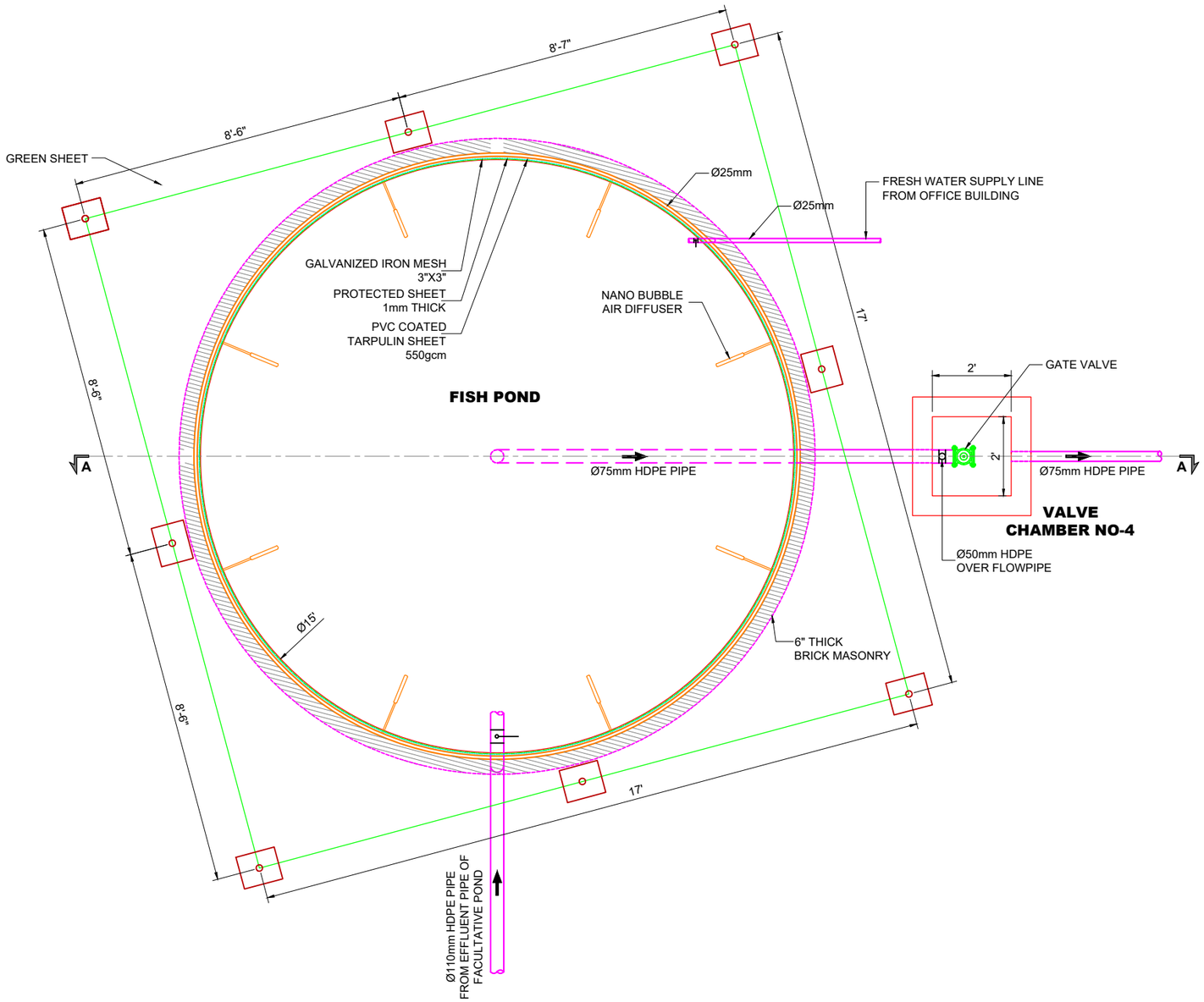
CHEMICAL ROOM PLAN & SECTIONS

SCALE: 1"=60'

DATE: April, 2025

DRAWING No.: **4695/11/C/2J113**

REV.: 0



PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
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CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

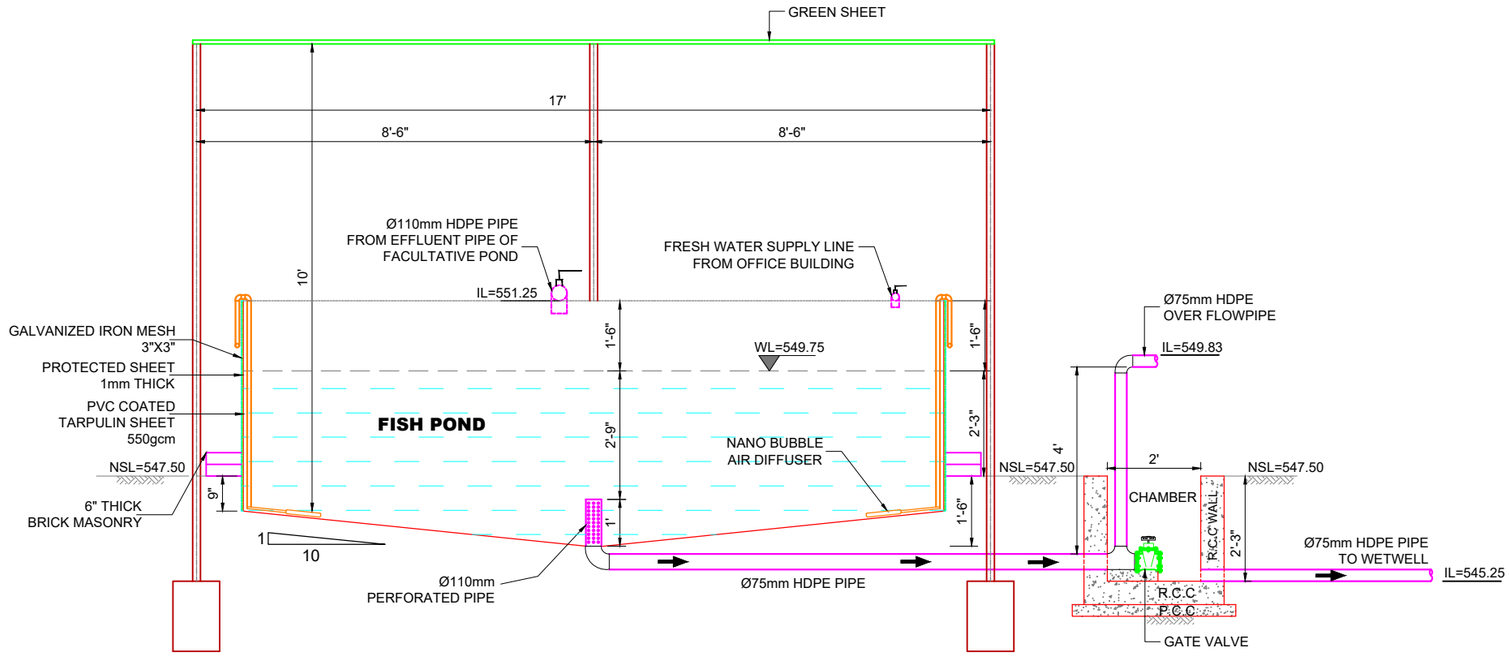
SEWAGE TREATMENT PLANT
PLAN OF FISH POND

SCALE: 1"=50'

DATE: April, 2025

DRAWING No.: **4695/11/C/2J114**

REV.: 0



SECTION A-A

VALVE CHAMBER NO-4

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
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CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
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CONSULTANT

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HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

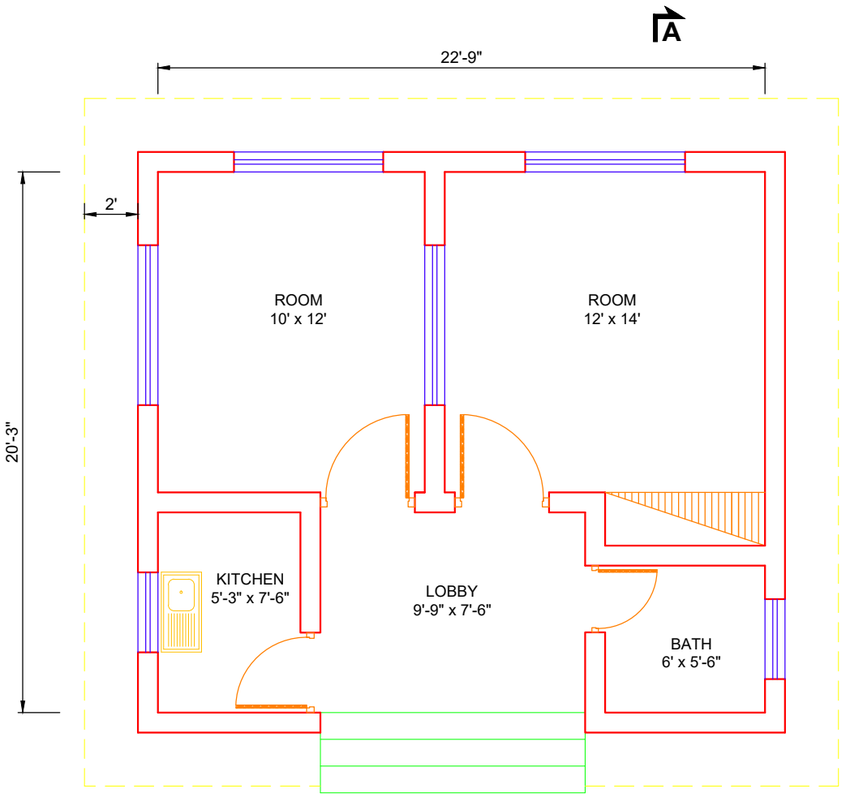
SEWAGE TREATMENT PLANT
FISH POND
SECTION A-A

SCALE: 1"=50'

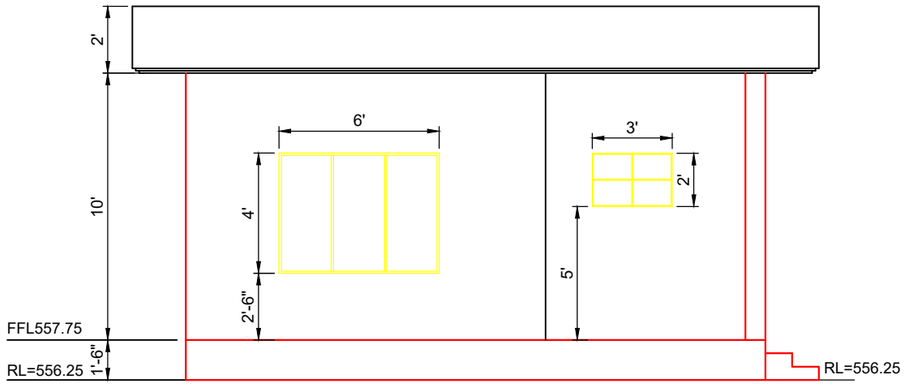
DATE: April, 2025

DRAWING No.: **4695/11/C/2J115**

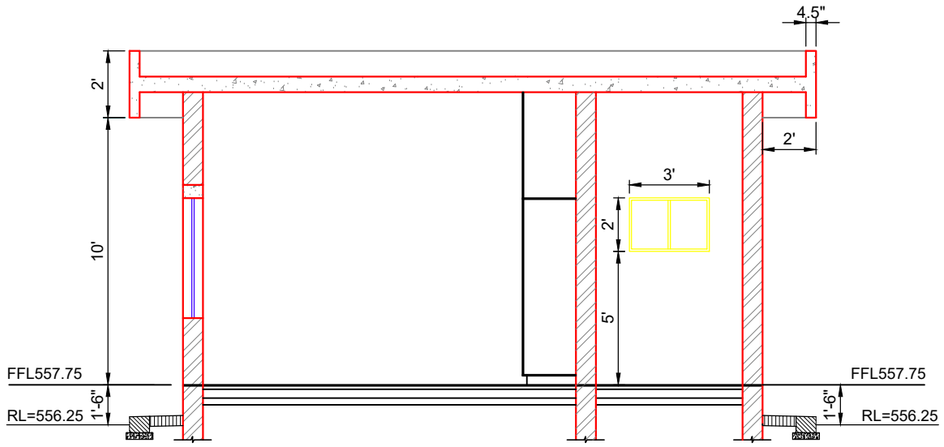
REV.: 0



STAFF BUILDING



SIDE ELEVATION



SECTION A-A

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

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HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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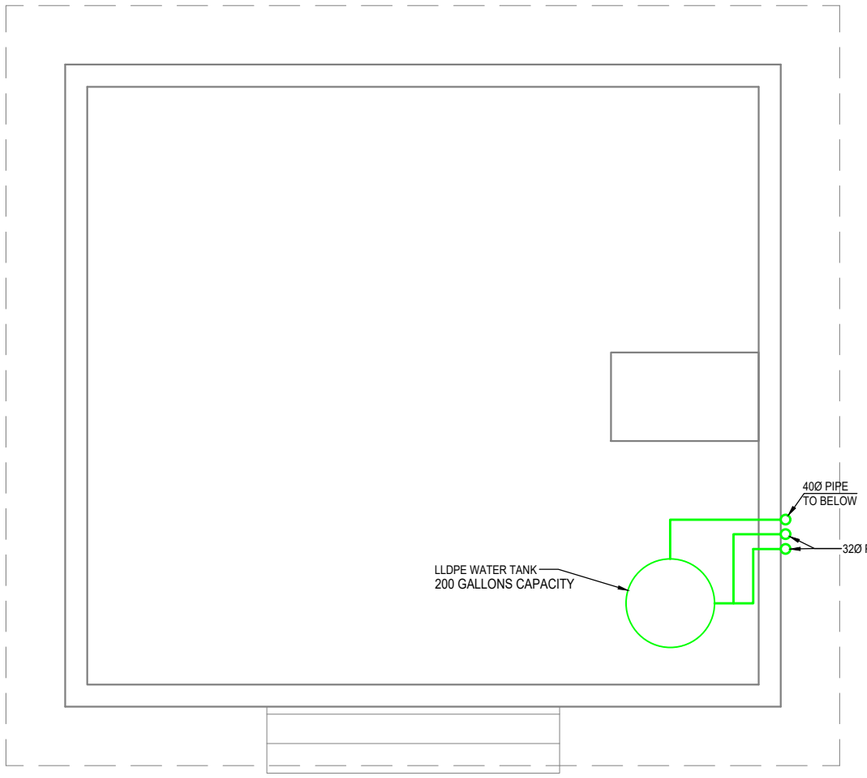
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
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PROJECT

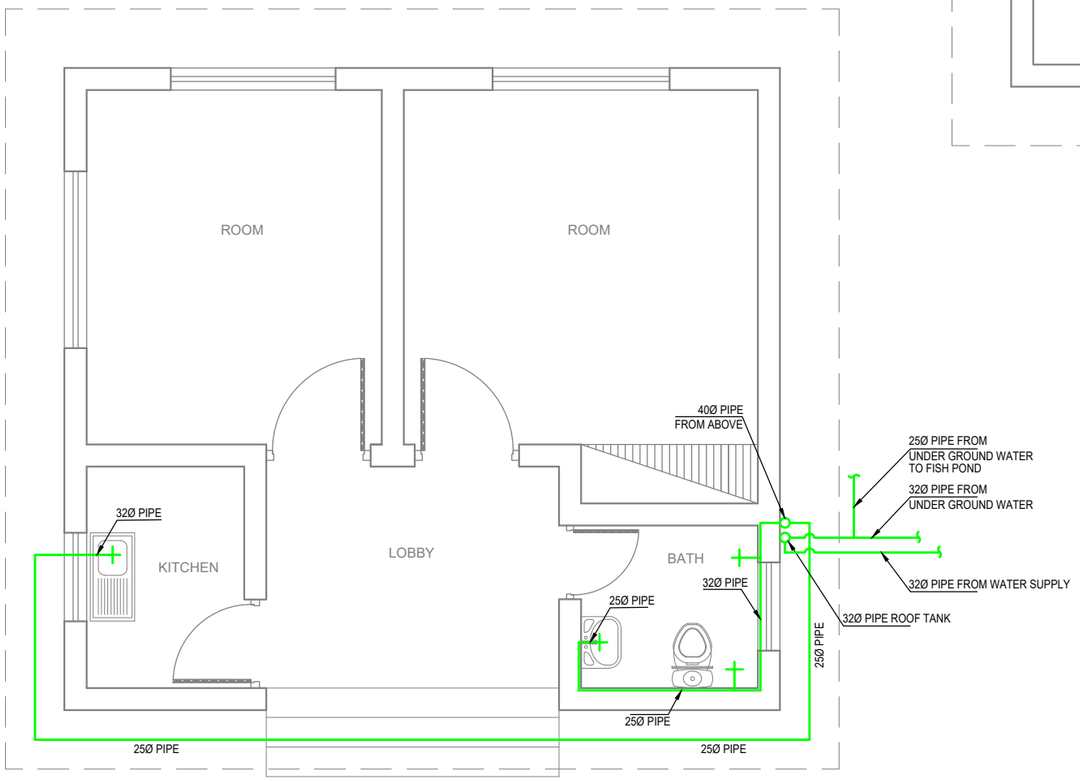
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

DETAIL OF STAFF BUILDING

DATE	DRAWING No.	SCALE	REV.
April, 2025	**4695/11/C/2J115**	1"=70'	0



ROOF FLOOR
STAFF BUILDING



GROUND FLOOR
STAFF BUILDING

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

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NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

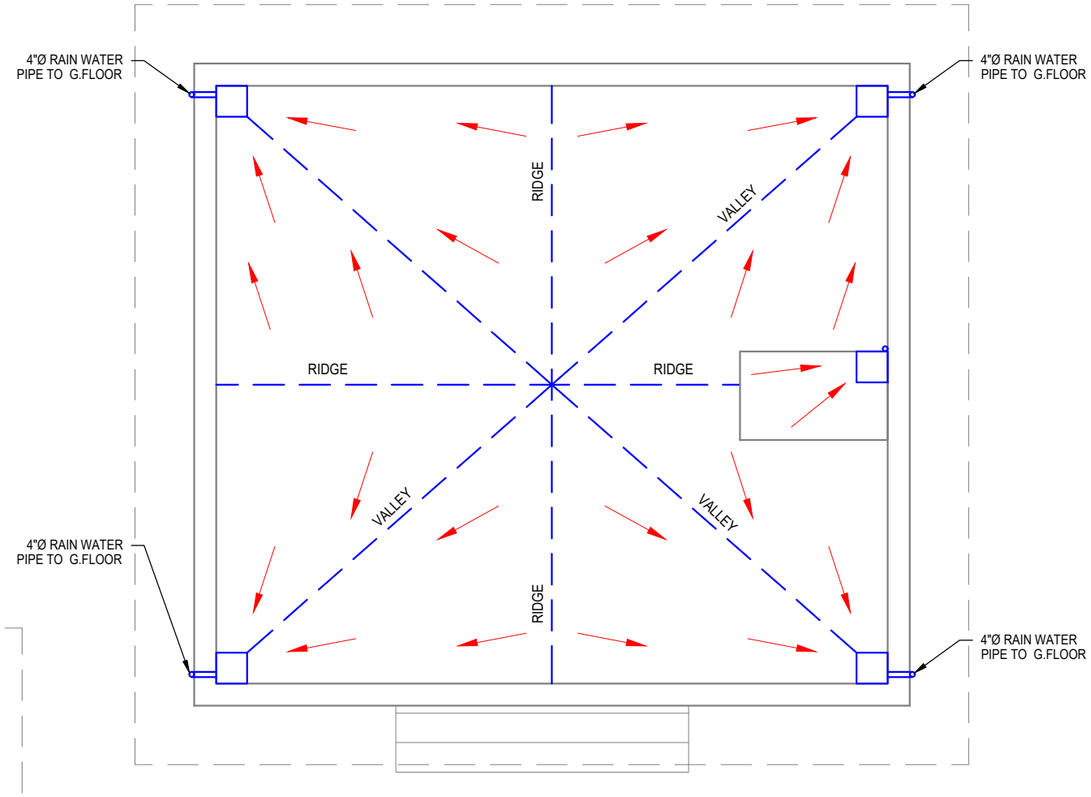
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

WATER SUPPLY OF STAFF BUILDING

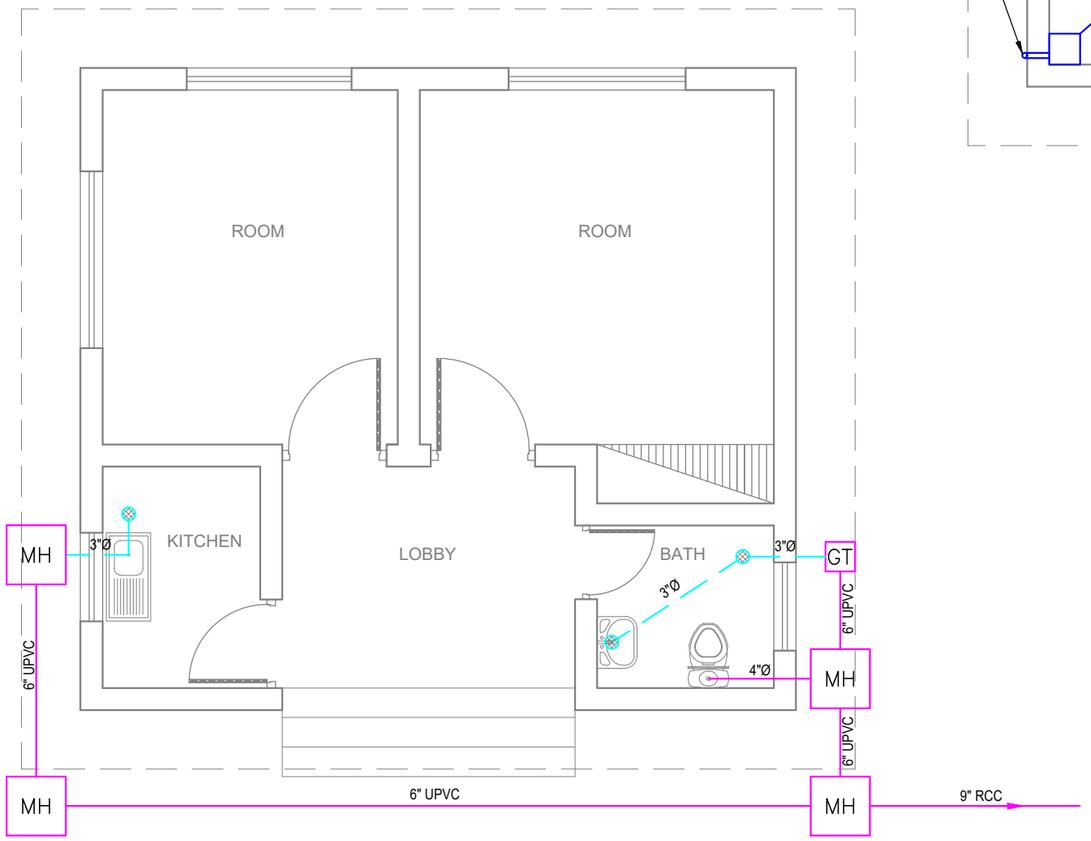
DATE	DRAWING No.	REV.
April, 2025	**4695/11/C/2J117**	0

SCALE

1"=60'



ROOF DRAINAGE
STAFF BUILDING



SEWERAGE
STAFF BUILDING

CLIENT

Strategic Planning & Implementation Unit (SP & IU), PGDP
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

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HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	RIZWAN
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

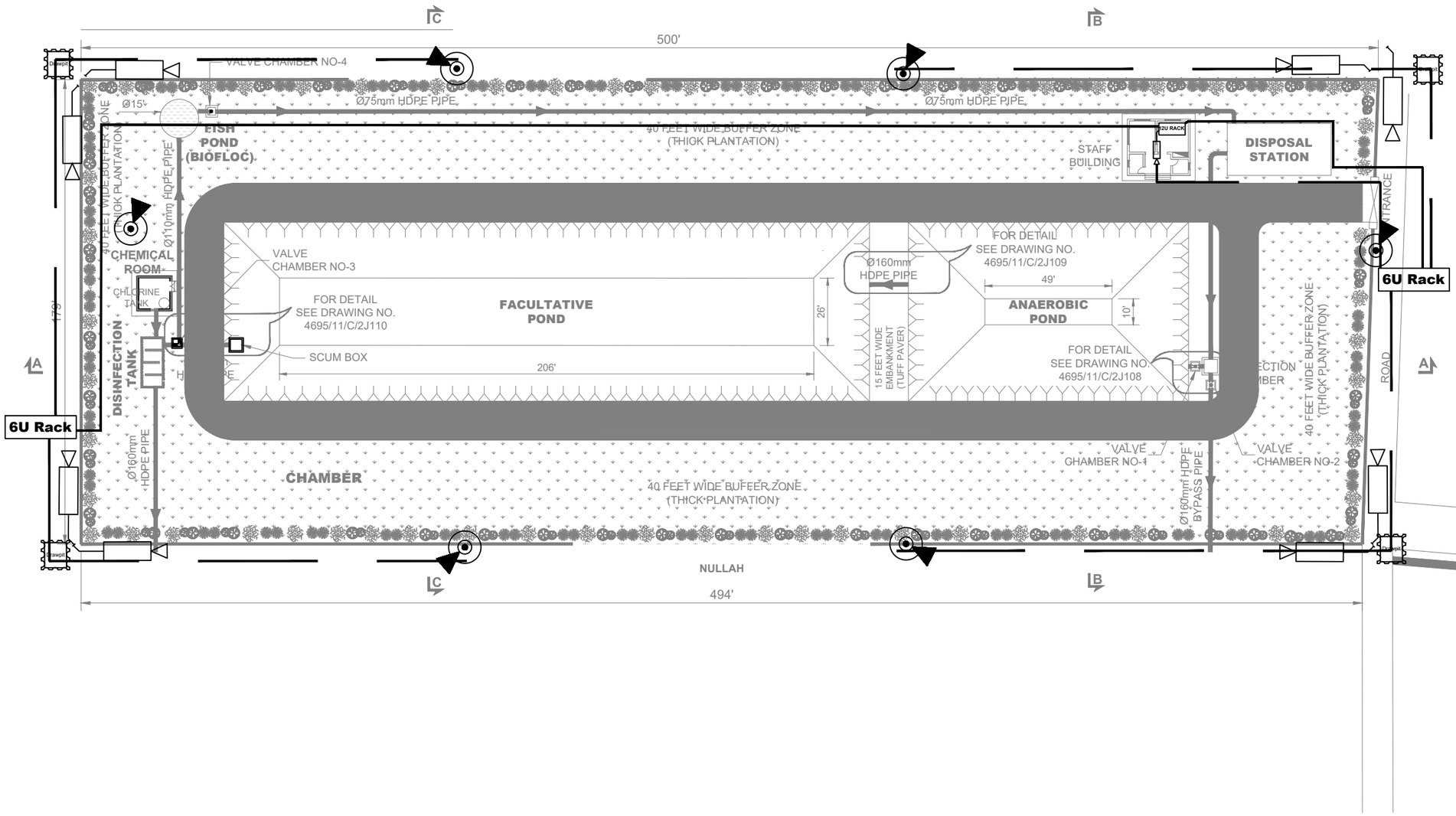
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

SEWERAGE & ROOF DRAINAGE OF STAFF BUILDING

DATE	DRAWING No.	REV.
April, 2025	**4695/11/C/2J117**	0

SCALE 1"=60'



LEGEND

Sr.No	ITEM	SYMBOL	QUANTITY
1	FIXED CAMERA		09
2	PTZ CAMERA		06
3	6U RACK	6U Rack	03
5	12U RACK	12U Rack	01
6	DUCT		370Meter
7	CAT-6		620Meter
8	OPTICAL FIBER		210Meter
9	DRAWPIT	Drawpit	04

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPD) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

DRAWING

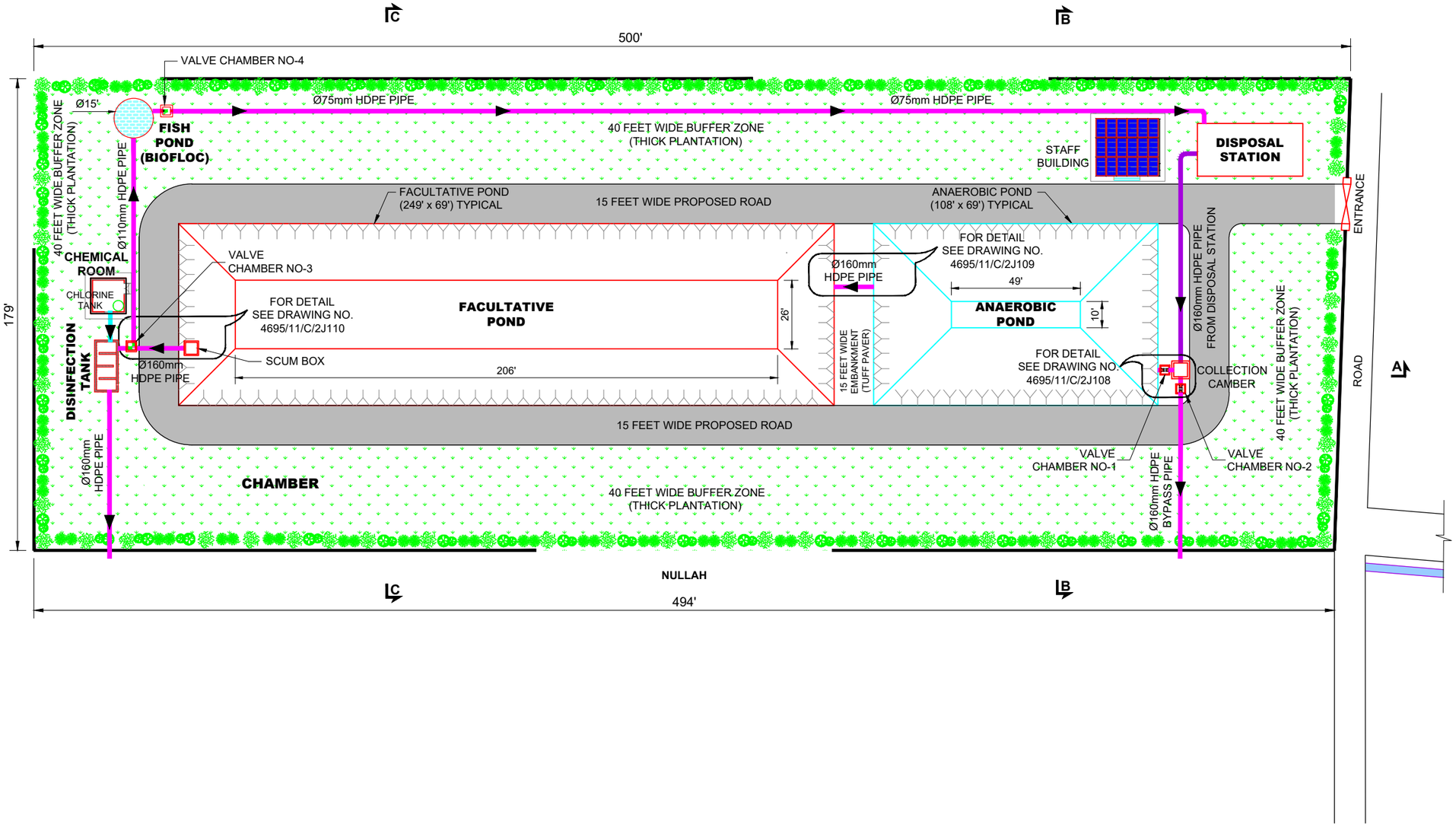
CHAK 2KB
CCTV SYSTEM OF
WASTE WATER TREATMENT PLANT

SCALE: 1"=42'

DATE: SEPTEMBER, 2024

DRAWING No.: 4695/166/C/1S001

REV.: 0



N

CLIENT	Strategic Planning & Implementation Unit (SP & IU) Environment Protection Department (EPD) Govt of Punjab.	CONSULTANT	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.	PROJECT	Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab
				SOLAR SYSTEM AND CABLE TRENCH LAYOUT OF WWTP CHAK 2KB	SCALE: 1"=30'
				DATE: SEPTEMBER, 2024	DRAWING No.: **4695/165/BQ001**
					REV.: 0

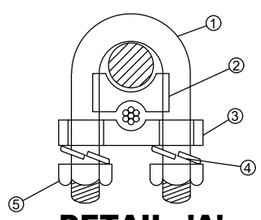
REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	RIZWAN
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

GENERAL NOTES:

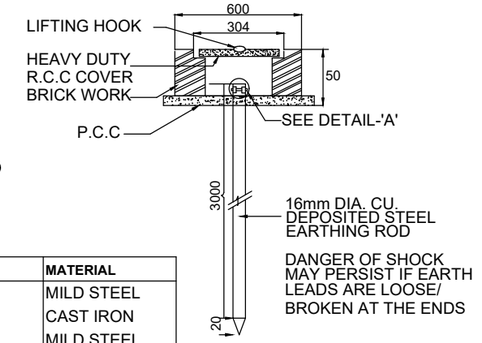
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ITEMS OF BILL OF QUANTITIES AND TECHNICAL SPECIFICATION
2. THIS DRAWING SHALL BE COORDINATED WITH OTHER DISCIPLINES WORKS FOR ROUTING, SPACING AND INSTALLATIONS
3. THE MINIMUM SIZE OF THE PVC CONDUIT SHALL BE 25mm (1") DIA.
4. LIGHT CIRCUIT WIRING SHALL BE WITH 3x2.5 mm Sq & LIGHT POINT WIRING SHALL BE WITH 3x1.5 mm. Sq SINGLE CORE STRANDED CU. PVC CABLES
5. ALL POWER SOCKETS (15/20Amp) SHALL BE WIRED WITH 3x6mm.Sq LIGHT PLUG (10/13Amp) SOCKETS FIRST POINT SHALL BE WIRED WITH 3x4mm.Sq & 10Amp. SOCKETS POINT TO POINT WIRED WITH 3x2.5mm. Sq STRANDED CU. PVC CABLES
6. ALL SINGLE CORE WIRES SHALL HAVE THE FOLLOWING COLOURS.
   PHASE WIRES..... RED, YELLOW & BLUE
   NEUTRAL WIRES.....BLACK
   C.P.C.....GREEN/YELOW (AS PER B.O.Q)
7. THE WIRING SHALL BE STARTED ONLY AFTER THE CONDUIT SYSTEM IS COMPLETELY INSTALLED AND ALL OUTLET BOXES ETC. ARE FIXED IN THEIR POSITIONS.
8. ALL POWER/LIGHT PLUG SOCKETS WIRING SHALL BE SEGREGATED AND HAVE INDEPENDENT WIRES RIGHT FROM MINIATURE CIRCUIT BREAKERS IN DISTRIBUTION BOARD.
9. ACTUAL LOCATION OF ALL OUTLETS MUST BE VERIFIED BY THE CONTRACTOR SITE ENGINEER BEFORE INSTALLATION COMMENCES
10. THE MOUNTING HEIGHT OF THE SOCKET OUTLETS SHALL BE MINIMUM 300mm (FFL)
11. THE MOUNTING HEIGHT OF THE LIGHTING SWITCHES SHALL BE MINIMUM 1200mm (FFL)
12. NO LUBRICATION EXCEPT AS RECOMMENDED BY MANUFACTURER SHALL BE USED ON WIRES FOR REDUCING FRICTION. NO OIL OR SOAP OF ANY KIND WILL BE ALLOWED ON WIRES FOR THIS PURPOSE.
13. THE CONTRACTOR SHALL SUBMIT CONDUITS LAYOUT PLAN BASED UPON THE ELECTRIFICATION DRAWINGS FOR THE APPROVAL OF ELECTRICAL ENGINEER, BEFORE POURING OF ROOF SLABS, WALL AND COLUMNS.
14. ALL THE ELECTRICAL WORKS SHALL BE EXECUTED IN STRICT ACCORDANCE WITH THE PROJECT SPECIFICATION
15. THE ELECTRICAL EQUIPMENT SHALL BE SUPPLIED FROM APPROVED MANUFACTURER AS PER APPLICABLE STANDARDS AND CODES

ROD TYPE EARTH

POINT DETAIL FOR DB,S

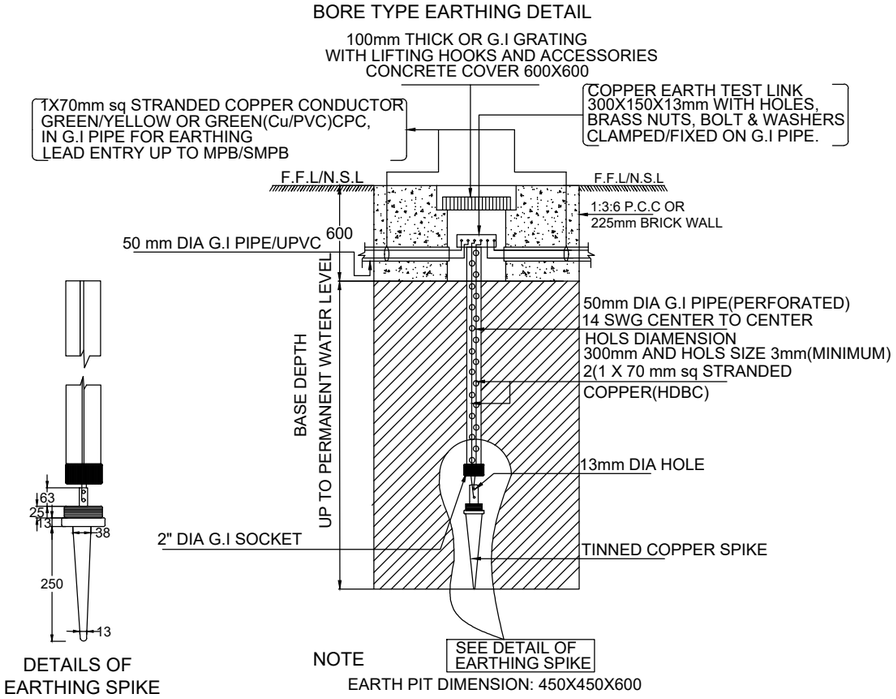


DETAIL -'A'



ITEM NO.	ITEM NAME	MATERIAL
1	U-BOLT	MILD STEEL
2	SPACER	CAST IRON
3	BASE	MILD STEEL
4	SPRING WASHER	CARBON STEEL
5	NUT	MILD STEEL

BORE TYPE EARTHING DETAIL



DETAILS OF EARTHING SPIKE

NOTE
EARTH PIT DIMENSION: 450X450X600

NOTES

1. THIS DRAWING IS FOR INDICATIVE DESIGN MODEL AND SHOULD BE READ IN CONJUNCTION WITH SPECIFICATIONS AND ITEMS OF BILL OF QUANTITIES.
2. EARTH BORE SHALL BE MADE AT 2000MM (2M) AWAY FROM FOUNDATION/STRUCTURE.
3. DISTANCE BETWEEN TWO EARTH BORES SHALL NOT BE LESS THAN 3000MM (3M)
4. CONNECTION SHALL BE BOLTED WITH THIMBLES, BRASS NUTS, BOLTS/WASHER ETC.
5. CONTRACTOR SHALL MEASURE EARTHING RESISTANCE IN THE PRESENCE OF SITE ENGINEER, FOR FINAL ACCEPTANCE.
6. THE VALUE OF EARTH RESISTANCE SHALL BE INCORPORATED IN FINAL AS-BUILT DRAWINGS.
7. THE LOCATION OF MAIN PANEL BOARD & DISTRIBUTION BOARDS IS TENTATIVE & SHALL BE FINALIZED AS PER SITE CONDITION / REQUIREMENTS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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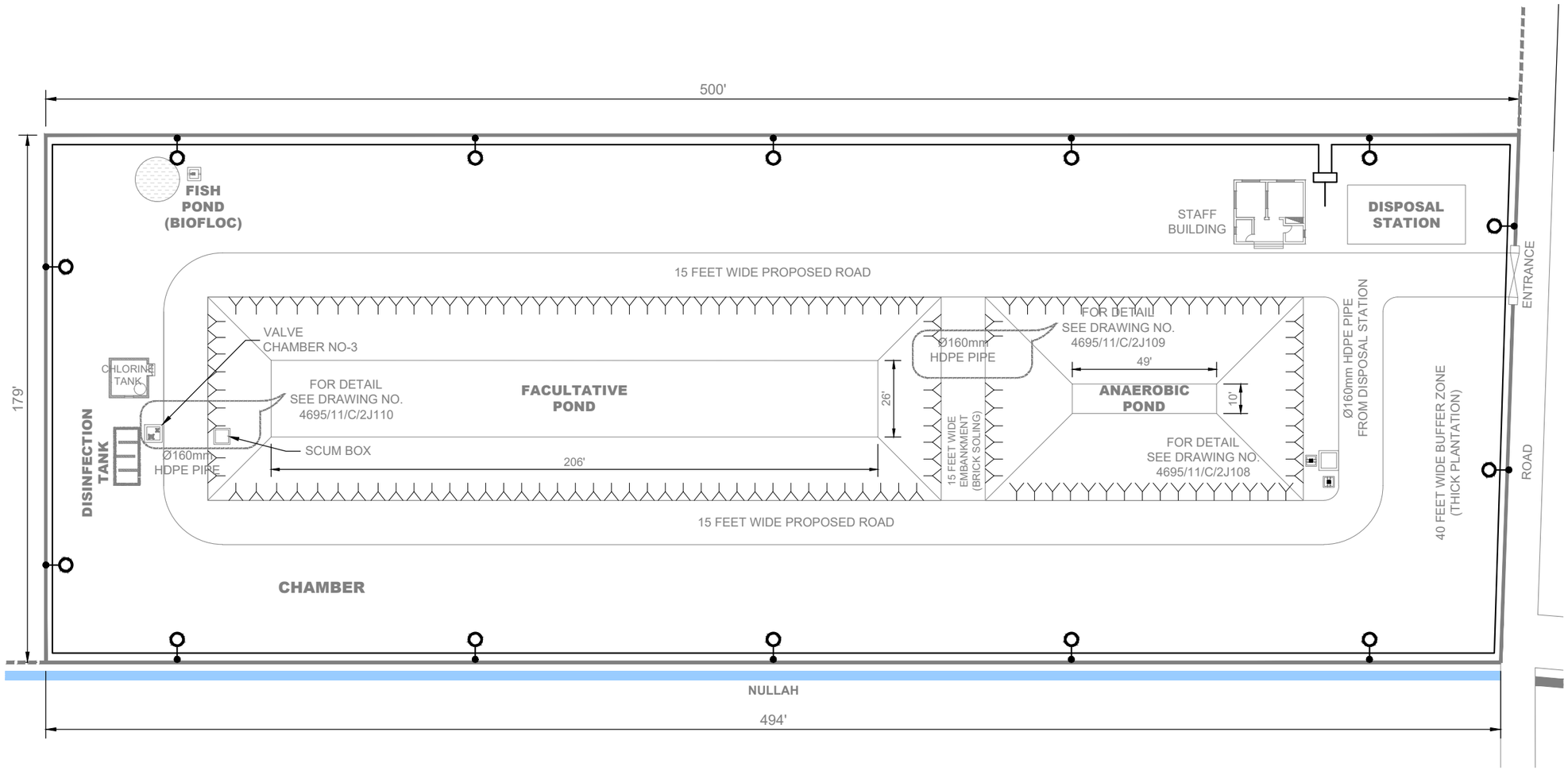
PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

LEGEND GENERAL NOTES ROD TYPE & BORE TYPE EARTHING DETAILS

DATE: SEP, 2024
DRAWING No.: **4695/161/TD/5E001**
SCALE: N.T.S.
REV.: 0

LEGEND:-

SYMBOL	DESCRIPTION
●–○	10 METER HIGH SINGLE ARM OCTAGONAL CONICAL POLE WITH 90W LED LIGHT



① 4 CORE 10 Sq.mm Cu./PVC/PVC+
1 Core 10 Sq.mm Cu./PVC AS CPC
IN PVC PIPE 100mm Ø CLASS "B"

CLIENT
Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

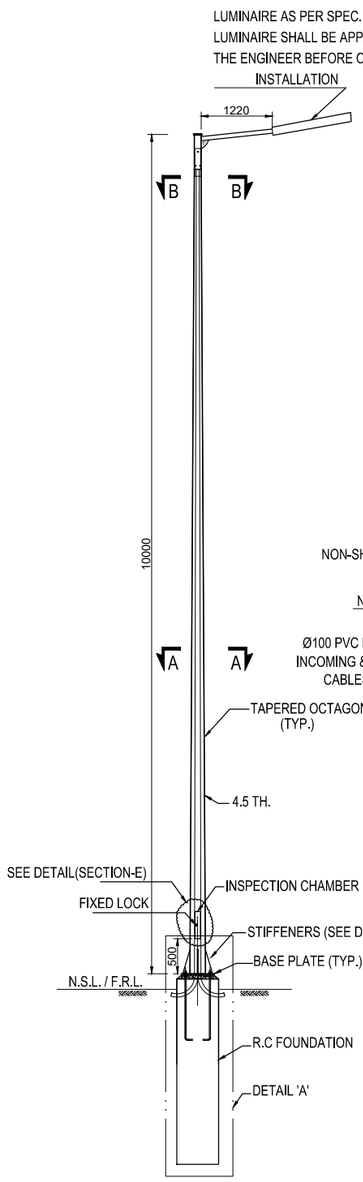
REV.	DATE	DESCRIPTION	APPROVED
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CHD./VER.	
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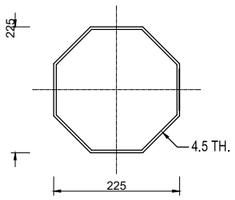
PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

CHAK 2KB PAK PATTAN
EXTERNAL ELECTRIFICATION
LAYOUT PLAN OF INFLUENT PUMPING STATION AND WWTP

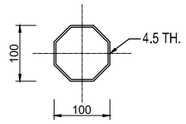
DATE: SEP, 2024
DRAWING No.: **4695/161/TD/5E002**
SCALE: N.T.S.
REV.: 0



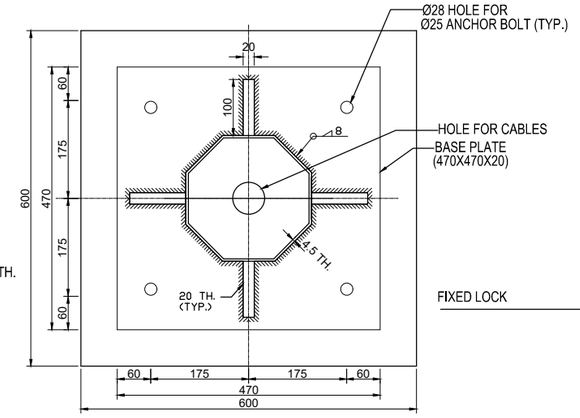
SINGLE LUMINAIRE HOT DIP GALVANIZED STEEL OCTAGONAL POLE



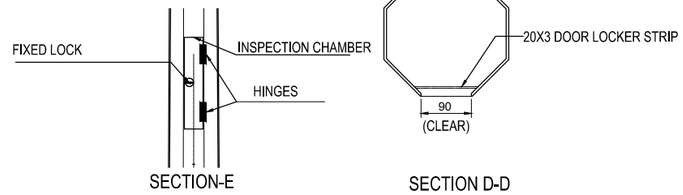
SECTION A-A



SECTION B-B

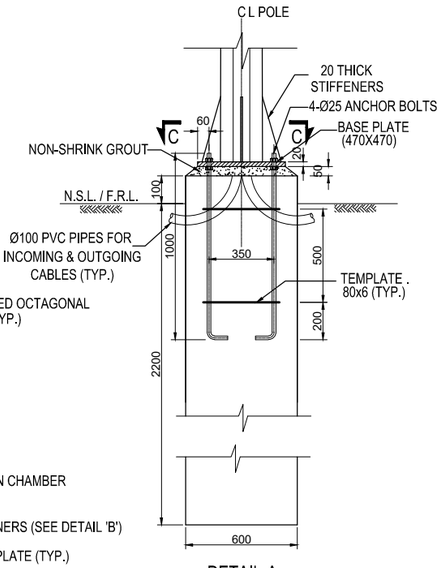


SECTION C-C

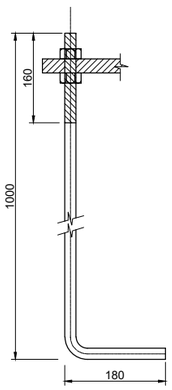


SECTION-E

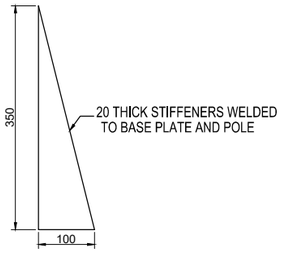
SECTION D-D



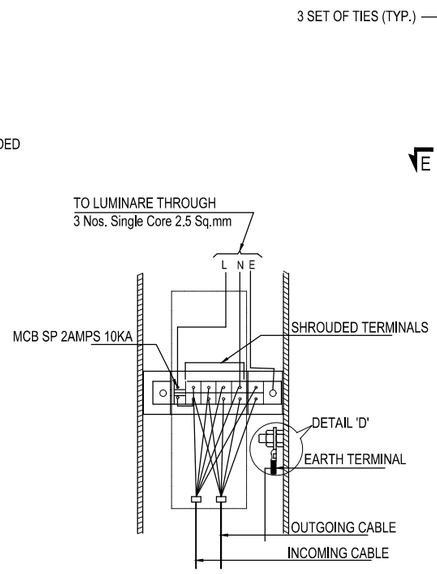
DETAIL-A
(CONCRETE OUTLINE)



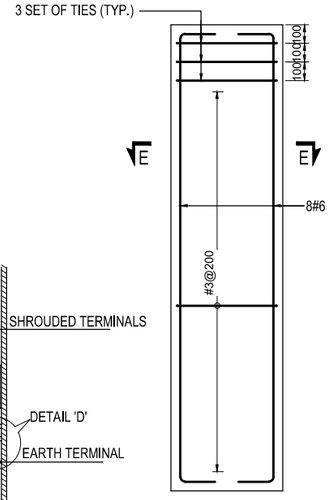
ANCHOR BOLT



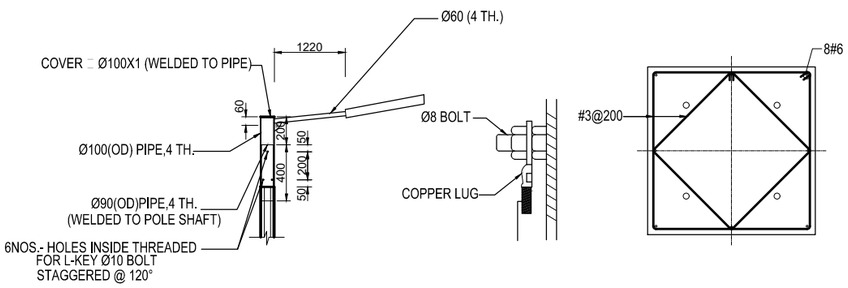
DETAIL-B



DETAIL OF INSPECTION CHAMBER



FOUNDATION
(REINFORCEMENT)



DETAIL-C

DETAIL-D

SECTION E-E

NOTES

1. FOR GENERAL NOTES REFER DRAWING NO. G001.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. UNLESS OTHERWISE NOTED, CONCRETE SHALL BE CLASSIFIED AS FOLLOWS.
   CONCRETE CLASS 28 DAYS (15x30 CM) CYLINDER STRENGTH Kg/sq. Cm
   REINFORCED A 210 (3000 psi)
4. THE STEEL FOR POLE & BASE PLATE SHALL BE OF YIELD STRENGTH OF 350MPa(50Ksi).
   & SHALL CONFORM TO ASTM A36 STEEL.
5. THE ANCHOR BOLTS SHALL CONFORM TO ASTM A307.
6. ALL WELDING SHALL CONFORM TO THE APPLICABLE PROVISIONS OF A.W.S
   (AMERICAN WELDING SOCIETY) CODE.
7. HOT DIP GALVANIZATION SHALL CONFORM TO BS EN ISO 1461 (IN SIDE & OUT SIDE)
   OR IN ACCORDANCE WITH ASTM A123 AND A325.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N,
MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN SA
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

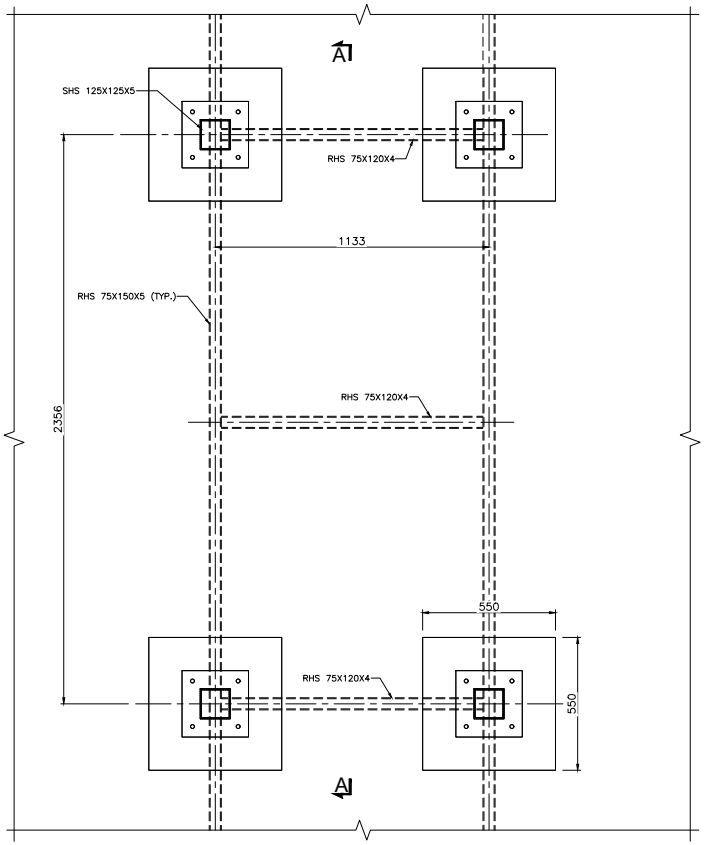
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

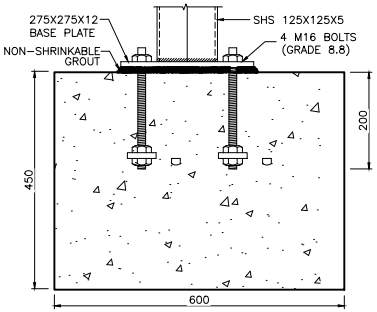
10M HIGH OCTAGONAL CONICAL LIGHTING POLE WITH SINGLE ARM BRACKET

N.T.S.

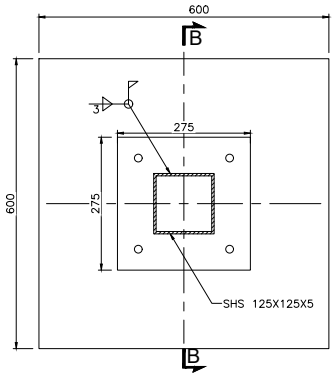
DATE	DRAWING No.	REV.
SEP, 2024	**4695/161/TD/5E003**	0



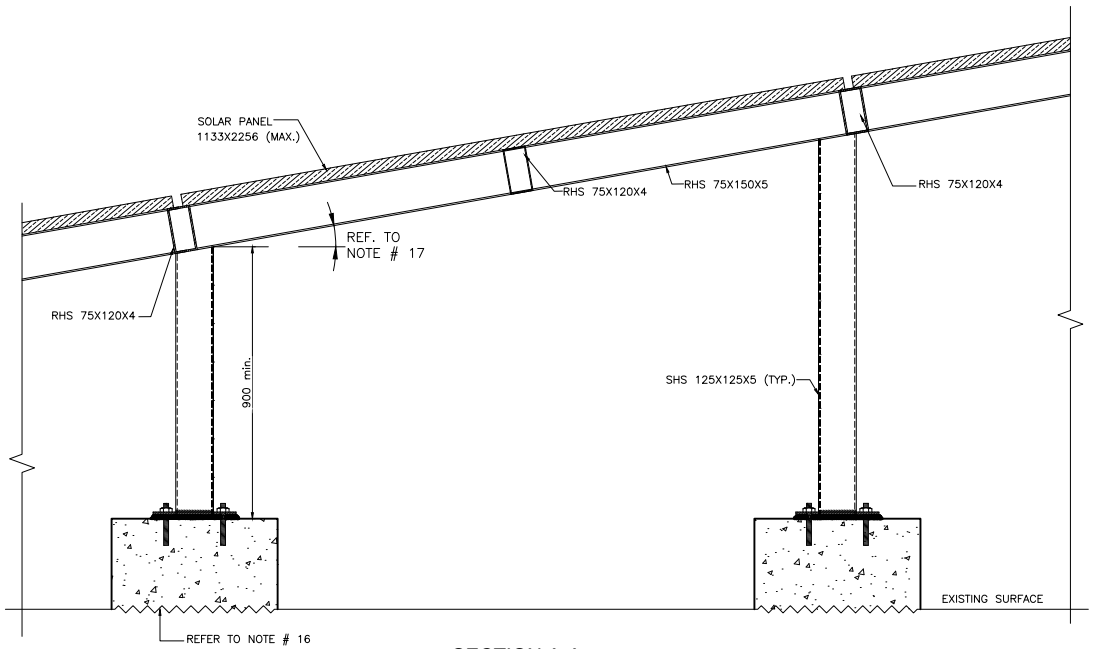
TYPICAL STRUCTURAL FRAMING PLAN



SECTION B-B



CONCRETE BLOCK DETAIL



SECTION A-A

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETER.
2. ALL CONNECTIONS TO BE DESIGNED AND DETAILED BY CONTRACTOR.
3. ALL STEEL GRADE SHALL HAVE MINIMUM YIELD STRENGTH OF 250 Mpa.
4. ALL WELD SHALL BE OF E70XX ELECTRODE.
5. ALL STEEL STRUCTURE AND ANCHOR BOLTS SHALL BE HOT DIP GALVANIZED (MIN 85 MICRON).
6. ALL NUT BOLTS SHALL BE OF STAINLESS STEEL MATERIAL (NON-METALLIC, GRADE A325 ANTI-THEFT).
7. IT IS ASSUMED THAT THE EXISTING ELEVATED SURFACE OR ROOF IS ADEQUATE TO BEAR THE LOADINGS FROM STRUCTURAL FRAMING OF SOLAR PANEL.
8. MINIMUM CLEARANCE OF PV MODULE SHALL BE 6 FEET ABOVE THE ROOF LEVEL.
9. TWO DRAINAGE CLIPS SHALL BE PROVIDED FOR EACH MODULE IN THE LAST/LOWEST ROW OF THE MODULES IN A SHED.
10. ALL BEAM TO BEAM & BEAM TO COLUMN CONNECTION ARE FULLY WELDED CONNECTION WHICH IS HAVING AT LEAST 4MM THICKNESS.
11. NON-SHRINKAGE GROUT OF AT LEAST 20MM THICKNESS SHALL BE PROVIDED UNDER ALL BASE PLATES.
12. ANCHOR BOLT (GRADE A490) SHOULD PROJECT A MINIMUM OF 3 THREADS ABOVE THE FULLY ENGAGED NUT(S).
14. CONTACTOR TO ENSURE THAT THE EXISTING DRAINAGE CHARACTERISTICS OF THE ROOF TOP ARE NOT COMPROMISED.
15. A PROTECTION MAT OF APPROVED TYPE SHALL BE PROVIDED BETWEEN ROOF TOP LAYER AND MOUNTING STRUCTURE/CONCRETE BLOCKS.
16. EXISTING SURFACE TO BE ROUGHENED & APPLY EPOXY CHEMICAL PRIOR TO CASTING OF NEW CONCRETE.
17. REFFER TO SIMMULATION REPORT FOR ANGLE .
18. COMMENCEMENT OF WORK SHOULD BE CARRIED OUT AFTER CLEARING OF SITE .

CONCEPTUAL DESIGN

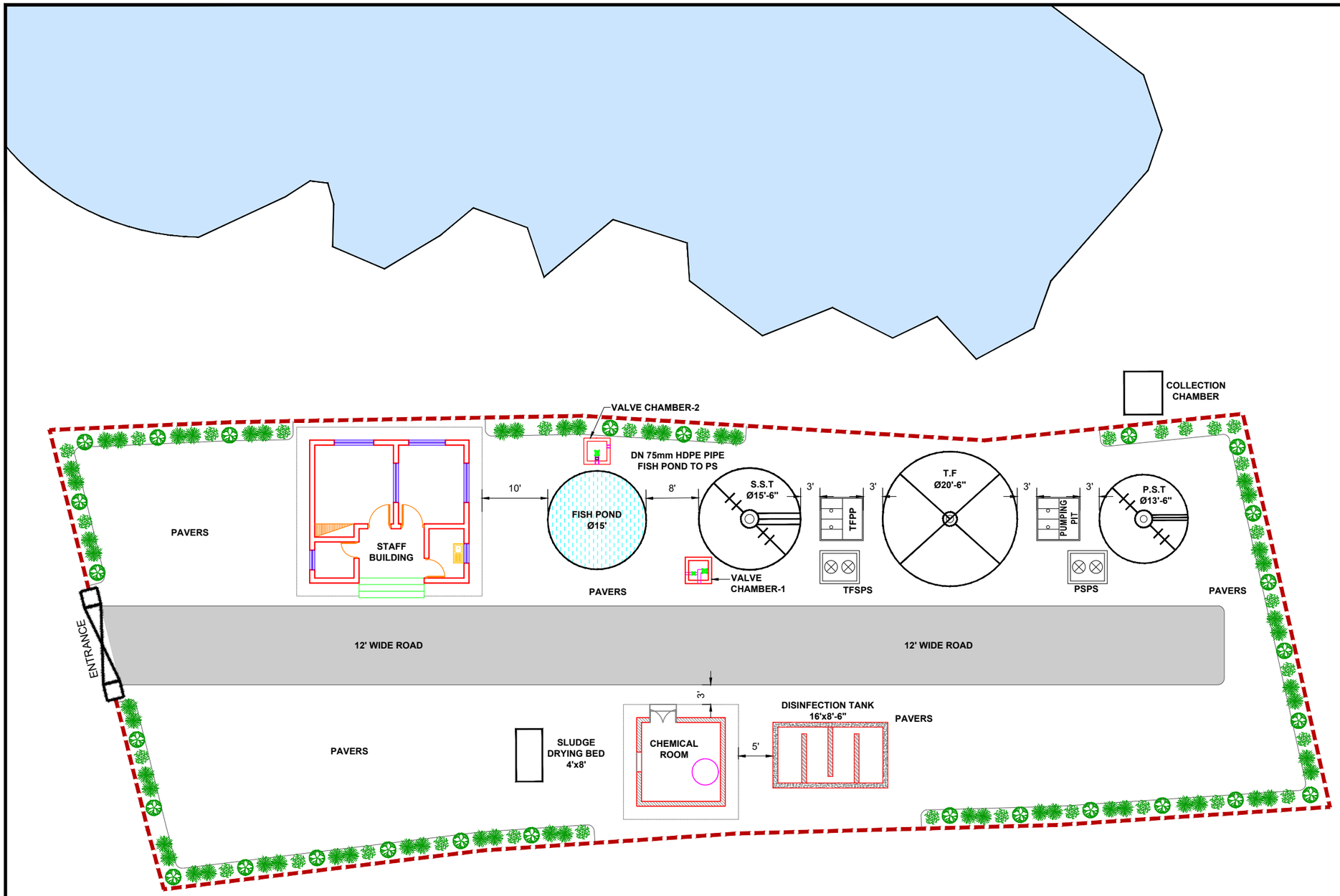
CLIENT	Strategic Planning & Implementation Unit (SP & IU) Environment Protection Department (EPD) Govt of Punjab.	CONSULTANT	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.	PROJECT	Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab Staff Building & Chemical Room at Pakpattan
		04	DRAWN: SOHAIB	DWG. TITLE	**Typical Solar Panel Framing for Elevated Structure**
		03	SUBMITTED:	SCALE	
		02	RECOMMENDED:	DATE	SEPTEMBER, 2024
		01	CHD./VER.:	DRAWING No.	**4695/TD/166/2/G01**
		REV. / DATE / DESCRIPTION / APPROVED	APPROVED:	REV.	0

STRATEGIC PLANNING & IMPLEMENTATION UNIT (SP & IU), PGDP
ENVIRONMENT PROTECTION DEPARTMENT (EPD) GOVT OF PUNJAB.

SURVEY, ENGINEERING DESIGN, TECHNICAL SPECIFICATIONS AND PREPARATION OF BIDDING DOCUMENTS FOR 3 PILOT PLANTS OF WASTEWATER IN PUNJAB

VILLAGE SARKALAN KALAR KAHAR
LIST OF DRAWINGS

SR. NO.	DRAWING NO.	TITLE
01	4695/11/C/2J101	LAYOUT PLAN OF TRICKLING FILTER - BLOWUP PLAN
02	4695/11/C/2J102	PRIMARY SEDIMENTATION TANK (PST) PLAN
03	4695/11/C/2J103	PRIMARY SEDIMENTATION TANK (PST) SECTION A-A & B-B
04	4695/11/C/2J104	PRIMARY SEDIMENTATION TANK (PST) SECTIONS
05	4695/11/C/2J105	PRIMARY SEDIMENTATION TANK (PST) DETAIL AND VIEW
06	4695/11/C/2J106	TRICKLING FILTER (TF) PLAN
07	4695/11/C/2J107	TRICKLING FILTER (TF) SECTION A-A
08	4695/11/C/2J108	TRICKLING FILTER (TF) SECTION B-B
09	4695/11/C/2J109	TRICKLING FILTER (TF) PERFORATED SLAB DETAIL
10	4695/11/C/2J110	SECONDARY SEDIMENTATION TANK (SST) PLAN
11	4695/11/C/2J111	SECONDARY SEDIMENTATION TANK (SST) SECTION A-A & B-B
12	4695/11/C/2J112	SECONDARY SEDIMENTATION TANK (SST) SECTIONS
13	4695/11/C/2J113	SECONDARY SEDIMENTATION TANK (SST) DETAIL AND VIEW
14	4695/11/C/2J114	SLUDGE DRYING BEDS PLAN & SECTION
15	4695/11/C/2J115	DISINFECTION TANK PLAN AND SECTION
16	4695/11/C/2J116	CHEMICAL ROOM PLAN & SECTIONS
17	4695/11/C/2J117	SEWAGE TREATMENT PLANT PLAN OF FISH POND
18	4695/11/C/2J118	SEWAGE TREATMENT PLANT FISH POND SECTION A-A
19	4695/11/C/2J119	DETAIL OF STAFF BUILDING
20	4695/11/C/2J120	WATER SUPPLY OF STAFF BUILDING
21	4695/11/C/2J121	SEWERAGE & ROOF DRAINAGE OF STAFF BUILDING
22	4695/11/C/2J122	PUMPING PIT DETAIL



NOTES

1. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
2. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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RECOMMENDED	
CHD./VER.	
APPROVED	

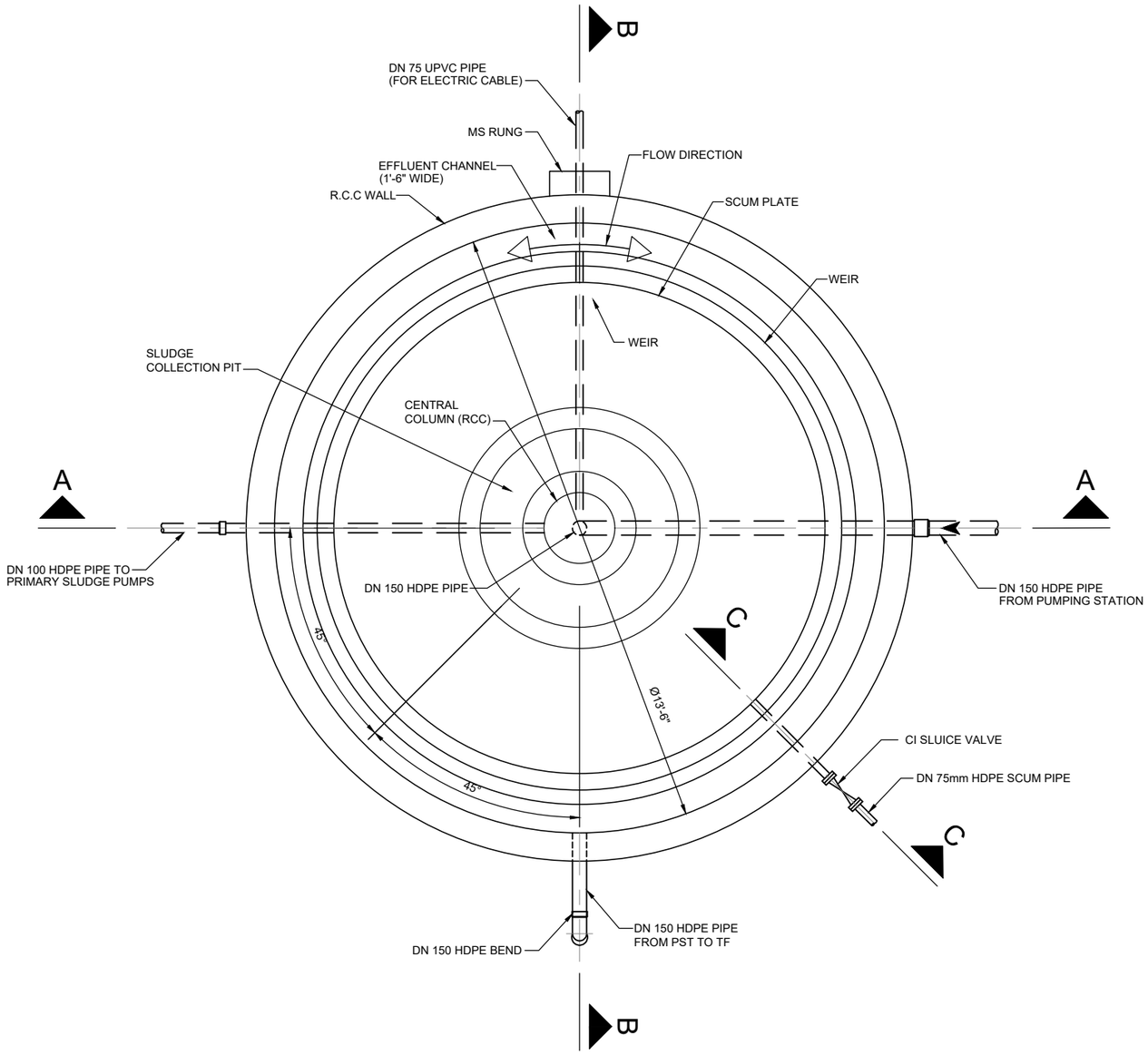
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

VILLAGE SARKALAN KALAR KAHAR BLOWUP PLAN OF TRICKLING FILTER OPTION-I

DATE	DRAWING No.	REV.
JANUARY, 2025	**4695/11/C/2J101**	0

SCALE: 1" = 17'



PLAN

SCALE 1:9

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

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PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

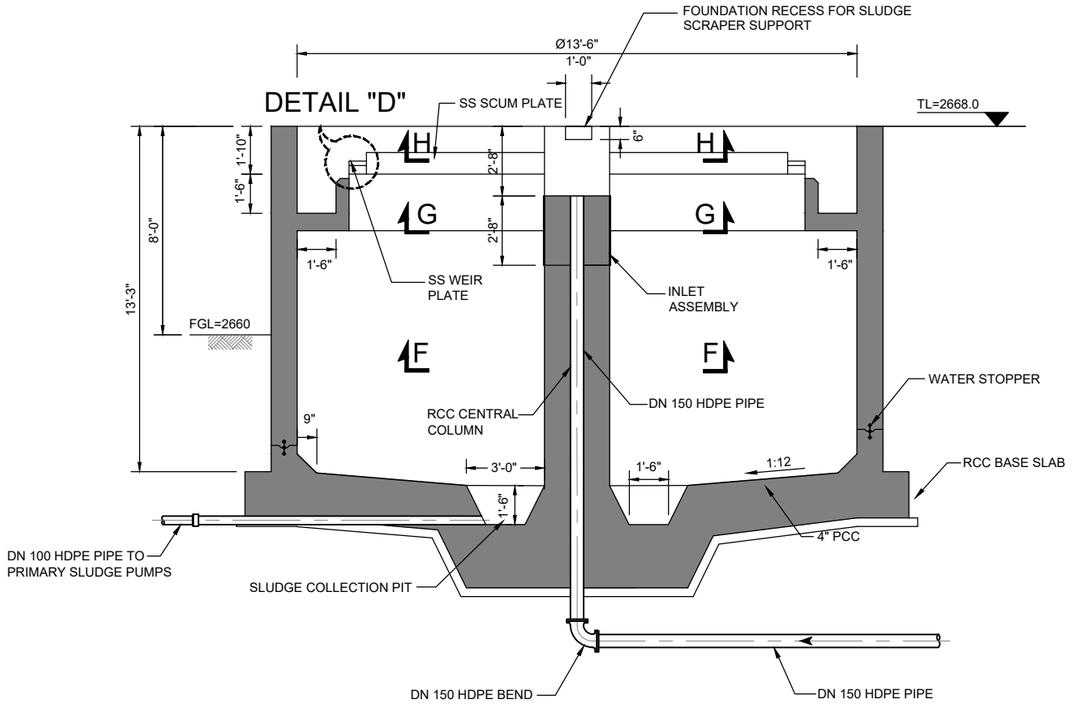
VILLAGE SARKALAN KALAR KAHAR
PRIMARY SEDIMENTATION TANK (PST) PLAN

DATE: MARCH, 2025

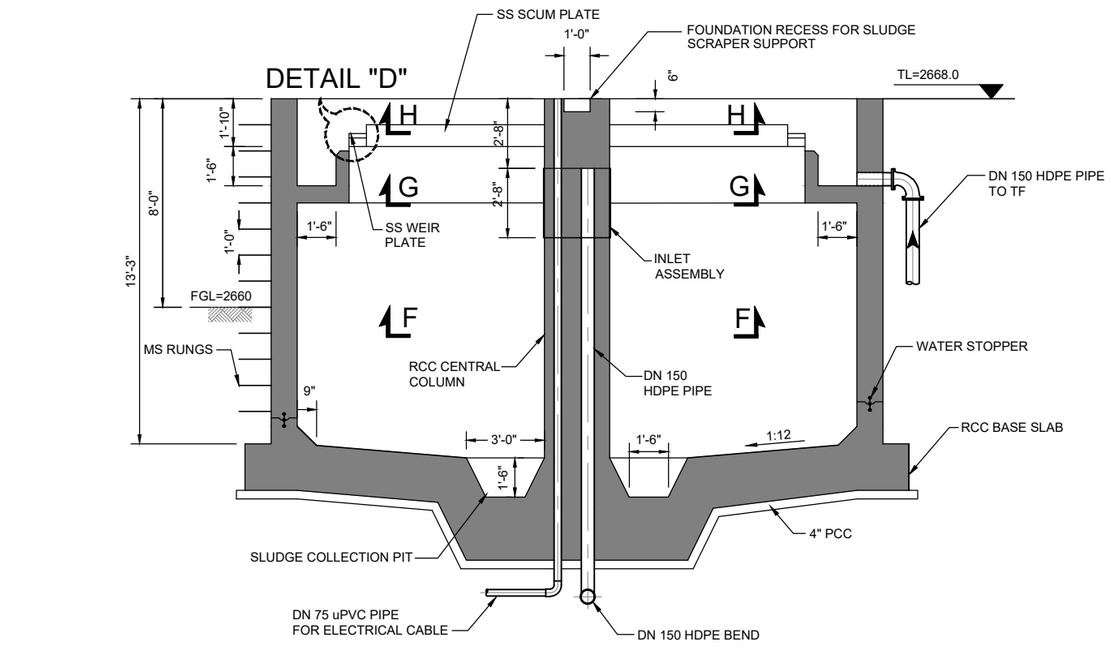
DRAWING No.: **4695/11/C/2J102**

SCALE: 1"=5'

REV.: 0



SECTION A-A



SECTION B-B

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	WALEED
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

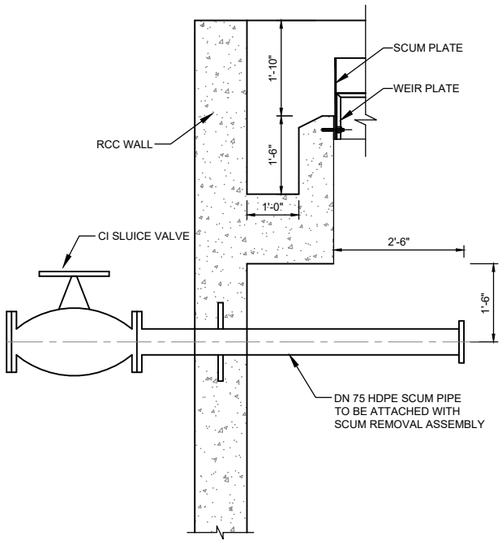
VILLAGE SARKALAN KALAR KAHAR
PRIMARY SEDIMENTATION TANK (PST)
SECTION A-A & B-B

SCALE: 1"=7'

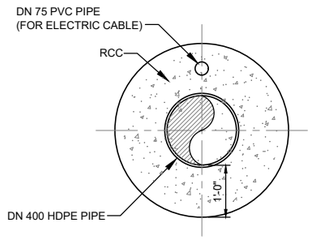
DATE: MARCH, 2025

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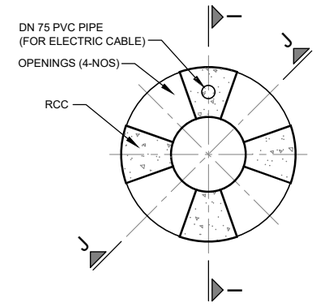
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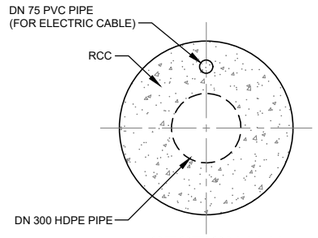
SECTION C-C
SCALE 1"=3'



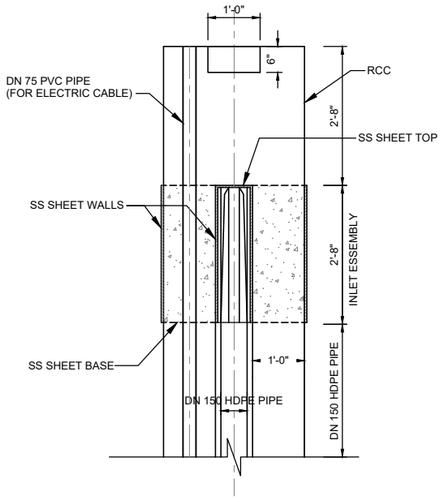
SECTION F-F
SCALE 1"=3'



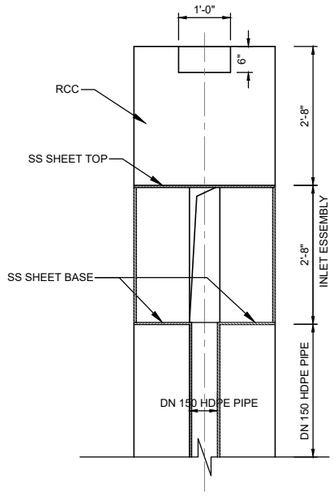
SECTION G-G
SCALE 1"=3'



SECTION H-H
SCALE 1"=3'



SECTION I-I
SCALE 1"=3'



SECTION J-J
SCALE 1"=3'

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

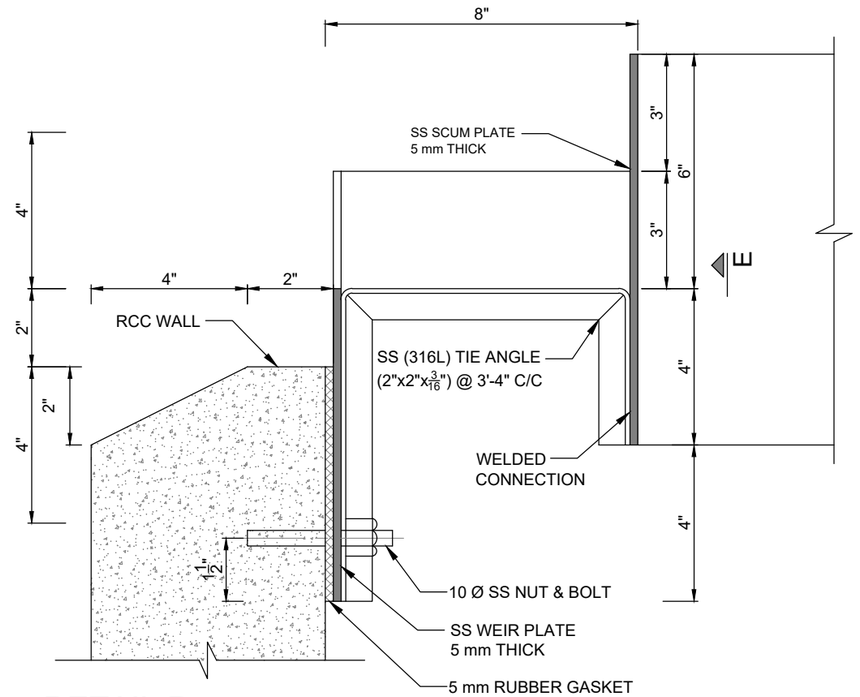
VILLAGE SARKALAN KALAR KAHAR
PRIMARY SEDIMENTATION TANK (PST)
SECTIONS

SCALE 1"=3'

DATE MARCH, 2025

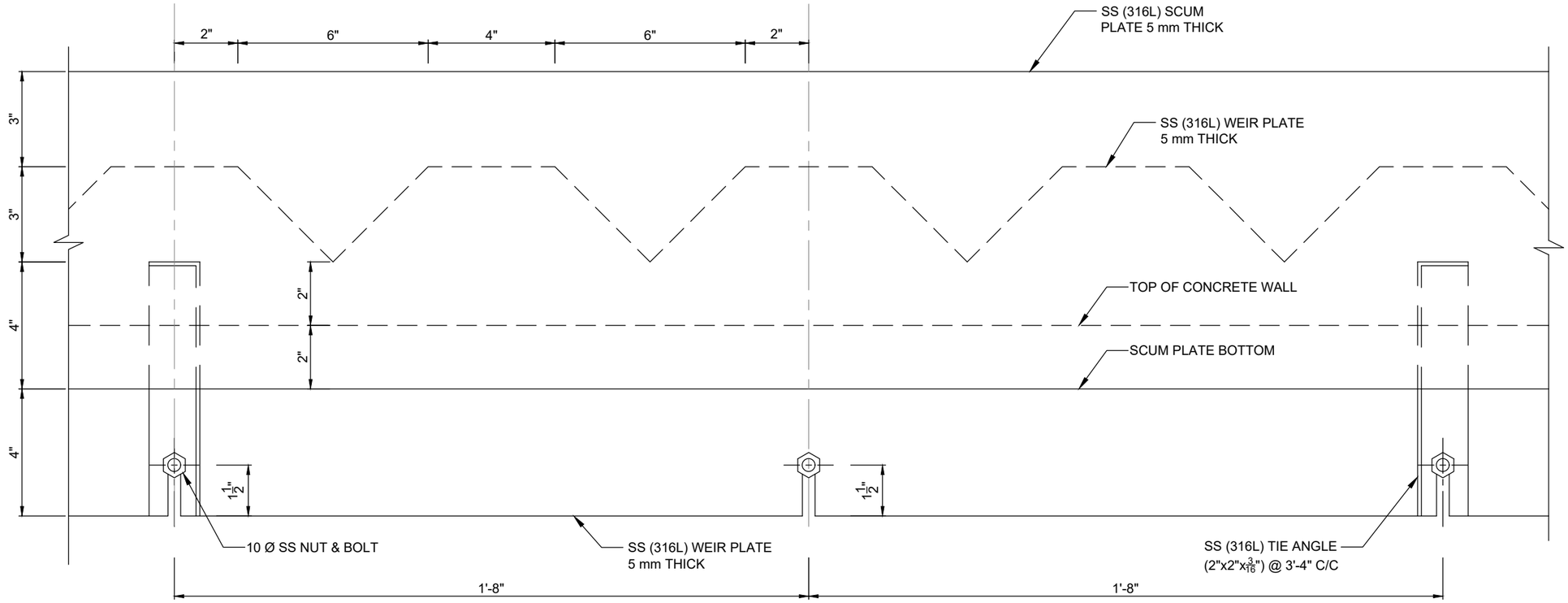
DRAWING No. **4695/11/C/2J104**

REV. 0



DETAIL D

SCALE 1"=4"



VIEW E

SCALE 1"=4"

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

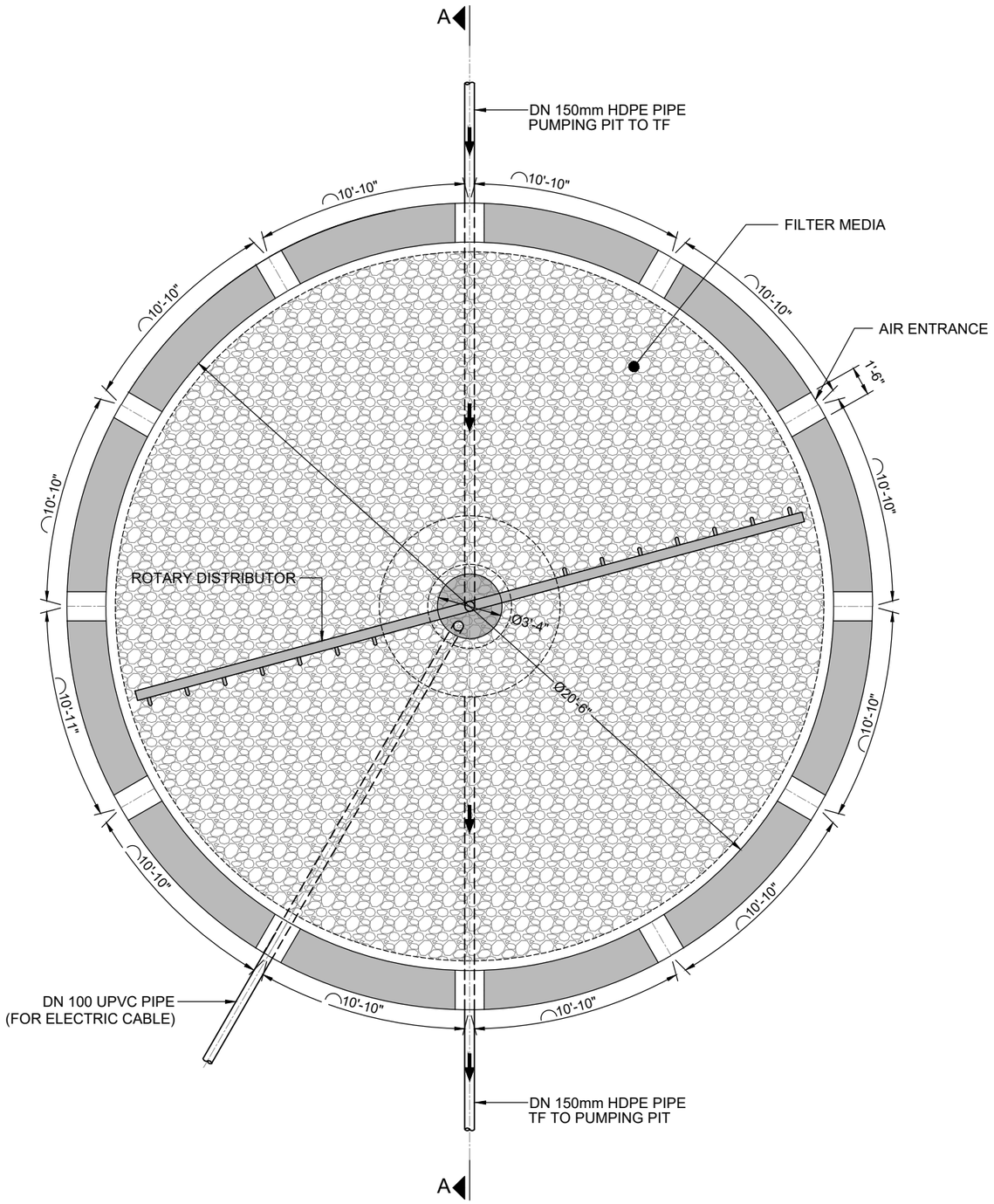
DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

VILLAGE SARKALAN KALAR KAHAR
PRIMARY SEDIMENTATION TANK (PST) DETAIL AND VIEW

DATE	DRAWING No.	SCALE	REV.
MARCH, 2025	**4695/11/C/2J105**	1"=4"	0



PLAN OF
TRICKLING FILTER

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	WALEED
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

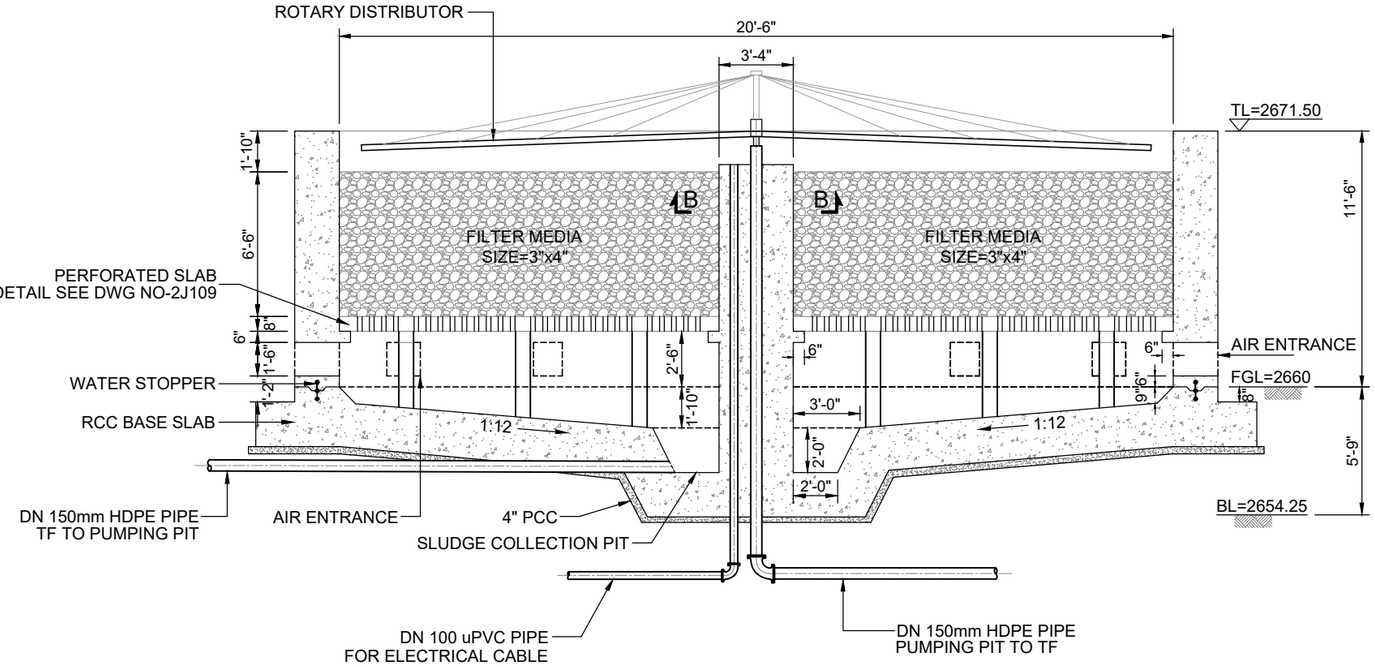
VILLAGE SARKALAN KALAR KAHAR
TRICKLING FILTER (TF)
PLAN

SCALE: 1"=7'

DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J106**

REV.: 0



SECTION A-A
SCALE 1"=7'

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

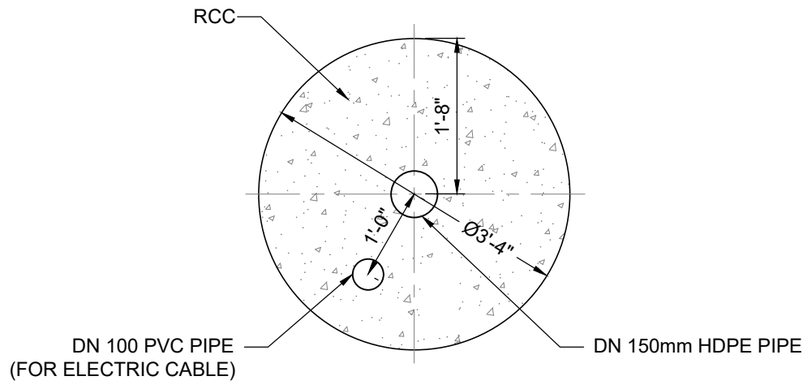
VILLAGE SARKALAN KALAR KAHAR
TRICKLING FILTER (TF)
SECTION A-A

SCALE 1"=7'

DATE MARCH, 2025

DRAWING No. **4695/11/C/2J107**

REV. 0



SECTION B-B

SCALE 1"=2'

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

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Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

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HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

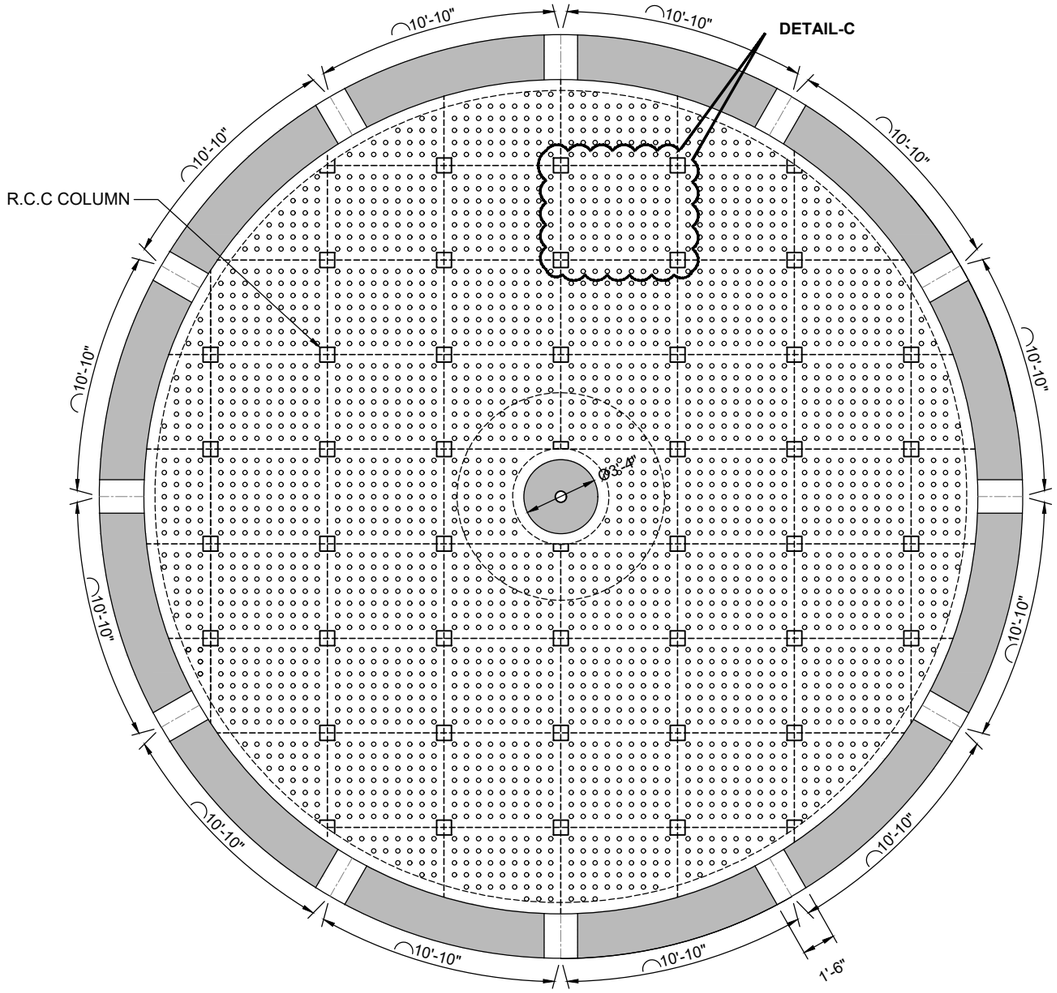
VILLAGE SARKALAN KALAR KAHAR
TRICKLING FILTER (TF)
SECTION B-B

SCALE 1"=2'

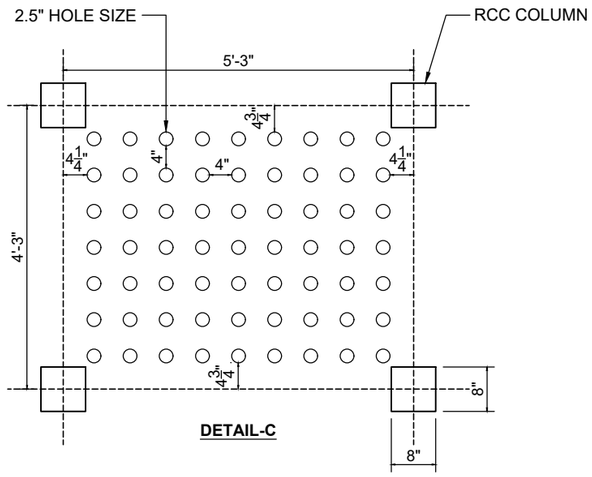
DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J108**

REV.: 0



PERFORATED SLAB (TYP.)



DETAIL-C

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
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CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

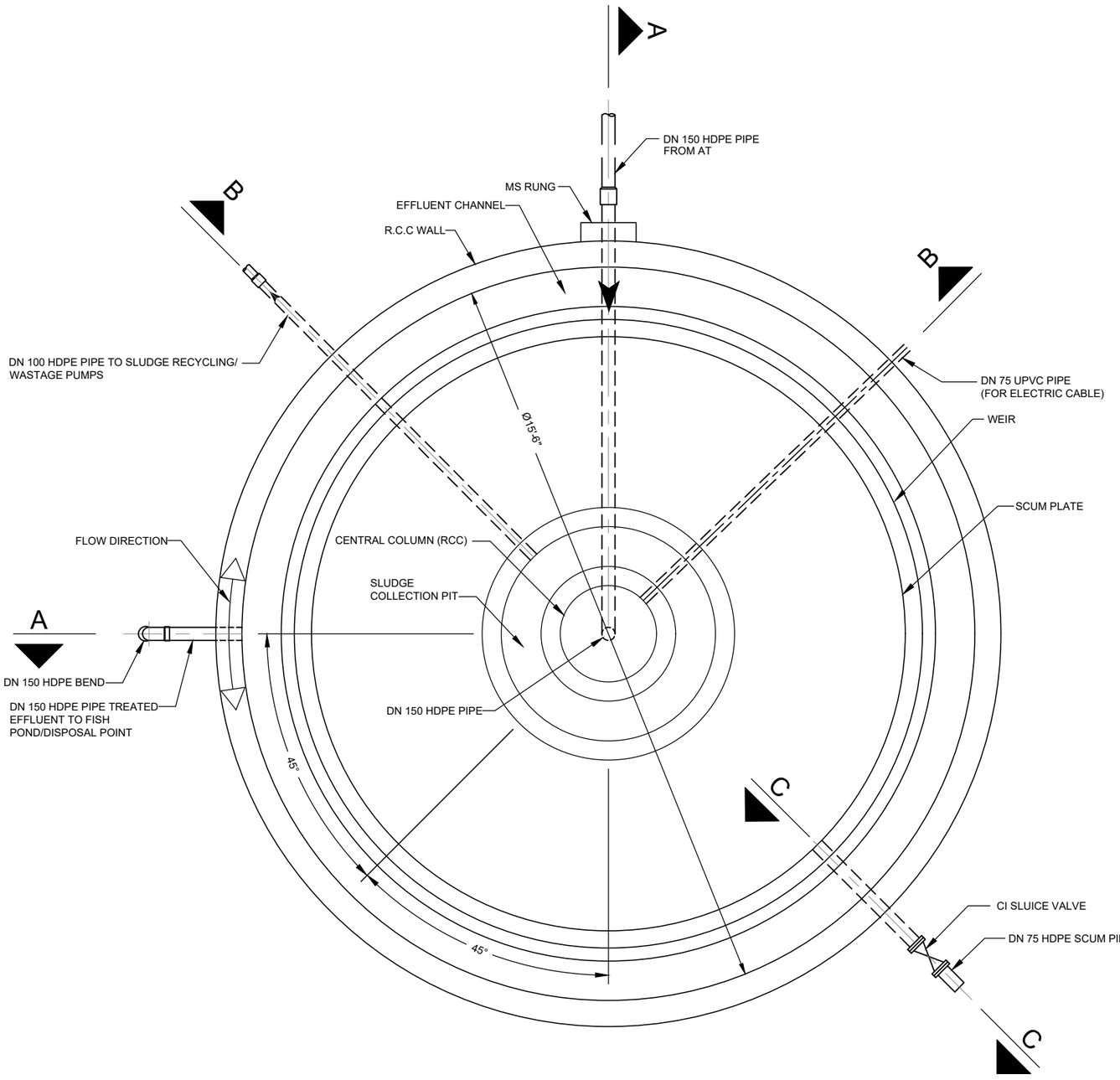
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

VILLAGE SARKALAN KALAR KAHAR
TRICKLING FILTER (TF)
PERFORATED SLAB DETAIL

DATE	DRAWING No.	REV.
MARCH, 2025	**4695/11/C/2J109**	0

SCALE: 1"=7'



PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
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3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

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HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

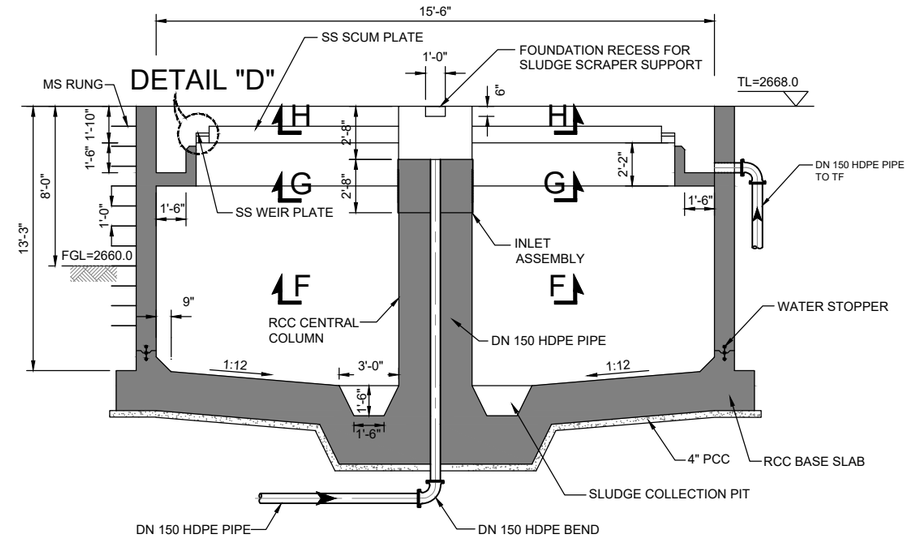
SECONDARY SEDIMENTATION TANK (SST) PLAN

SCALE

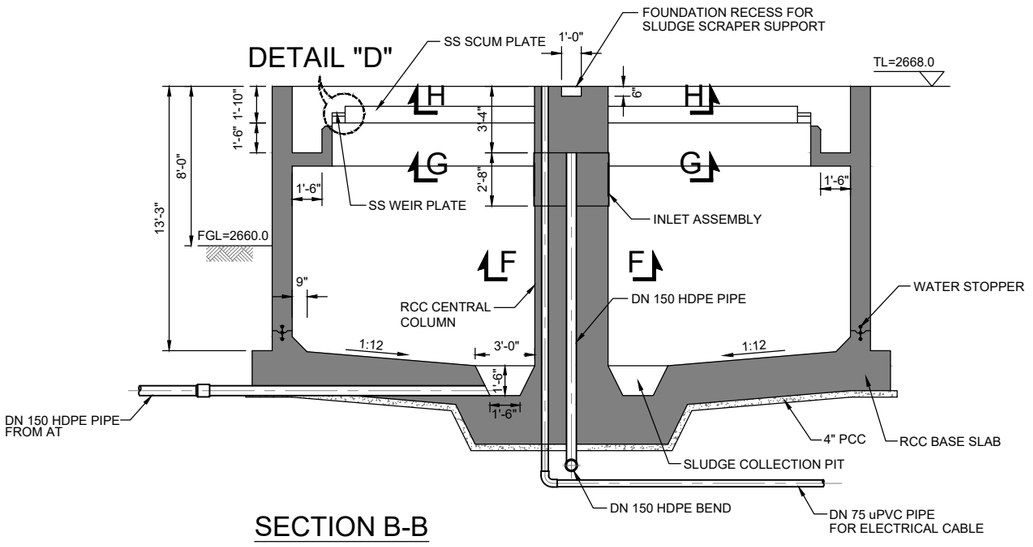
DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J110**

REV.: 0



SECTION A-A



SECTION B-B

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
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CLIENT

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Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

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HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	WALEED
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

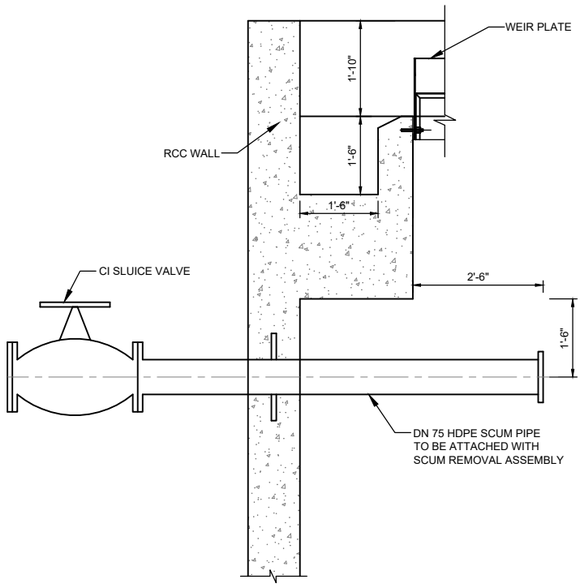
SECONDARY SEDIMENTATION TANK (SST) SECTION A-A & B-B

SCALE

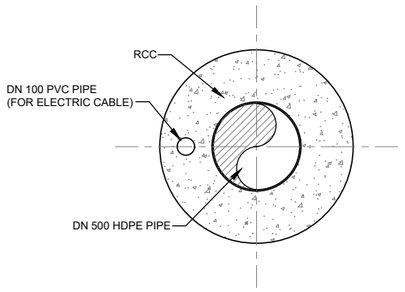
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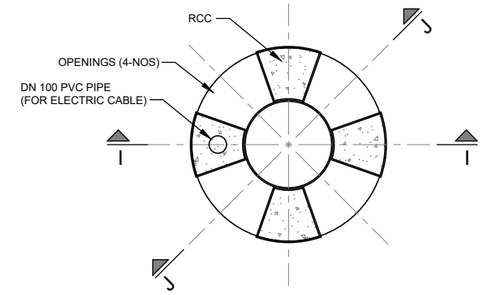
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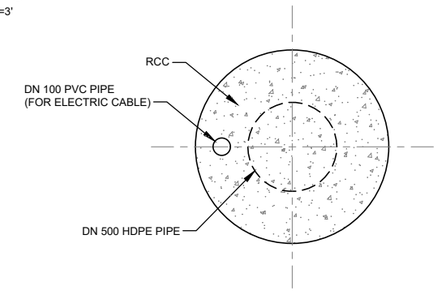
SECTION C
SCALE 1"=3'



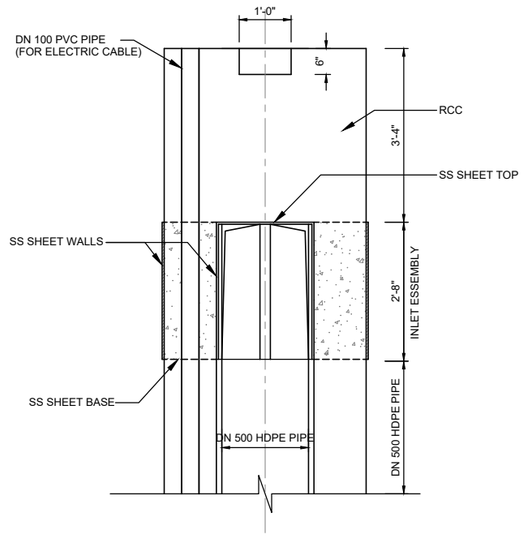
SECTION FF
SCALE 1"=3'



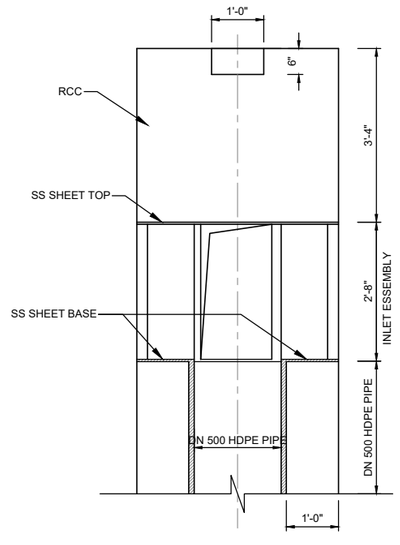
SECTION GG
SCALE 1"=3'



SECTION HH
SCALE 1"=3'



SECTION II
SCALE 1"=3'



SECTION JJ
SCALE 1"=3'

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
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CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
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DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

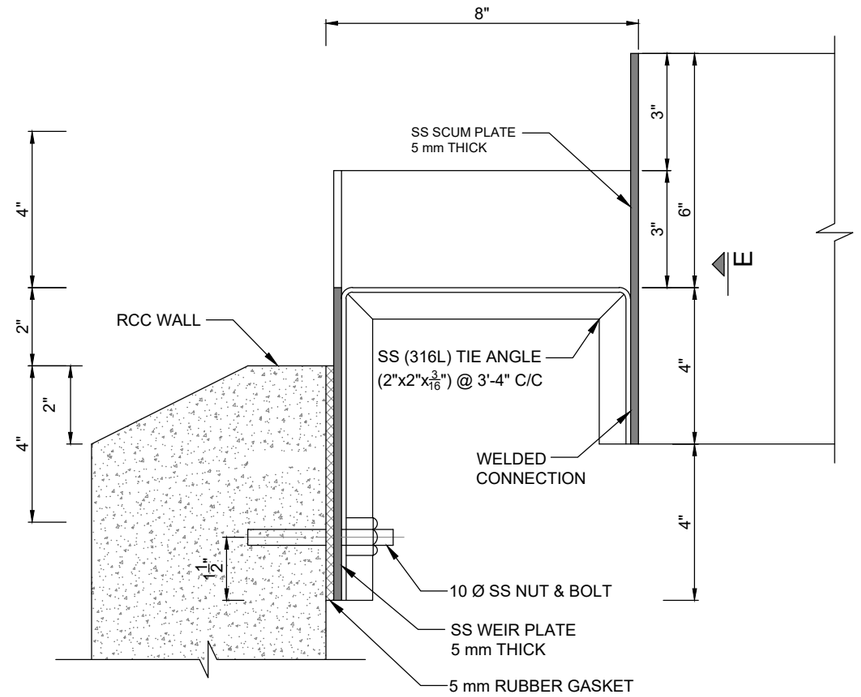
SECONDARY SEDIMENTATION TANK (SST) SECTIONS

SCALE 1"=3'

DATE MARCH, 2025

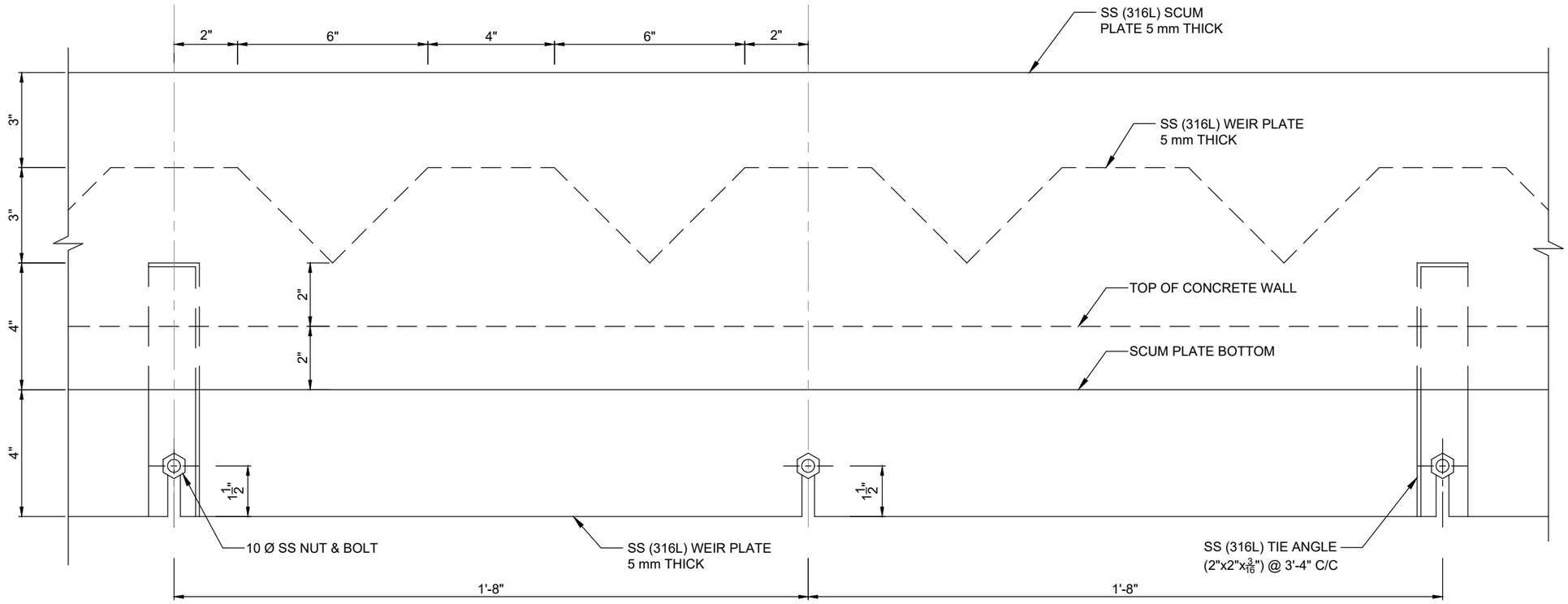
DRAWING No. **4695/11/C/2J112**

REV. 0



DETAIL D

SCALE 1"=4"



VIEW E

SCALE 1"=4"

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
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CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

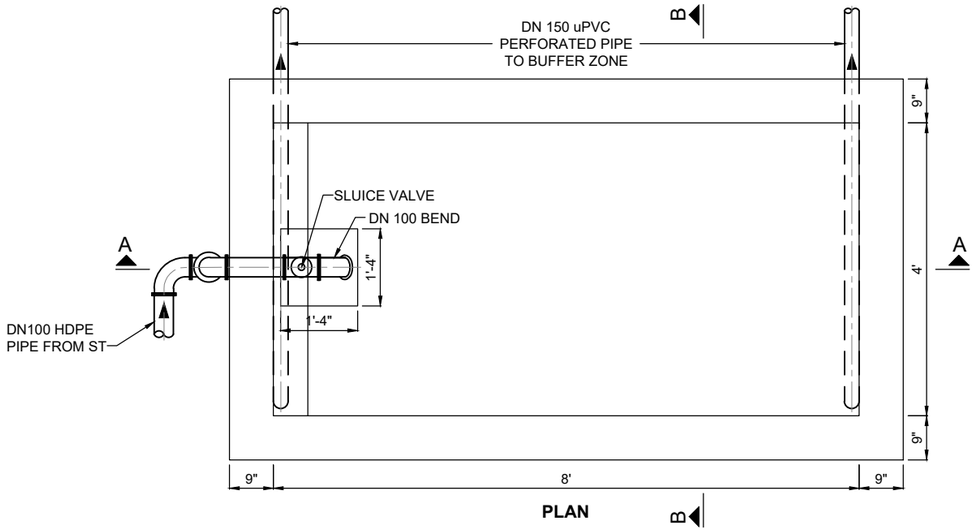
PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

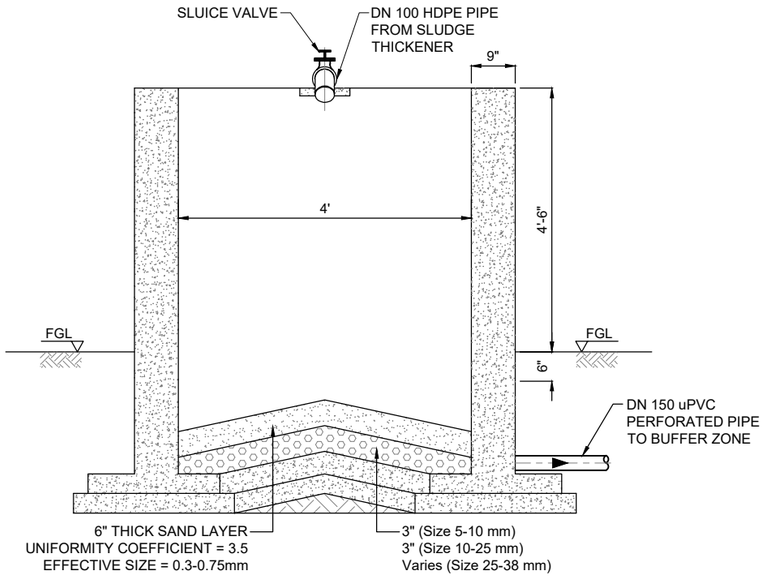
SECONDARY SEDIMENTATION TANK (SST) DETAIL AND VIEW

DATE	DRAWING No.	REV.
MARCH, 2025	**4695/11/C/2J113**	0

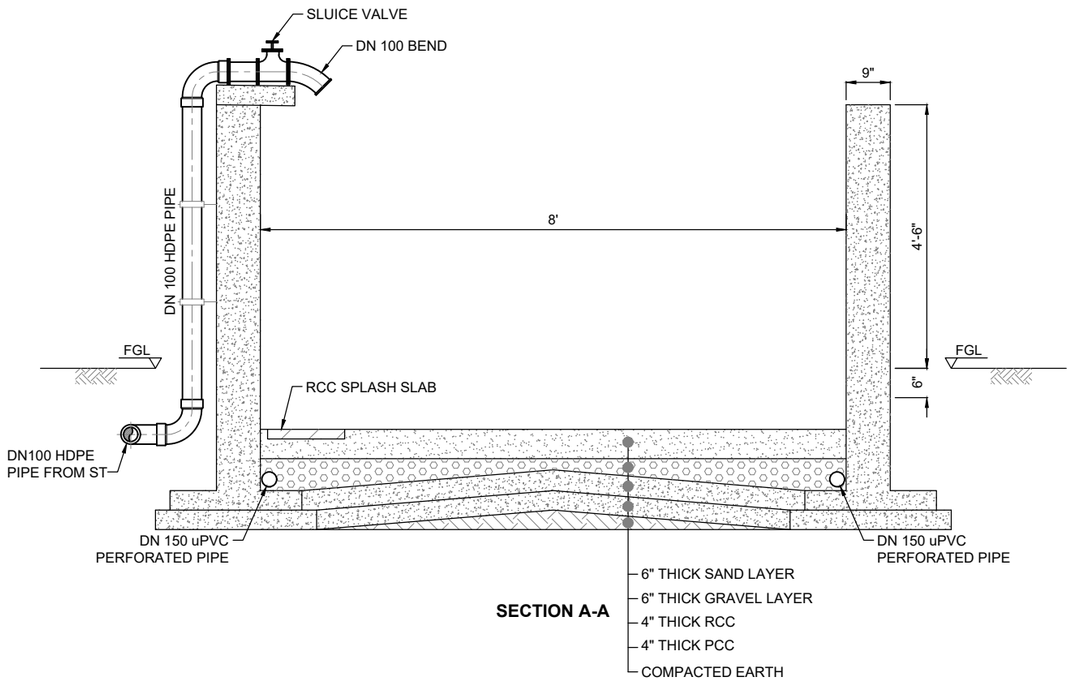
SCALE 1"=4"



PLAN



SECTION B-B



SECTION A-A

CLIENT

Strategic Planning & Implementation Unit
(SP & IU)
Environment Protection Department
(EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N,
MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

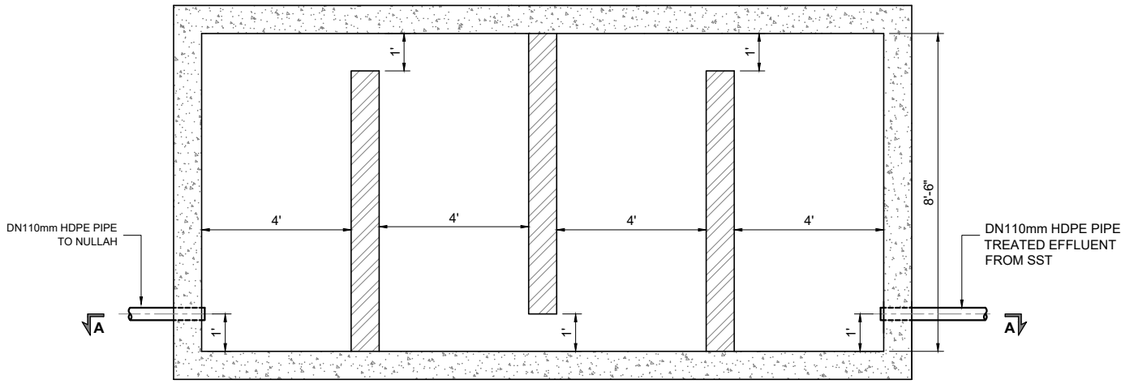
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

SLUDGE DRYING BED
PLAN & SECTIONS

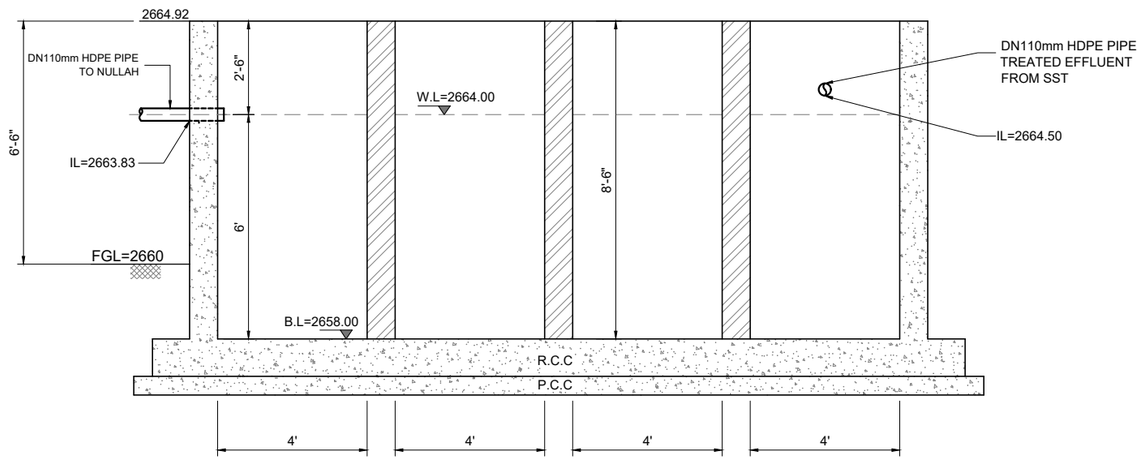
DATE	DRAWING No.	REV.
MARCH, 2025	**4695/11/C/2J114**	0

SCALE

1"=3'



PLAN OF
DISINFECTION TANK



SECTION A-A

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT
Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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APPROVED	

PROJECT
Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

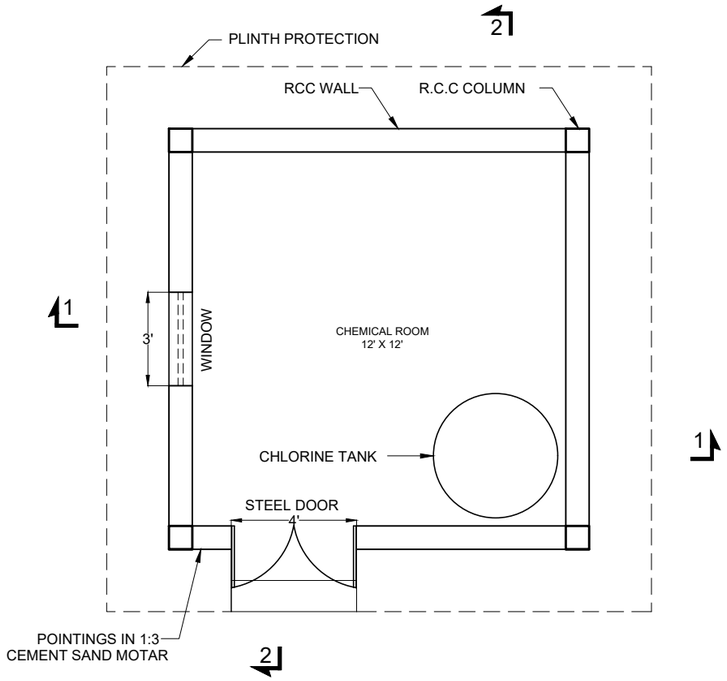
VILLAGE SARKALAN KALAR KAHAR
DISINFECTION TANK
PLAN AND SECTION

SCALE 1"=50'

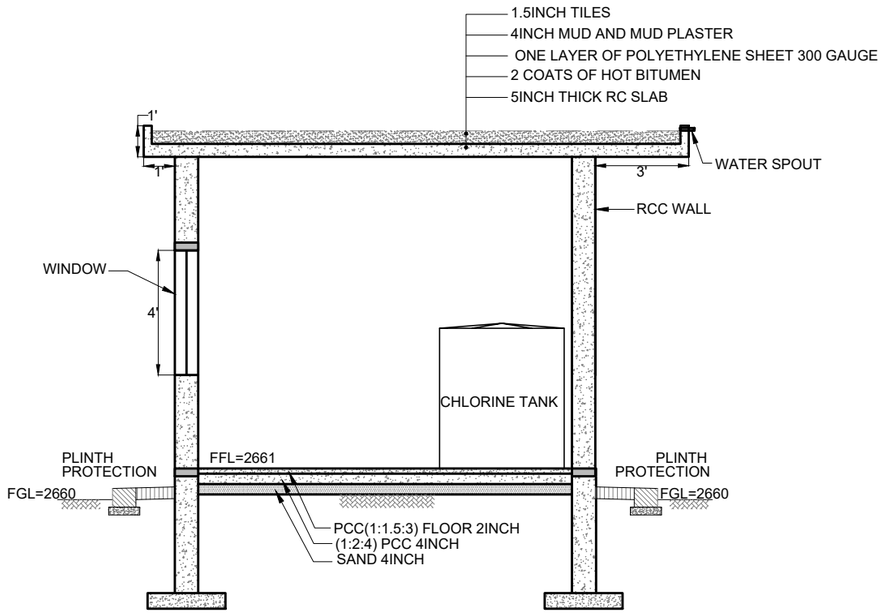
DATE MARCH, 2025

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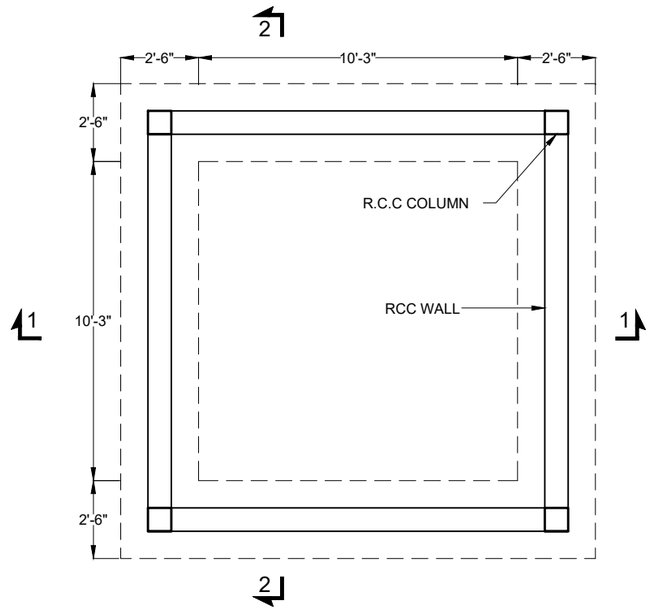
REV. 0



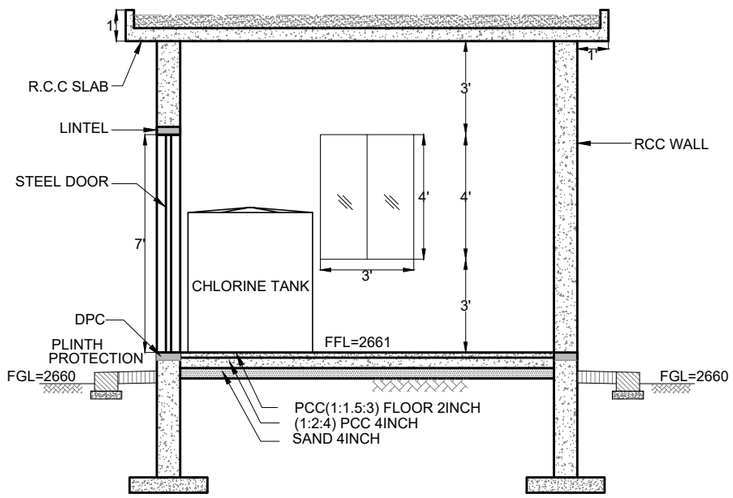
PLAN



SECTION 1-1



FOUNDATION PLAN



SECTION 2-2

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

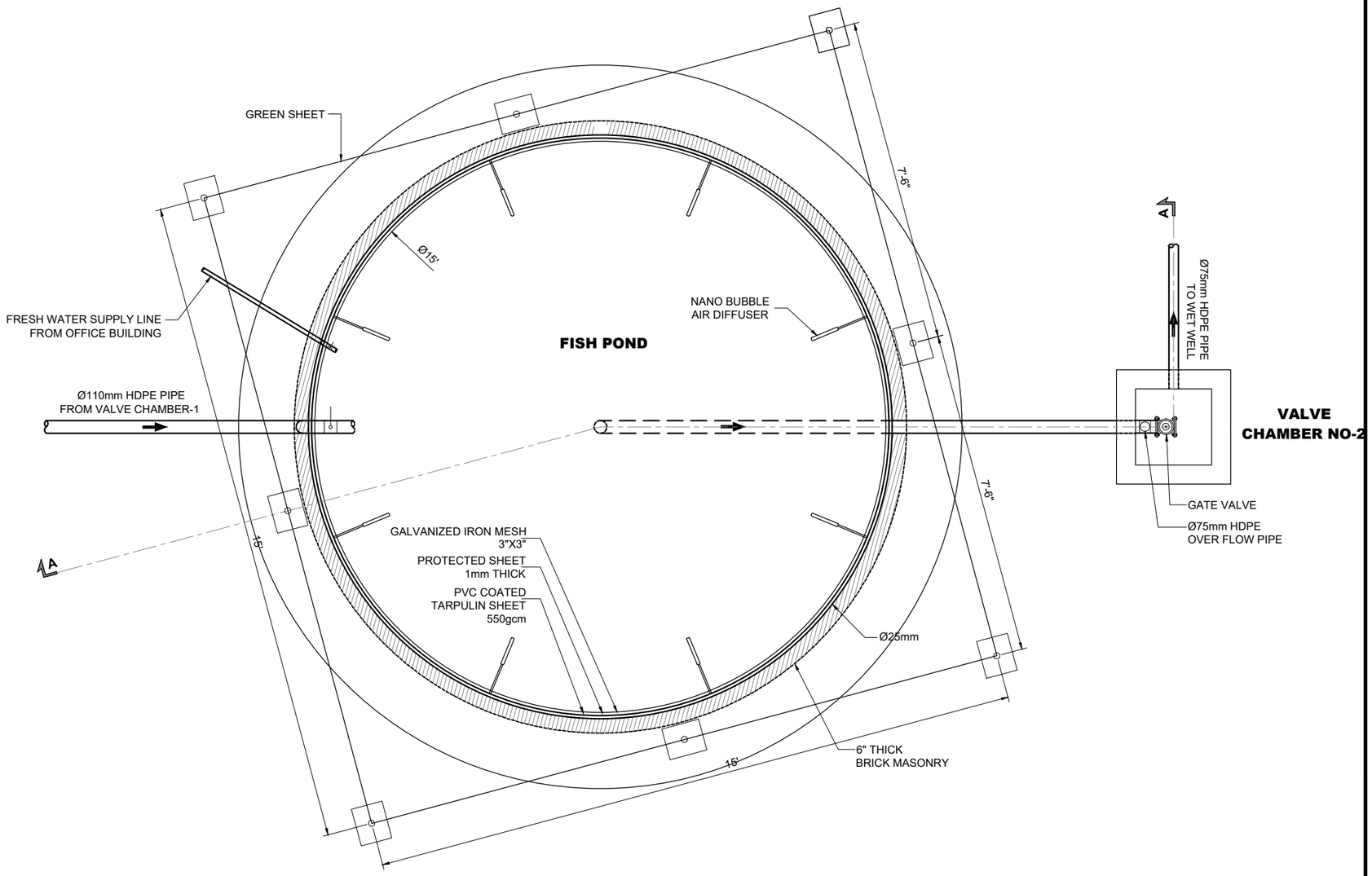
CHEMICAL ROOM PLAN & SECTIONS

SCALE: 1"=60'

DATE: September, 2024

DRAWING No.: **4695/11/C/2J116**

REV.: 0



PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

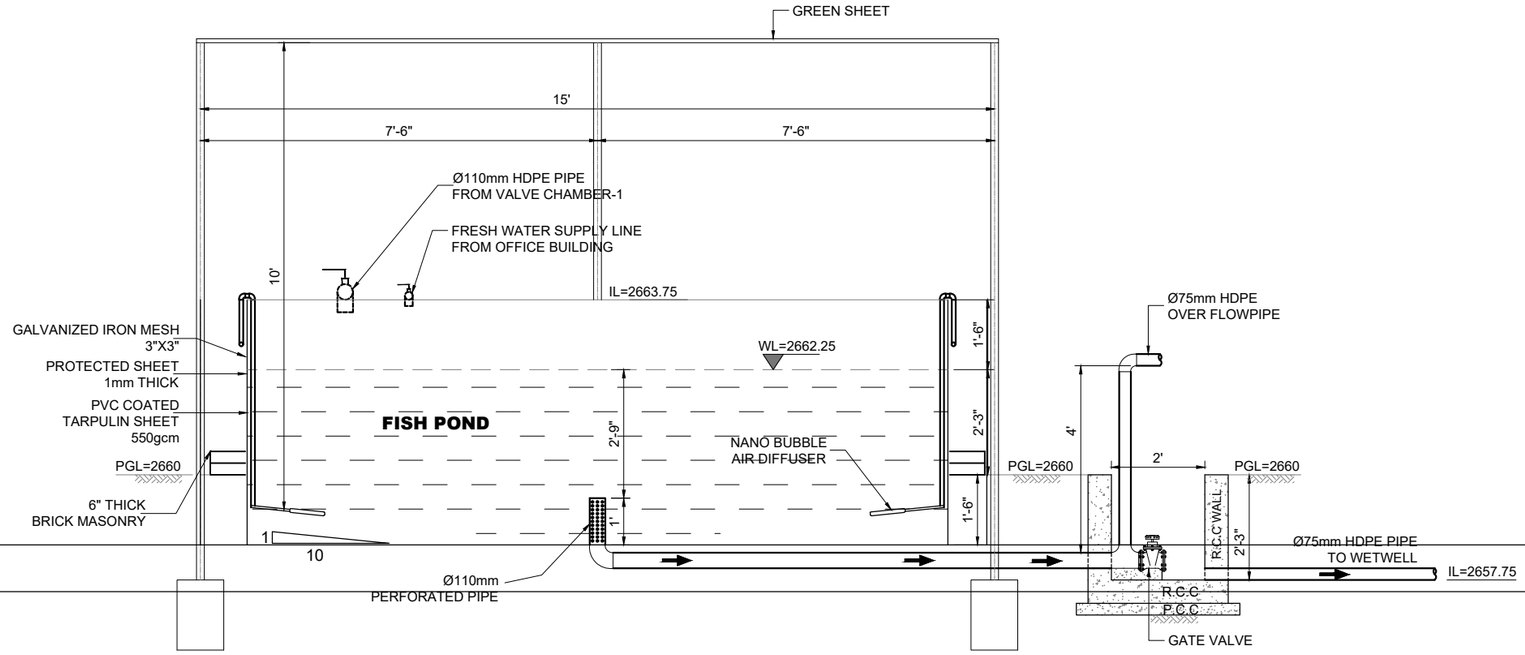
SEWAGE TREATMENT PLANT
PLAN OF FISH POND

SCALE: 1"=50'

DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J117**

REV.: 0



SECTION A-A

VALVE CHAMBER-2

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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02			
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

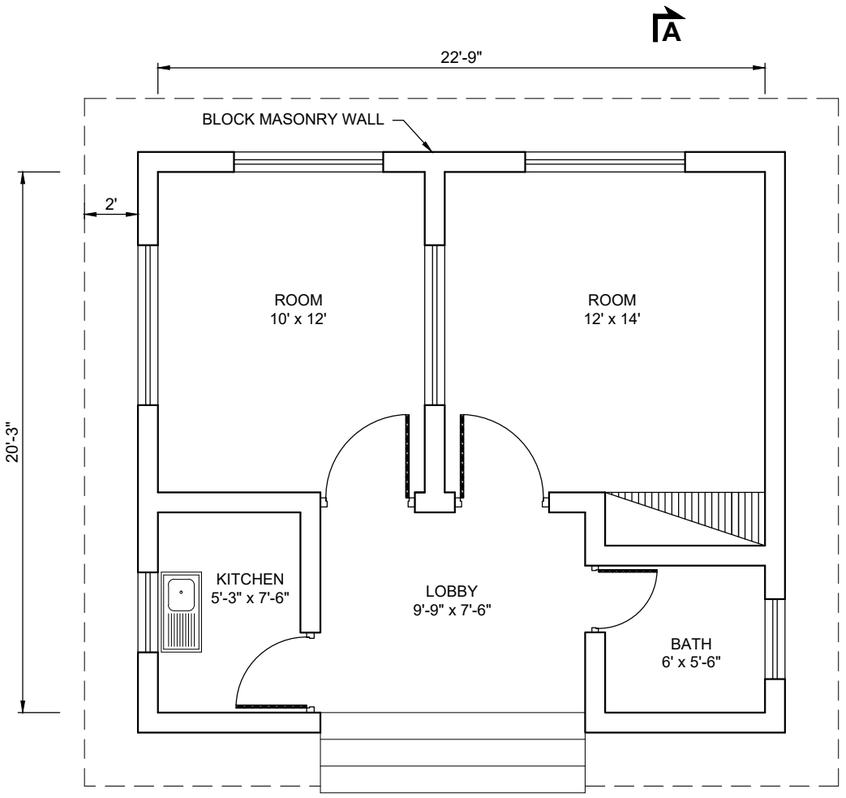
SEWAGE TREATMENT PLANT
FISH POND
SECTION A-A

SCALE: 1"=50'

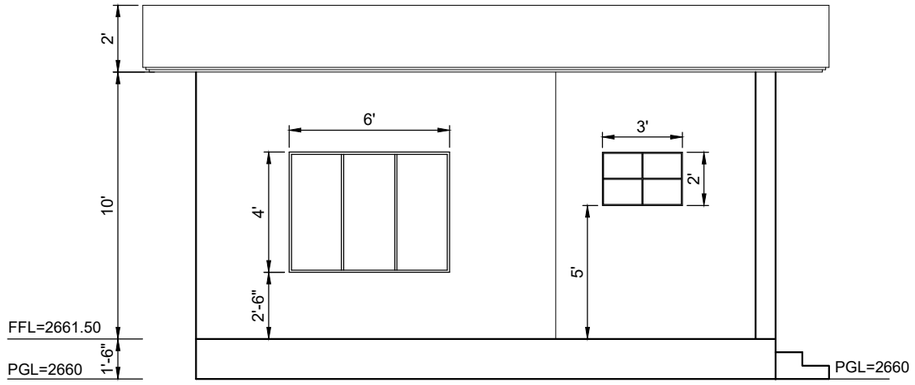
DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J123**

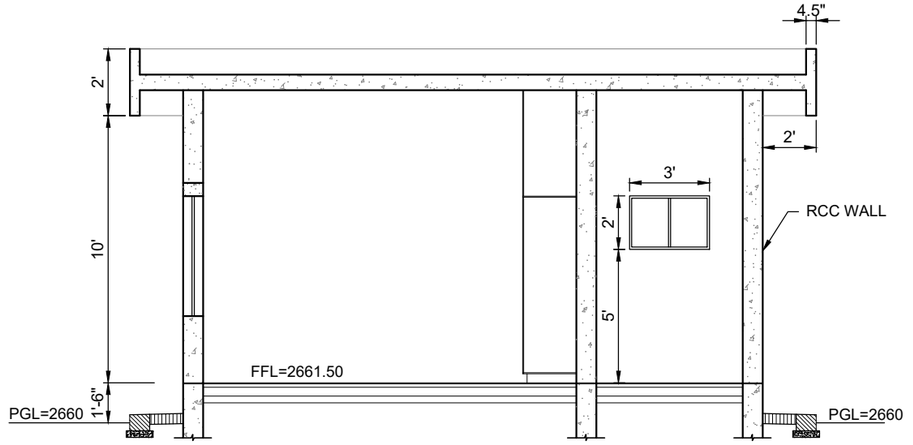
REV.: 0



STAFF BUILDING



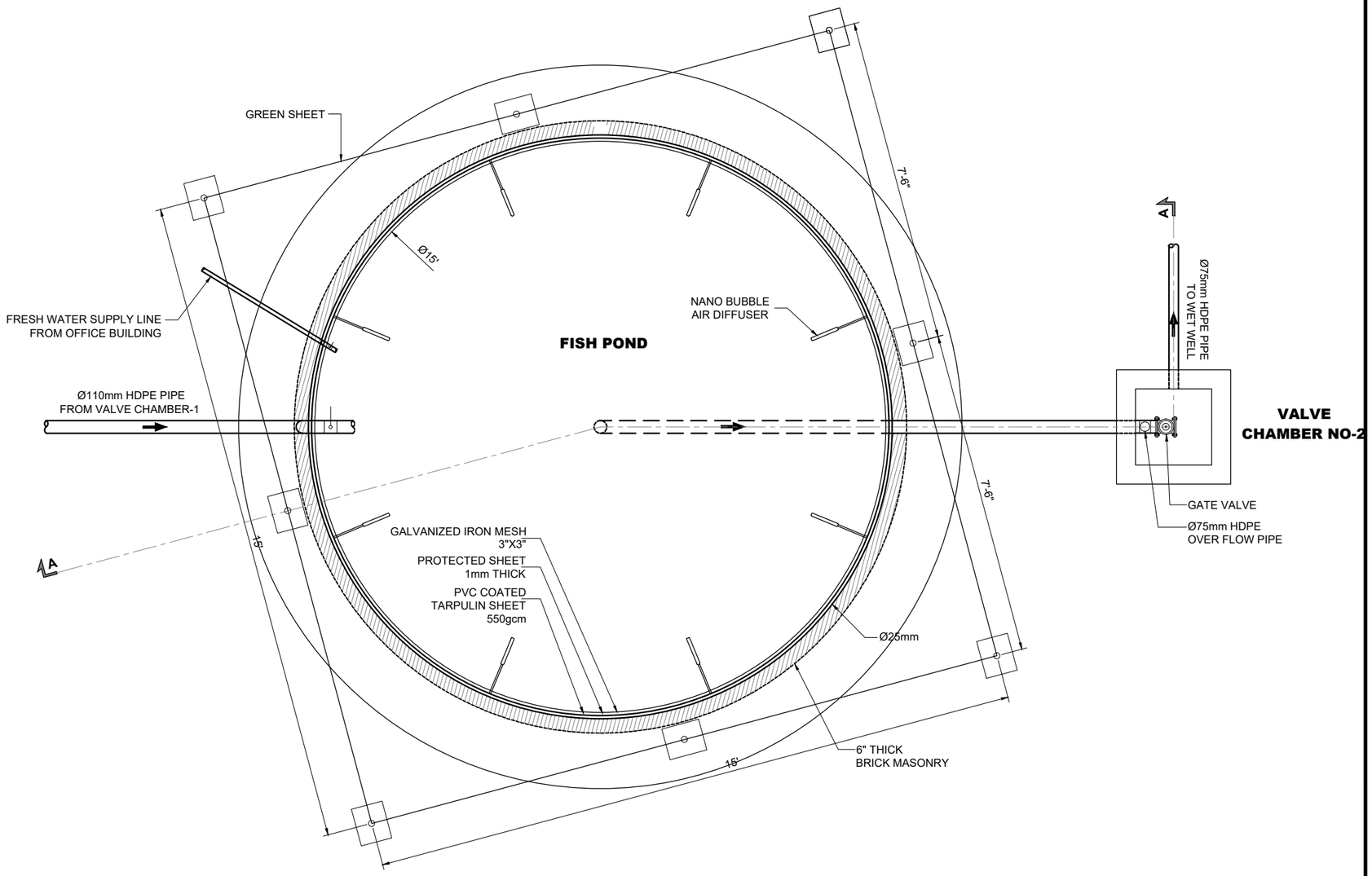
SIDE ELEVATION



SECTION A-A

CLIENT: Strategic Planning & Implementation Unit (SP & IU) Environment Protection Department (EPU) Govt of Punjab.	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.	PROJECT: Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab	**DETAIL OF STAFF BUILDING**	SCALE: 1"=70'	
			DATE: MARCH, 2025	DRAWING No.: **4695/11/C/2J124**	REV.: 0

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	WALEED
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	



PLAN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

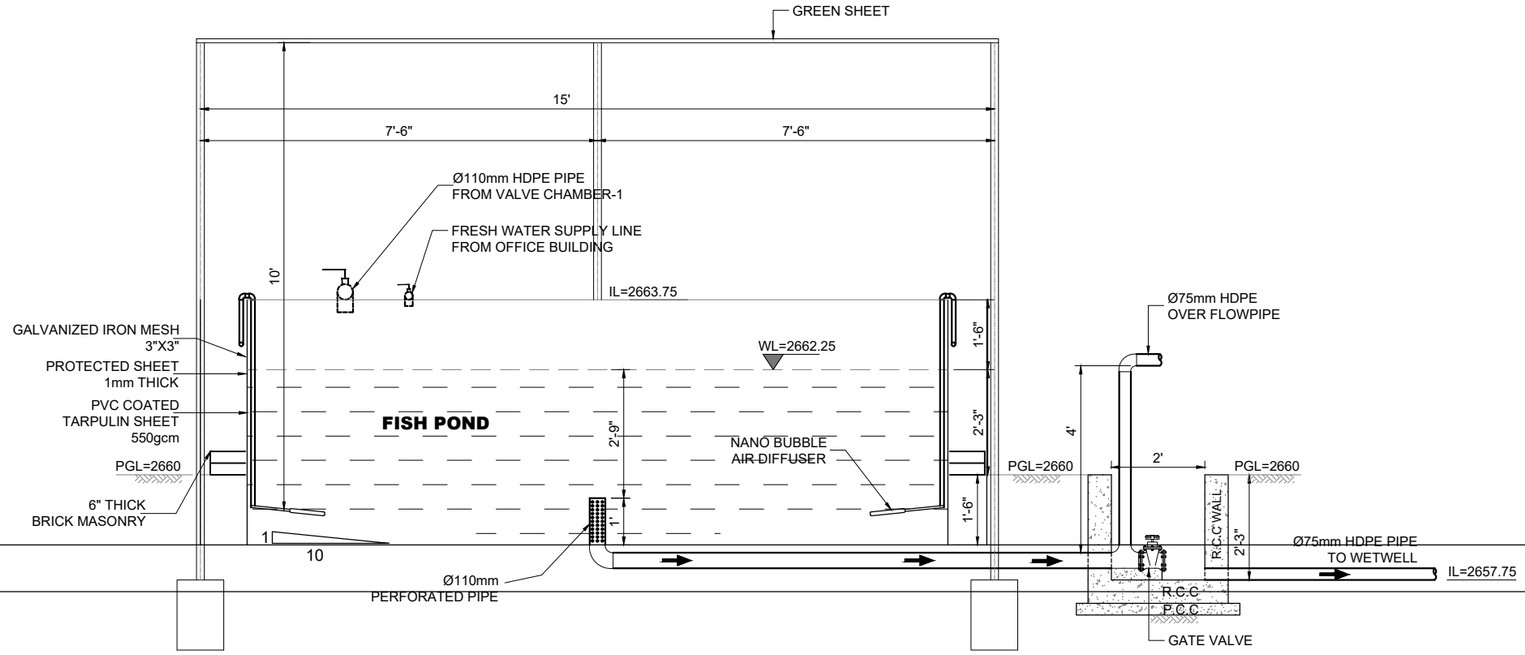
SEWAGE TREATMENT PLANT
PLAN OF FISH POND

SCALE: 1"=50'

DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J122**

REV.: 0



SECTION A-A

VALVE CHAMBER-2

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 4695/11/C/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
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DRAWN	WALEED
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

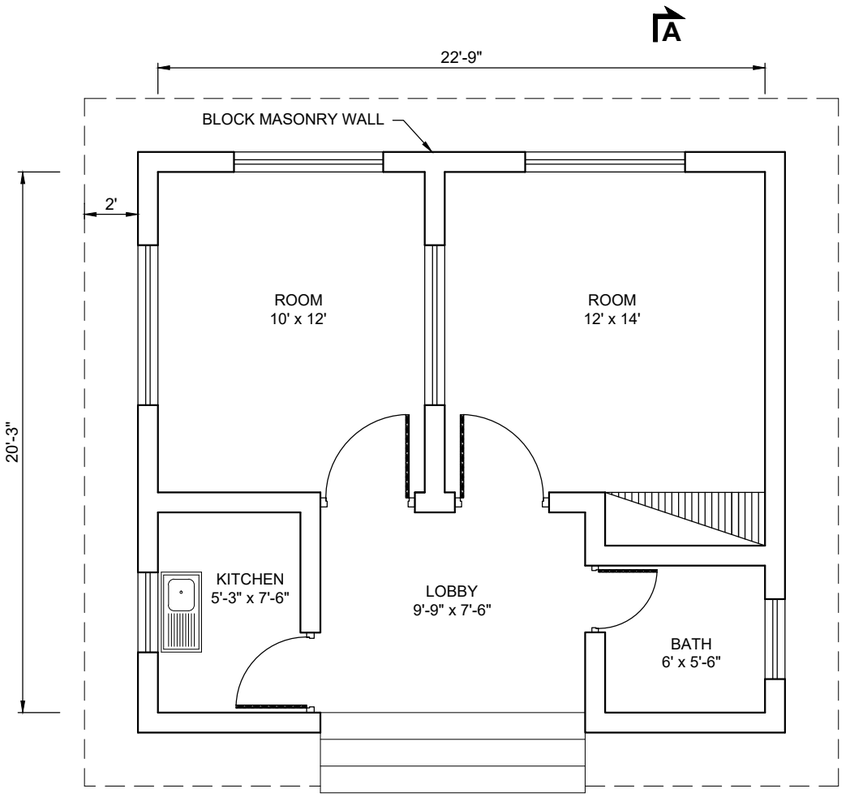
SEWAGE TREATMENT PLANT
FISH POND
SECTION A-A

SCALE: 1"=50'

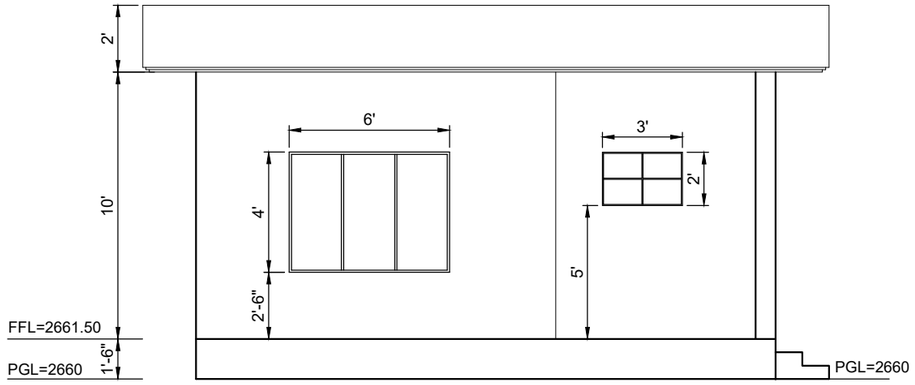
DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J118**

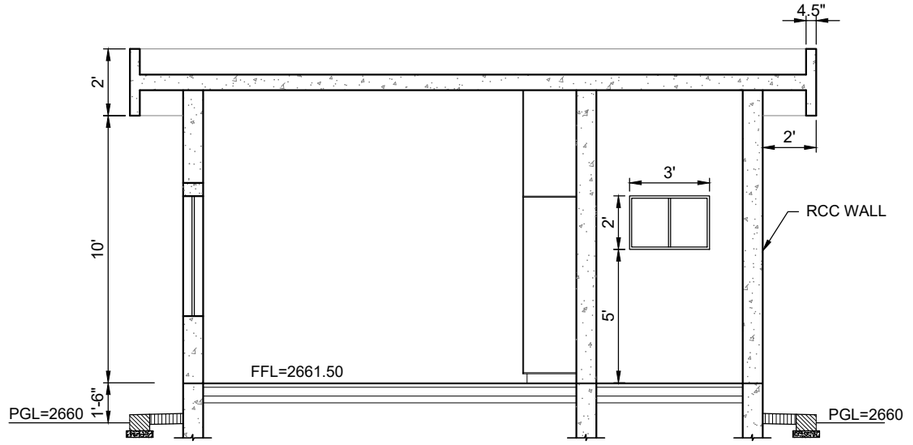
REV.: 0



STAFF BUILDING

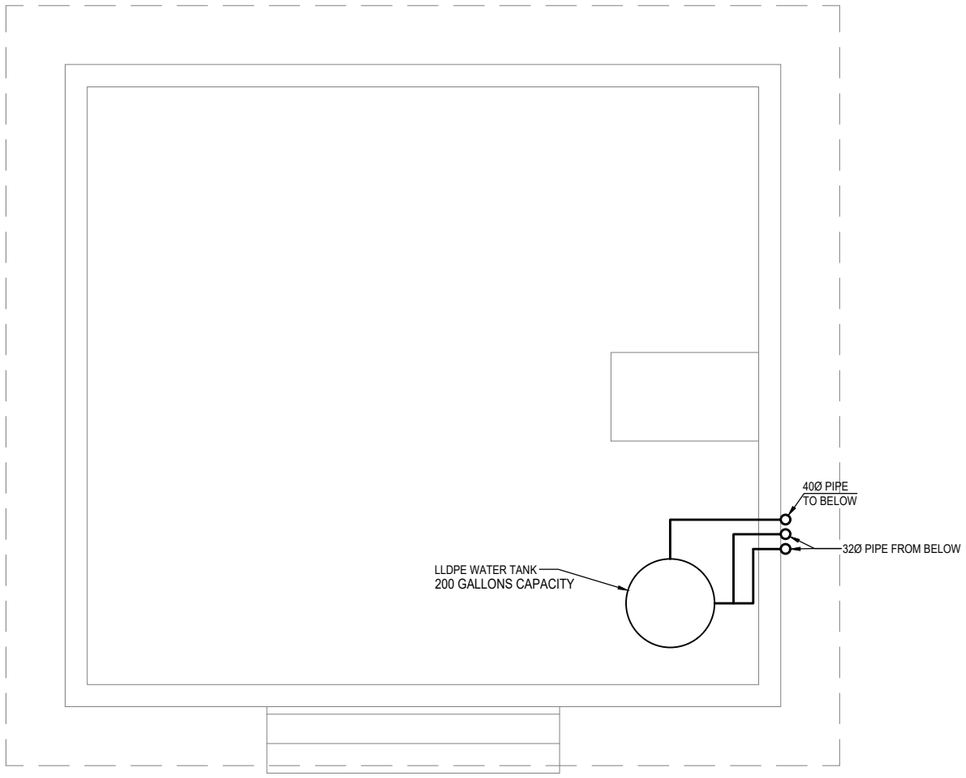


SIDE ELEVATION

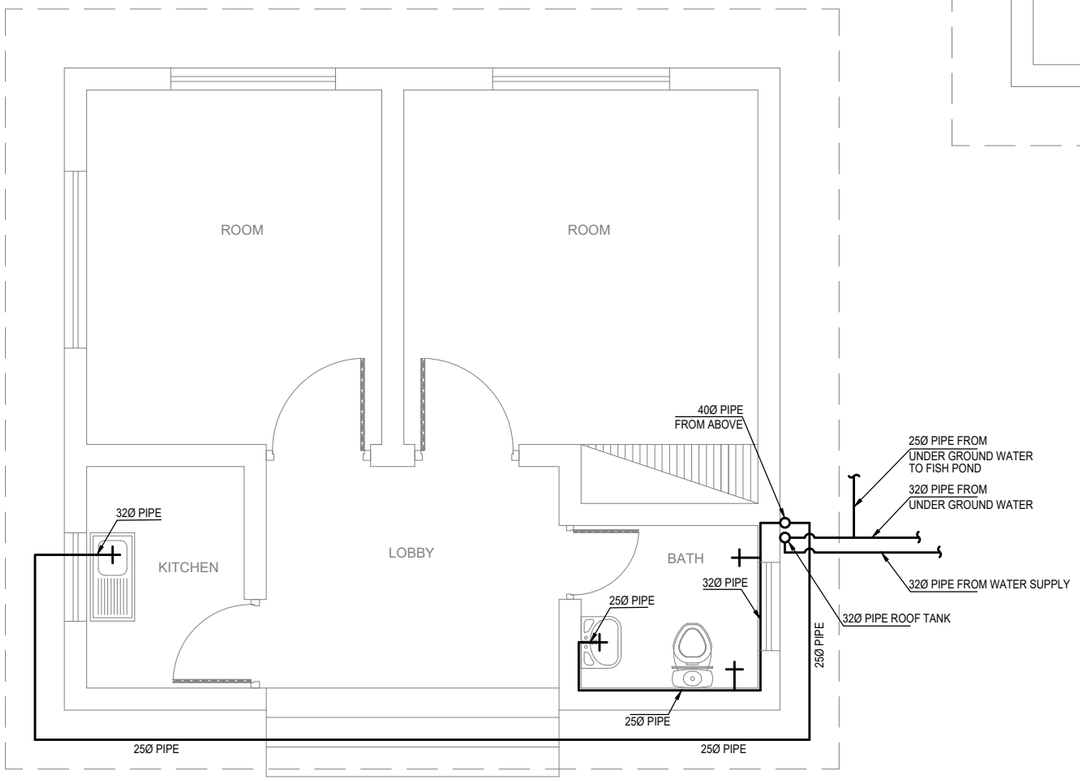


SECTION A-A

CLIENT: Strategic Planning & Implementation Unit (SP & IU) Environment Protection Department (EPU) Govt of Punjab.	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.	04		DRAWN	WALEED
		03		SUBMITTED	
		02		RECOMMENDED	
		01		CHD./VER.	
		REV. DATE DESCRIPTION	APPROVED	APPROVED	
PROJECT: Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab	**DETAIL OF STAFF BUILDING**			SCALE: 1"=70'	
	DATE: MARCH, 2025	DRAWING No.: **4695/11/C/2J119**		REV.: 0	



ROOF FLOOR
STAFF BUILDING



GROUND FLOOR
STAFF BUILDING

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

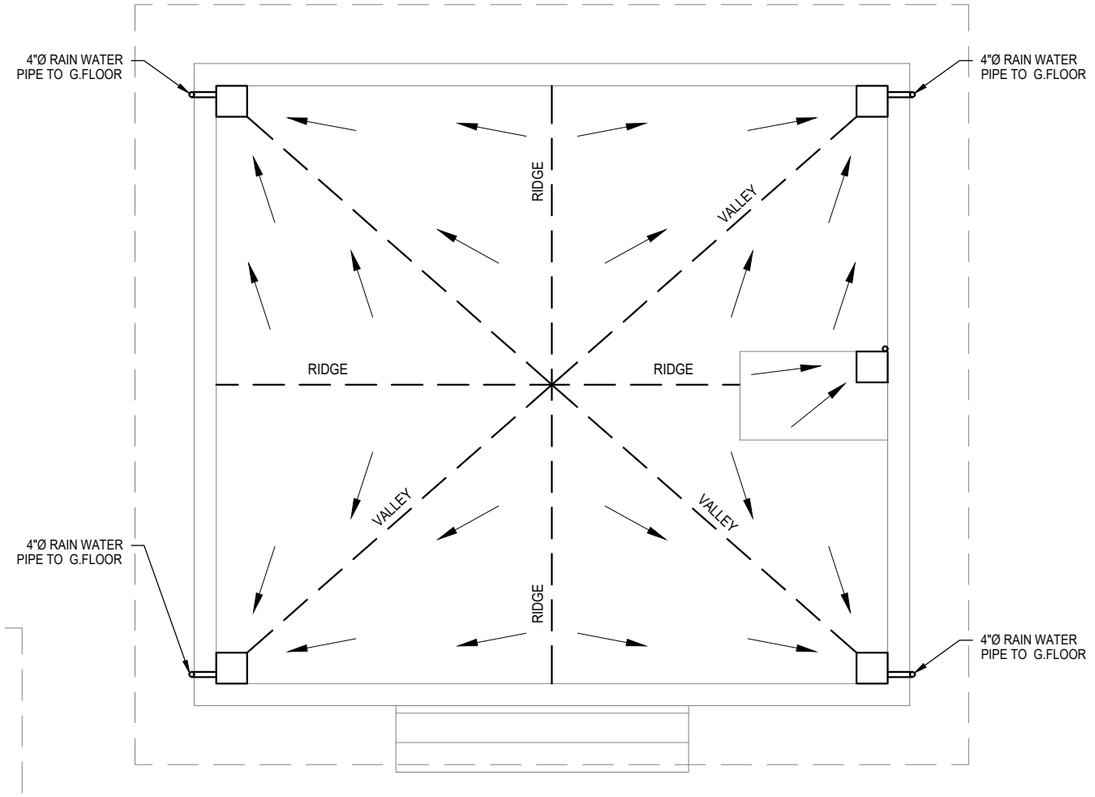
WATER SUPPLY OF STAFF BUILDING

DATE: MARCH, 2025

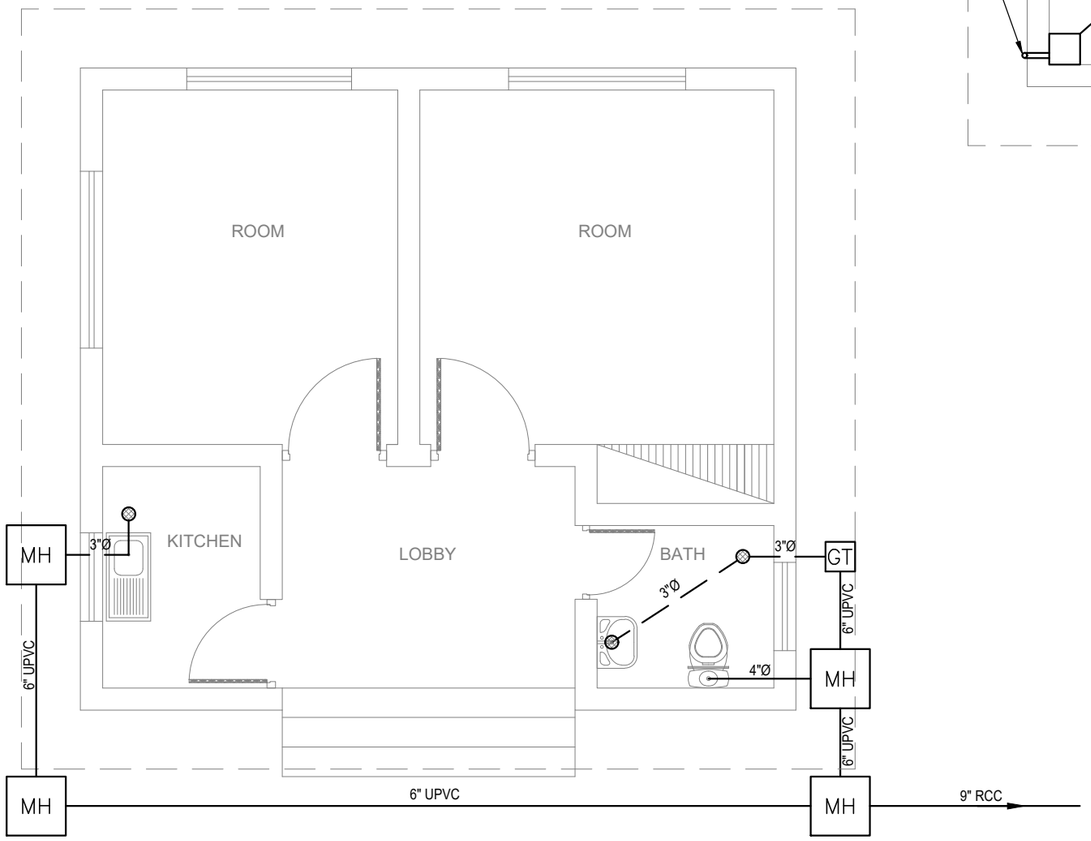
DRAWING No.: **4695/11/C/2J120**

SCALE: 1"=60'

REV.: 0



ROOF DRAINAGE
STAFF BUILDING



SEWERAGE
STAFF BUILDING

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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CHD./VER.	
APPROVED	

PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

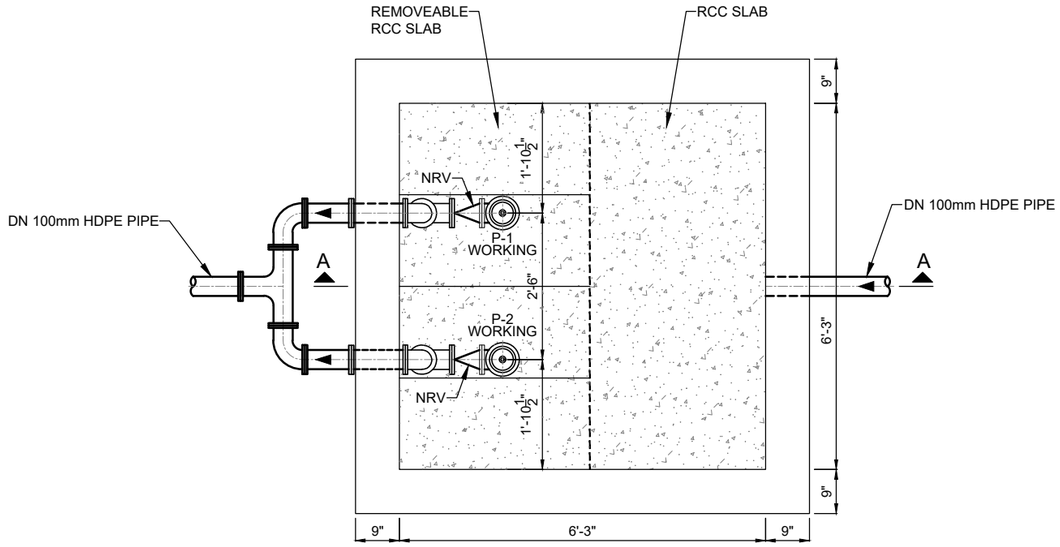
SEWERAGE & ROOF DRAINAGE OF STAFF BUILDING

DATE: MARCH, 2025

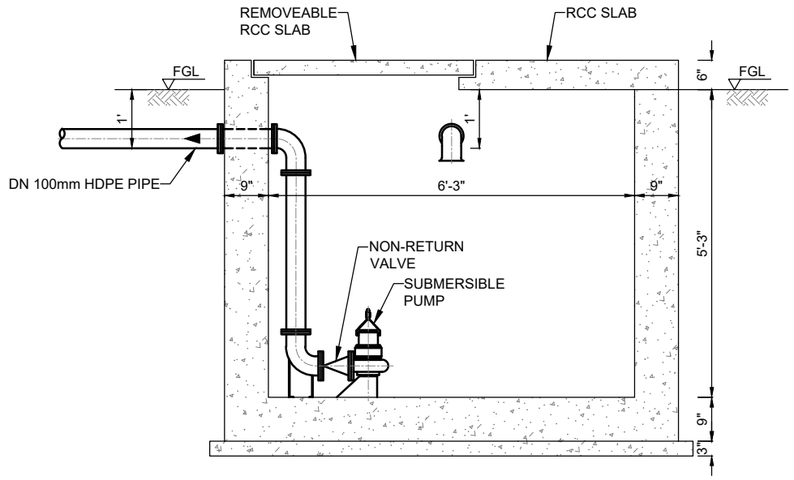
DRAWING No.: **4695/11/C/2J121**

SCALE: 1"=60'

REV.: 0



PLAN



SECTION A-A

CLIENT

Strategic Planning & Implementation Unit (SP & IU)
Environment Protection Department (EPU) Govt of Punjab.

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
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PROJECT

Survey, Engineering Design, Technical Specifications and Preparation of Bidding Documents for 3 Pilot Plants of Wastewater in Punjab

PUMPING PIT
PLAN & SECTIONS

SCALE: 1"=3'

DATE: MARCH, 2025

DRAWING No.: **4695/11/C/2J122**

REV.: 0