Tender for "CONSTRUCTION, SUPPLY, INSTALLATION, TESTING, COMMISSIONING AND OPERATION AND MAINTENANCE FOR FIVE YEARS OF THE SEWAGE TREATMENT PLANTS FOR KOZHIKODE MEDICAL COLLEGE WITH SEPTAGE TREATMENT FACILITIES FOR SURROUNDING AREA"

2018_LSGD_254695_1 ADDENDUM No. 3 Dt.20/02/2019

Tender No. EG21/61457/13 dated 30 Nov 2018

Clarifications- including discussions in the Prebid meeting held on 18 December 2018 at Kozhikode Corporation& queries received from the prospective bidders.

Note: These clarifications are to be considered as a part of the Tender No. EG21/61457/13 dated 30 Nov 2018 in the Concerned Sections.

1. As per the 2018_LSGD_254695_1**ADDENDUM No.** 2 published on 02/02/2019 the prospective bidders are requested to adhere to the revised Tender Documents uploaded with this Addendum for Bid Submission. The earlier published document shall NOT be used for bidding.

2. The Zoning, Plant capacities, soil analysis report, drawings, Electrical schedules are uploaded in the website along with this tender.

3. The technology to be adopted for the treatment process is Electrolytic Process. Change in treatment technology (eg. MBBR, ASP etc) is NOT allowed

4. **For the Financial Proposal the bidder shall use the Form FIN 2. Form FIN 1 shall NOT be used for quoting the financial proposal. The bidders are required to provide the costs quoted for Civil, Tanks, Mechanical & Electrical Works in the table attached (Table 2) in FIN2. This Table (Table 2) shall be used by the Employer for reference during payments.**

5. The Capacity of the Treatment Plants are 1 MLD & 2 MLD with 100 KLD Septage Treatment Facility along with the required sewerage networks and are being installed to treat the effluents coming from Kozhikode Medical College & the septage being generated from the surrounding areas.

6. During the Defect Liability Period of one year & during the four years of Operation & Maintenance the bidder shall be responsible to rectify any defects with respect to the electro mechanical equipment's and others so as to ensure the proper functioning of the plant. This will include the replacement of bus bar, electrodes, supply of daily/routine consumables for disinfection, filtering etc., annual painting if required & all other repair work which are required for smooth running of the system. The Electricity & diesel charges shall be first paid by the contractor / bidder & shall be reimbursed by Kozhikode Medical College. Regarding the matters during the Operation & Maintenance period a separate agreement shall be signed by the bidder with Kozhikode Medical College.

7. The payment schedule for the Operation & Maintenance charges shall be on an yearly basis.

8. The bidder shall be responsible for support and liaising with various Departments for obtaining all NOC's with respect to the establishment & proper functioning of the treatment plant, which will include but not limited to Consent to Establish and Consent to Operate.

9. The Inlet parameters considered for this Electrolytic process is given in the currently uploaded Tender Document.
   The output parameters of the treated water shall confirm to the latest standards published by the regulatory authority (Kerala/Central Pollution Control Board) norms & conditions specified in the consent to establish & operate.
   The bidder should take into consideration the variations in the input effluent parameters that could be expected based on their experience in designing & implementing such plants using Electrolytic Process.

10. The retention period for the collections tanks are 9 hrs for both 1MLD & 2 MLD plants.
11. As per the design, the number of DC rectifier units is 12 for 1MLD and 18 for 2MLD.

12. The DPR for this project has taken into consideration all the possible worse situations. The consultants design seen uploaded is capable of meeting the quality standards followed by the statutory agency, ie the PCB. In case the bidder undertakes the construction work and even after constructing the plant according to the design specifications, they find any technical hassles like difficulty in achieving the discharge quantity standards etc, the DPR consultant shall guide them. The liability of the sewerage network system & the process performance of the Treatment Plants will completely rest with the contractor/bidder implementing Project & maintaining it.

13. The IV value to be considered for the Carbon Filters is 800mg/g

14. MS-Epoxy coated material cannot be used for Sand Filter.

15. Sand Filters for 1MLD = 4 no's connected in parallel & for 2MLD = 8 no's in parallel.

16. The KVA required for DC Rectifier, back-up generator details are mentioned in the Schedule of Works for Electrical.
17. For structures in contact with sewage M30 Sulphate resistant cement shall be used. The grade of concrete used is given in the design drawings.

Sd/-

Superintending Engineer,
Kozhikode Corporation.

TENDER DOCUMENT

for the work of

CONSTRUCTION, SUPPLY, INSTALLATION, TESTING, COMMISSIONING AND OPERATION & MAINTENANCE FOR FIVE YEARS OF THE SEWAGE TREATMENT PLANTS FOR KOZHIKODE MEDICAL COLLEGE WITH SEPTAGE TREATMENT FACILITIES FOR SURROUNDING AREAS WITH ELECTROLYTIC TECHNOLOGY

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KOZHIKODE MUNICIPAL CORPORATION
Local Self Government Department,
Government of Kerala

Dated 30 November 2018

NOTICE INVITING TENDER

TENDER NO. EG21/61457/13

Online tenders are invited for and on behalf of the Council of Municipal Corporation of Kozhikode only from eligible bidders for the work "Construction, Supply, Installation, Testing, Commissioning And Operation & Maintenance For Five Years Of The Sewage Treatment Plants For Kozhikode Medical College With Septage Treatment Facilities For Surrounding Areas With Electrolytic Technology" in Kozhikode Medical College under AMRUT scheme.

1	Name of work	Construction, Supply, Installation, Testing, Commissioning And Operation & Maintenance For Five Years Of The Sewage Treatment Plants For Kozhikode Medical College With Septage Treatment Facilities For Surrounding Areas With Electrolytic Technology
2	Probable Amount of Contract(PAC)	Rs.14,10,64,556/-
3	Period of Completion	9 months
4	Earnest Money Deposit	Rs.5,00,000/-
5	Tender Processing Fee	Rs.15,000 + 12% GST
6	Type of Tender	Two Bid Lumpsum e-Tender
7	Issue of Tender documents	Can be downloaded from the web site www.etenders.kerala.gov.in
8	Date of receipt of bid related Queries	25.02.2019, 03.00 PM
9	Last date & time of receipt of Tender	11.03.2019, 03.00 PM
10	Date & Time of Opening of Technical Bid	14.03.2019,11.00 AM

Tender documents and tender schedule may be downloaded free of cost from the e-GP Website www.etenders.kerala .gov.in **The bid submission fee and EMD shall be remitted online as per tendering process.**

All bid/tender documents are to be submitted online only & in the designated cover(s)/envelope(s) on the e-GP website. Technical bid & financial bid shall be submitted in their respective designated online covers. Tenders/bids shall be accepted only through online mode on the e-GP website and no manual submission of the same shall be entertained. Late tenders will not be accepted. Date of opening of financial bids will be intimated to the eligible bidders by email only.

Additional Documents to be submitted through online/Speed Post

Sl No	Scanned Copy (Through online cover)	Through Speed Post (Super scribing Name of work and Tender No.)
1	Copy of Regn. Certificate attested by Gazetted Officer of Govt. Department with validity and class of registration	Copy of Regn. Certificate attested by Gazetted Officer of Govt. Department with validity and class of registration
2	Copy of EMD exemption certificate / concession certificate attested by Gazetted Officer of Govt. Department if any	Copy of EMD exemption certificate / concession certificate attested by Gazatted officer of Govt. Department if any
3	Form 83&84 along with Preliminary agreement. In Stamp paper worth Rs.200/- duly filled and signed by bidder	Form 83& 84, Original of Preliminary agrement In Stamp paperworth Rs.200/- duly filled and signed by bidder
4	Copy of govt. Orders and proof of eligibility in participation in tendering etc. in case of Labour Contract Co-operative Society	Copy of Govt. Orders and original of proof of eligibility in participation in tendering etc. In case of Labour Contract Co-operative Society
5	Duly filled e-payment requisition	Duly filled e-payment requisition
6	Any other certificate required for tender acceptance	Attested copy of any other certificate required for tender acceptance

Copy of all above tender documents of online cover are to be submitted online and subsequently through speed post or by hand (2 hard copies) duly filled and signed.

The Technical bids shall be opened online at the office of the S.E., Kozhikode Municipal Corporation on 14.03.2019,11.00 AM in the presence of the Bidders/their representatives who wish to attend at the above address. If the tender opening date happens to be on a holiday or non-working day due to any other valid reason, the tender opening process will be done on the next working day at the same time and place.

Tenders received online and copy/originals received by speed post (except financial bid), without the necessary documents mentioned above will not be considered and shall be summarily rejected. Further details can be had from the office of NIT or Office of the S.E. Kozhikode Corporation during working hours.

The bidder is advised to submit the bids well before the stipulated date & time to avoid any kind of network issues, traffic congestion, etc. In this regard, the department shall not be responsible for any kind of such issues faced by bidder. All other existing conditions related to Pre-Qualification tender of Kerala PWD & LSGD will be applicable in this tender also.

Sd/-

Superintending Engineer,
(for and on behalf of The Secretary,
Kozhikode Municipal Corporation)

GENERAL GUIDELINES

1. This Tender Document is applicable to Lumpsum Tender. The Tender document shall be available in downloadable manner from website

www.etenders.kerala.gov.in

2. The Notice inviting e-Tender, special conditions/specifications and drawings can be downloaded from the websites mentioned above.

3. Tender Document shall be submitted duly signed before opening the tender.

4. Provisions of Tender Document shall supersede the provisions of other documents.

5. All copies of the certificate submitted along with Tender Document should be attested by the bidder.

6. Maintenance of the plants during the Defect Liability Period (1 year) shall be under the scope of the contractor.

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ELIGIBILITY CRITERIA

a. The bidder should have had average annual financial turnover of 40% of PAC during the last three years ending 31st March 2018 (attested copy of Certificate from CA to be submitted and uploaded).

OR

The bidder must have successfully completed at least 3 projects of similar nature with capacity 500KLD or above.

b. The applicant/Partners should possess a valid Civil License from anywhere in India for carrying out similar projects as tendered. The successful bidder should be willing to take the necessary licenses in Kerala for Electrical Works before the commencement of work if prescribed by the Employer in case the rules of the State may require.

c. The bidder shall be an individual/proprietary firm/firm in partnership/limited company or a corporation/joint venture
d. Black listed contractor bids will not be considered.
e. To become eligible for bid, the bidders shall have to furnish an affidavit in their letter head as under, duly signed by authorized personnel:-

"I/We undertake and confirm that eligible similar works(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of the Employer, then I/we shall be debarred for bidding in<Name of LSGD>in future forever. Also, if such a violation comes to the notice before date of start of work, I/We shall forfeit the entire amount of Earnest Money Deposit/Performance Guarantee."

PARTICULARS SHOWING STATUS OF TENDERER

1. Name of tenderer :
2. Address
   - i. Permanent :
   - ii. Present for communication :
   - iii. E-mail ID/Fax/Telephone :

3. Status of the tenderer/individual or public Ltd. Co. or Private Ltd Co. or registered Partnership concern or proprietary concern :

4. Name and address of the chairman of Chairman of Board of Directors and Managing Director/Managing Partner (in case of partnership concern) or Proprietor (in case of proprietary concern) [Memorandum of Articles and Authorization/Partnership deed] :

5. Whether the tenderer is a registered contractor of KWA/any State/Central Govt. Department (CPWD, MES, Railway etc) or local bodies (i.e., Port trust, District board, Municipality or a statutory body) with Reg. No. and year and issuing authority :

6. Name and address f two responsible persons (preferably Senior Engineers/Officers of a Govt. Department, Quasi Government organization or a local body), to whom reference can be made regarding experience and performance :

7. Whether Authorization to act on behalf of the firm presented or not :

(Office Seal) Signature with Name & Designation

Abstract of Bid

1.	**Name of the Project:**		Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
2.	**Name of the Work**		CONSTRUCTION, SUPPLY, INSTALLATION, TESTING, COMMISSIONING AND OPERATION & MAINTENANCE FOR FIVE YEARS OF THE SEWAGE TREATMENT PLANTS FOR KOZHIKODE MEDICAL COLLEGE WITH SEPTAGE TREATMENT FACILITIES FOR SURROUNDING AREAS WITH ELECTROLYTIC TECHNOLOGY
3.	**The Employer:**		The Secretary Kozhikode Corporation, Kozhikode.673 032 Kerala, India. Email: secretarykkd@gmail.com
4.	**a) Date of access to Bid documents, online**		From **11.00 Hours 07.12.2018**
	b) Last date and time of closure of tender		**11.03.2019, 03.00 PM**
	c) Date and time for opening of Technical Bid		**Date : 14.03.2019** Time **11.00** Hours
5.	**Period of bid validity**		120 (one hundred & twenty) days, after the date of Bid opening
6.	**Amount of Bid Security**		**Rs 5,00,000/- (Indian Rupees Five lakh only)** To be remitted Online via NEFT/ SBI account.
7.	**Performance Security**		**5 % of the contract amount, out of this 50% should be in the form of Treasury fixed deposit and the balance in the form of an Unconditional Bank Guarantee, to be**

			provided within 14 (Fourteen) days of date of the Notification of Award from the Employer. The term of deposit should cover the entire defect liability period of the work.
8.	**Period Within Which Formal Agreement Shall be Executed after Notification by the Employer**		**Within 14 (fourteen) days from the date of Notification of Award from the Employer.**
9.	**Time for Execution of the work:**		**Nine Months**
10.	**Amount of Penalty for Delay**		**For the First extension of time of completion, 1% of the PAC subject to a minimum of Rs.1000/-and maximum of Rs.50,000/-** **Beyond 1st extension of time of completion, 2% of the PAC subject to a minimum of Rs. 2000/- and maximum of Rs. 1,00,000/-.**
11	**Amount of Incentive of timely completion**		**Incentive at the rate of 1 % of the estimate PAC subject to the maximum of Rs. 4 lakhs**
12.	**Retention Money**		**This will be @ 2.5% of gross amount of each running bill, so that the amount so retained shall be 2.5% of the value of work done till then. This will be released as per prevailing rules.**

General Guidelines for Bidders

1. General:

1.1. The eligible bidder shall fill up the letter of transmittal form and upload duly signed.

1.2. All information called for in the enclosed forms should be furnished against the relevant columns in the forms. If for any reason, information is furnished on a separate sheet, this fact should be mentioned against the relevant column. Even if no information is to be provided in a column, a “nil” or “no such case” entry should be made in that column. If any particulars/query is not applicable in case of the bidder, it should be stated as “not applicable”. The bidders are cautioned that not giving complete information called for in the application forms or not giving it in clear terms or making any change in the prescribed forms or deliberately suppressing the information may result in the bid being summarily disqualified. Bids made by telegram or telex and those received late will not be entertained.

1.3. References, information and certificates from the respective clients certifying suitability, technical knowledge or capability of the bidder should be attested by the bidder.

1.4. The bidder may furnish any additional information which he thinks is necessary to establish his capabilities to successfully complete the envisaged work. He is, however, advised not to furnish superfluous information. No information shall be entertained after submission of eligibility criteria document unless it is called for by the Employer.

1.5. Any information furnished by the bidder found to be incorrect either immediately or at a later date, would render him liable to be debarred from tendering/taking up of work in Kollam Municipal Corporation

2. Definitions:

2.1 In this document the following words and expressions have the meaning hereby assigned to them.

2.2 Employer: Means the Secretary, Kozhikode Municipal Corporation.

2.3 Bidder: Means the individual, proprietary firm, firm in partnership, Joint venture, limited company private or public or corporation.

2.4 “Year” means “Financial Year” unless stated otherwise.

2.5 “Similar works” means treatment plants using the technology mentioned in the tender document i.e., Electrolytic technology only.

2.6 ‘Lead Partner/partner in charge’ means the partner who is authorized by an agreement executed by all partners to receive any instructions / communications / payments from<LSGD> and to attend any discussions or other activities in respect of this contract on behalf of all partners.

2.7 'Testing' When a structure / component / equipment is tested to ascertain its strength / durability /material comparison with respect to design / service loads or performance to the satisfaction of the Engineer in charge or as stipulated in the scope of work or as per IS / BIS, or any such standards / specifications, it is defined as testing.

2.8 'Trial Running' means putting all components together with the service / design conditions so as to ascertain the individual and combined performance of all works under the scope together, with respect to the design performance for a period specified in the scope of works.

2.9 'Commissioning': means having ensured satisfaction in performance with respect to design / service conditions in testing and trial running putting the works under the scope of work into desired real service conditions from a particular moment of time continuously or otherwise as envisaged.

2.10 'Training' means imparting of training to Authority staff with sufficient practical and theoretical knowledge for the operation and maintenance of the service system/scheme and the knowledge for attending to emergency repairs or acting appropriately on emergency situations that may arise during the life time of the system, as included in the 'work'.

3. Method of application:

3.1 If the bidder is an individual, the application shall be signed by him above his full type written name and current address.

3.2 If the bidder is a proprietary firm, the application shall be signed by the proprietor above his full type written name and the full name of his firm with its current address.

3.3 If the bidder is a firm in partnership, the application shall be signed by all the partners of the firm above their full typewritten names and current addresses, or, alternatively, by a partner holding power of attorney for the firm. In the latter case a certified copy of the power of attorney should accompany the application. In both cases a certified copy of the

partnership deed and current address of all the partners of the firm should accompany the application.

3.4 If the bidder is a limited company or a corporation, the application shall be signed by a duly authorized person holding power of attorney for signing the application accompanied by a copy of the power of attorney. The bidder should also furnish a copy of the Memorandum of Articles of Association duly attested by a Public Notary.

3.5 If the contractor is willing to appoint a Joint Venture, mention the name of company, experience, and an agreement between the contractor and Joint Venture Company. The partners shall satisfy the requirements as given below:
(i) There shall not be more than three partners in a joint venture and one partner shall be designated as lead partner.

(ii) The lead partner submitting the tender on behalf of the joint venture shall (a) submit complete information pertaining to each such partner and (b) state in the covering letter attached to the tender the name of the lead partner in charge duly authorized for submitting the tender which shall be evidenced by proper power of attorney signed by legally authorized signatories of all the partners.

(iii) Original or notary attested copy of the agreement confirming the intent of all parties to form a joint venture shall be attached with the tender. It shall also distinctly show:

a) The financial participation of each member of the joint venture and the responsibility of each member as regards the planning and execution of the work.

b) Name of the lead partner in charge who is authorized to incur liabilities and receive instructions for and on behalf of all/any of the partners of the joint venture during the entire period of the contract including any extended period, as well as for receiving payments due.

c) An undertaking to the effect that all the partners of the joint venture shall be jointly &severally responsible for the execution of the contract, in accordance with the terms and conditions of the contract.

d) A partner or a design consultant who has joined with the lead partner to compete in this bid shall not compete singly or in association with any other tenderer for this work. The tenderer while submitting his bid shall obtain an undertaking in this regard from his design consultant / partner and produce it along with the technical bid.

e) The aggregate of the qualification criteria of all partners together shall be sufficient to meet the requirements as if a single tender only on financial criteria.

The lead partner shall be any one of the partners of the JV as mutually agreed upon among the partners.

g) The extent of participation of each partner shall be specified as also experience of all such partners in the relevant field.

h) Status of persons signing the tender on behalf of the firm in the event of the tender being submitted by a firm, the person signing the tender on behalf of the firm shall state his position in the firm as to whether he is the proprietor, partner or Manager etc. He shall also furnish with the tender, the letter or other documents (in original) authorizing him to act on behalf of the firm.

4. Final decision making authority

The employer reserves the right to accept or reject any bid and to annul the process and reject all bids at any time, without assigning any reason or incurring any liability to the bidders.

5. Particulars provisional

The particulars of the work given are provisional. They are liable to change and must be considered only as advance information to assist the bidder.

6. Site visit

The bidder is advised to visit the site of work, at his own cost, and examine it and its surroundings to himself collect all information that he considers necessary for proper assessment of the prospective assignment.

Information and Instructions to Bidders

1. Information, Instructions for bidders and corrigendum if any, posted on website shall form part of bid document.

2. The intending bidder must read the terms and conditions of **Tender document** carefully. He should only submit his bid if he considers himself eligible and he is in possession of all the documents.

3. The tender document(s), may be downloaded free of cost from the e-Government Procurement (e-GP) website (www.etenders.kerala.gov.in). No payment is required for downloading the tender documents from the above website however a tender processing fee of **Rs. 15000 + 12%GST**, as mentioned above in this document, is required to be remitted through online payment mechanism for e-procurement system of Govt. of Kerala. Only those bidders having a valid and active registration, on the date of bid submission, shall submit bids online n the e-GP website.

4. Earnest money Deposit (EMD) amounting to Rs. 5.00 Lakh (Rupees Five Lakh only) to be remitted online through e-GP site by the bidder. The earnest money deposit along the bid by the successful tenderer shall be returned after receiving the aforesaid performance guarantee.

   4.1. EMD of the unsuccessful tenderers will be refunded without any interest on finalization of the contract with the successful tender or on the expiry of the validity period which is earlier.

   4.2. EMD deposited with Secretary Kozhikode Muncipal Corporation, Kozhikode will be forfeited: if bidder withdraws his bid during the period of validity specified or if the successful bidder fails within the time limit to sign the contract document or fails to furnish the required security deposit.

   4.3. On acceptance of the tender, the EMD will be refunded after remittance of the performance guarantee and execution of agreement.

   4.4. The amount of EMD remitted earlier for any work or sum due to the contractor from Secretary Kozhikode Municipal Corporation, Kozhikode or its associates cannot be adjusted towards EMD for this work. Only the EMD remitted as prescribed in this Tender Document is acceptable.

5. All bids shall be submitted online on the e-GP website only in, as per the type of tender. All the documents shall be signed and sealed by the authorized personnel. No manual submission of bids shall be entertained for the tenders published through e-GP system under any circumstances. However signed copies of documentary evidences as the proof of eligibility criteria shall be submitted to Secretary Kozhikode Municipal Corporation, Kozhikode in hard copies also.

6. The e-GP system shall not allow submission of bids online after the stipulated date &time. The bidder is advised to submit the bids well before the stipulated date & time to avoid any kind of network issues, traffic congestion, etc. In this regard, Kozhikode Municipal Corporation, Kozhikode shall not be responsible for any kind of such issues faced by bidder.

7. Ineligible bidders or bidders who do not possess valid & active registration, on the date of bid submission, are strictly advised to refrain themselves from participating in this tender. If such instances are noticed, the same shall be treated as “fake bidding” by the respective bidder and such bidder shall be blacklisted as per Kozhikode Municipal Corporation, Kozhikode rules in force. The bidders, who submit their bids for this tender after digitally signing using their Digital Signature Certificate (DSC), accept that they have clearly understood and agreed the terms and conditions including the Forms/Annexures of this tender. Mention of price details at any place other than the designated place, shall disqualify the bid and the bid shall be summarily rejected.

8. Tender duly signed using bidder’s valid Digital Signature Certificate shall be submitted online on e-GP website www.etenders.kerala.gov.in

and

Tender duly signed by authorized representatives (**2 Hard Copies**) shall be submitted on or before 28.02.2019, 05.00 PM at the following address:

The Superintending Engineer,, Kozhikode Municipal Corporation,
Beach Road, Kozhikode, Kerala
Pin - 673032

9. **Certificate of Financial Turnover:** At the time of submission of bid, contractor may submit Affidavit/ Certificate from chartered accountant mentioning Financial Turnover of last 3 years or for the period as specified in the bid document. The entire voluminous balance sheet and further details if required may be asked from the contractor after opening of technical bids.

10. The Eligibility and Technical bid shall be opened first on due date and time as mentioned above. The time and date of opening of financial bid of contractors qualifying the technical bid shall be communicated to them via email only at a later date.

11. For any queries / clarifications regarding this tender, the parties may contact our office on all working days

    Tel No.0495-2365040,

    Email : cekozhikodecorporation@gmail.com,kzhcmmu@gmail.com

12. Secretary, Kozhikode Municipal Corporation, Kozhikode reserves the right to reject any prospective application without assigning any reason. ***Two Unabridged Tender Documents (One Original & Copy) should be submitted duly signed and sealed on all pages*** along with the following documents:

List of Documents to be scanned and uploaded within the period of bid submission:

I. Registration/accreditation certificate of the Contractor/Firms.
II. Valid License Copy as mentioned in Eligibility Criteria a. above
III. Certificates of Work Experience.in detail.
IV. Copy of Project Completion Certificates of completed projects from the appropriate concerned authority duly signed by; of the Government Agency/ Client for which was carried out by the Contracting firm.
V. Certificate of Financial Turnover from CA (Form B).
VI. Bank Solvency Certificate (Form C)Any other Document as specified in this Tender Document.
VII. Certificate of Registration for Service Tax/GST and acknowledgement of up to date filed return.
VIII. Preliminary Agreement in stamp paper worth Rs. 200/-
IX. Affidavit as per Eligibility criteria
X. Duly filled up Forms A, B, C, D, E, F, G & H
XI. Copy of Pan card

The above documents shall be properly indexed in the above order with reference number and shall be uploaded and also submitted along with signed and sealed Tender Document and its corrigendum/addendum if any in a bound format. Loose sheets shall

not be accepted. All Certificates shall be attested by the bidder. **The Envelope shall also be super-scribed with the Name of Work, Tender No. and "Technical bid".**

The financial bid will be opened only of those tenderers whose technical proposals furnished in Eligibility and Technical bid are in order & that qualify the technical evaluation.

13. Agreement shall be drawn with the successful bidder. Bidders shall quote his rates as per various terms and conditions of this Tender Document which will form part of the agreement.

14. The time allowed for carrying out the work will be 9 months from the date of agreement' or from the first date of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the bid documents.

15. The details of the proposed site for the work are provided under "Scope of Work".

16. The structural drawings if any shall be made available in phased manner, as per requirement of the same as per approved programme of completion submitted by the contractor after award of work.

17. The bid document consisting of plans, specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents and General Conditions of Contract Form can be seen on website www.etenders.kerala.gov.in and shall form part of bid document.

18. **Performance Guarantee**: The successful tenderer, hereafter referred to as the Contractor shall deposit an amount equal to 5 % of the contract amount, out of this 50% should be in the form of Treasury fixed deposit and the balance in the form of an Unconditional Bank Guarantee, to be provided within 14 (Fourteen) days of date of the Notification of Award from the Employer. The term of deposit should cover the entire defect liability period of the work.

19. The Performance Guarantee shall be initially valid up to the stipulated date of defect liability period. In case the time for completion of work gets enlarged, the contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work plus defect liability period.

20. **Measurements of work done**

    Procedure as per PWD manual will be followed for the measurements of work done.

21. **Materials supplied**

The contractor shall, at his own expense, provide all materials, required for the works. The contractor shall, at his own expense and without delay, supply to the Employer samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The contractor shall, if requested by the Employer furnish proof, to the satisfaction of the Employer that the materials so comply. The Employer shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Employer for his approval, fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Employer or their Representative shall be issued after the test results are received. The Contractor shall at his risk and cost submit the samples of materials to be tested or analyzed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Employer. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

The contractor shall, at his risk and cost, make all arrangements and shall provide all facilities for the Employers Representative may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by Secretary, Kozhikode Municipal Corporation and bear all charges and cost of testing.. The Employer or his authorized representative shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

The Employer shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Employer shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Employer shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Employer may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

22. **Work to be Executed in Accordance with Specifications, Drawings, Orders etc.**
The contractor shall execute the whole and every part of the work in the most substantial and workman like manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work signed by the Employer. The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

23. **Action in case Work not done as per Specifications**
All works under or in course of execution or executed in pursuance of the contract, shall at all times be open and accessible to the Employer , its authorized officers in charge of the work and all the superior officers, officer of the Quality Assurance Unit of the Employer or any organization engaged bythe Employer for Quality Assurance and of the Chief Technical Examiner‘s Office, and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor‘s agent shall be considered to have the same force as if they had been given to the contractor himself.
If it shall appear to the Employer or its authorized officers in-charge of the work or to the Quality Assurance or his subordinate officers or the officers of the organization engaged by the Employer for Quality Assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing which shall be made within defect liability period of the completion of the work from the Employer specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and

cost. In the event of the failing to do so within a period specified by the Employer in his demand aforesaid, then the contractor shall be liable to pay compensation.

24. The bid submitted shall become invalid if :

    a) The bidder is found ineligible.

    b) The bidder does not submit all the documents (including GST registration) as stipulated in the bid document.

25. **The bidders responsibility and understanding of the work :** Intending Bidders are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their bids as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. A bidder shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed. The bidders shall be responsible for arranging and maintaining at his own cost for all materials, tools & plants, facilities for workers, and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of bid by a bidder implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and local conditions and other factors having a bearing on the execution of the work. All statutory deductions shall be made from the amount eligible to the contractor in each part bill at prevailing rates.

26. **The competent authority on behalf of Secretary, Kozhikode Municipal Corporation does not bind itself to accept the lowest or any other bid and reserves to itself the authority to reject any or all the bids received without assigning any reason thereof. All bids in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the bidders shall be summarily rejected.**

27. Canvassing whether directly or indirectly, in connection with bidders is strictly prohibited and the bids submitted by the contractors who resort to canvassing will be liable for rejection.

28. The competent authority on behalf of Secretary, Kozhikode Municipal Corporation reserves to himself the right of accepting the whole or any part of the bid and the bidders shall be bound to perform the same at the rate quoted.

29. The contractor shall not be permitted to bid for works if he/she is the near relative of an officer posted by Kozhikode Municipal Corporation, Kozhikode.

30. ***The bid for the works shall remain open for acceptance for a period of One Hundred &Twenty Days (120) days from the date for opening of technical bids.*** If any bidder withdraws his bid before the said period or issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the bid which are not acceptable to Kozhikode Municipal Corporation, Kozhikode, then Kozhikode Municipal Corporation, Kozhikode shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid. Further the bidders shall not be allowed to participate in the rebidding process of the work.

31. This notice inviting Bid shall form part of the contract document. The successful bidder/contractor, on acceptance of his bid by the Accepting Authority shall within 7 days from the stipulated date of start of the work, sign the contract consisting of:-
    a) The Notice Inviting Bid, all the documents including additional conditions, specifications and drawings, if any, forming part of the bid as submitted at the time of invitation of bid and the rates quoted at the time of submission of bid and acceptance thereof together with any correspondence leading thereto.

32. **Evaluation criteria**

The details submitted by the bidders will be evaluated by technical committee formed for the work.

32.1 **Evaluation of Applications for Eligibility**

Stage I – The applications received along with the required EMD and the cost of tender shall be evaluated for eligibility to take part in the tendering process by a three stage system.
Stage II – The applications will be evaluated for conformity to the eligibility criteria prescribed.

All those applications found eligible in stage I will be further evaluated for selection by the following scoring method based on the details submitted by the applicants in the Envelope I.

Sl.No.	Qualification Criteria	Maximum Marks
1	Personnel and establishment	15
3	Organization empanelled for Liquid waste management in Kerala	10
4	Experience in successfully installing and successfully commissioning of similar works for Hospitals with capacity 500KLD or above**	25
	Completed 1or more works of capacity greater than 500KLD: 25 marks	
	Completed 1 or more works of capacity 250-500KLD: 15marks	
	Completed 1 or more works of capacity 200KLD to <250KLD: 10marks	
	Experience in successfully installing and commissioning similar works with associated sewerage network in any Government organizations**	20
	Completed 1 or more works of capacity greater than 1MLD: 20 marks	
	Completed 1 or more works of capacity 500KLD-1MLD: 15marks	
	Completed 1 or more works of capacity 250KLD to < 500KLD: 10marks	
	Experience in successfully installing and commissioning similar works with associated sewerage network in any Private organizations**	20
	Completed 1 or more works of capacity greater than 1MLD: 20 marks	
	Completed 2 or more works of capacity greater than 500KLD: 15marks	
	Completed 2 or more works of capacity 250KLD to < 500KLD: 10marks	
4(a)	Experience in successfully installing and commissioning STP/ETP with associated sewerage network in Kerala	10
	Total marks	100

*** Relevant Completion certificates from the appropriate Authority should be furnished. Bidders not furnishing the completion certificates, shall not score the required marks*

To qualify, the applicant must secure at least 60% (Sixty percent) marks in aggregate

32.2 Technical Staff and Employees:

The bidder should have sufficient number of Technical and Administrative employees for the proper execution of the contract. The bidder should submit a list of these employees stating clearly how they would be involved in this work. CV's of the personnel who shall be engaged for the said works should be attached along with the bid, duly signed. Successful bidder should provide the willingness of the above personnel.

Sl. No	Minimum qualification of Technical Representative	Discipline	Minimum Experience (years)	Number	Marks**
1	Project Manager	M Tech/B Tech in Environmental/Civil Engineering	10	1	3
2	Environmental Engineer/Chemical Engineer	M Tech in Environmental Engineering/Chemical Engineering	5	1	3
3	Electrical/Mechanical Engineer	B Tech in Electrical/Mechanical Engineering	5	1	3
4	Support Engineers	Diploma in Civil Engineering	1-2	2	3
		Diploma in Electrical/Mechanical Engineering	1-2	2	3
Total					15

**Split up of marks

a)	Educational Qualifications	1mark
b)	Adequacy for the assignment/job(Experience in carrying out similar assignment)	1mark
c)	Experience of Urban Sector projects in any Govt. department	1mark

Stage III – The Technical bids of only those applications found eligible in stage II will be further evaluated by Technical Committee constituted by the Employer.
The committee will evaluate the offer based on the viability of the process technology, operational expenditure, maintenance cost, compliance with statutory requirement, etc.
The technical bids will be evaluated by the committee for maximum 100 marks. The committee shall obtain clarifications from the tenderer(s) and/or call them for discussions wherever required, and select a final scheme. A list of eligible applicants whose financial bids will be opened shall be prepared and all concerned shall be intimated.

33. **Award of Work**

33.1 The successful bidder for executing the work will be selected based on Combined Technical cum Cost Based System.

(1) Under this system, the technical proposals will be allotted weightage of 70% and the financial proposals will be allotted weightage of 30%.

(2) Bid with the lowest quoted amount (L1) will be assigned a financial score of 100 and other bids will be assigned scores that are inversely proportional to their quoted amount.

(3) The total score, both technical and financial, shall be obtained by weighting the technical and cost scores and adding them up.

The calculations for arriving at the total combined score (Technical and Cost) is given below.

Marks obtained by a Bidder for the technical bid = M
Amount quoted by the lowest bidder = L1
Amount quoted by a Bidder = L
Points for financial proposal of the bidder = (L1/L) x 100 = F
(FINAL TOTAL amount quoted will be used as the FINANCIAL SCORE F)

Combined technical and financial score (H) of the Bidder

= M x 0.7 + F x 0.3 = H

(4)The combined technical and cost scores of all the bidders will be calculated as above and the bidder who secures the highest combined score H will be selected as the successful contractor.

(5)The contract will be awarded to the successful bidder at his/her quoted/negotiated amount.

33.2 The contractor whose bid is accepted shall sign a written agreement with the Employer. The Employer reserves the right to restrict the list of eligible contractors to any number deemed suitable.

33.3 Even though an applicant may satisfy the specified criteria, he would be liable to disqualification if he has:

(1) Made misleading or false representation or deliberately suppressed the information in the forms, statements and enclosures required in the application for eligibility.

(2) Record of poor performance such as slow process of work, abandoning of work, not properly completing the contract or financial failures/ weaknesses etc.

33.4 Refund of Earnest Money Deposit (EMD)

(1) EMD of the Tenderers whose Technical Bid is found not acceptable will be returned as soon scrutiny of Technical Bid has been completed by the employer.

(2) EMD of the unsuccessful Tenders will be returned within 28 days of the end of the Tender Validity period.

(3) The Earnest Money of the successful Tenders will be taken as part of the Security Deposit.

34. Opening of Price bid

The financial bids of only the qualified and technically acceptable bidders shall be opened at the notified time and date. The bid shall remain valid for ***a period of 90 days from the date for opening of bid.***

35. Award criteria

15.1 The employer reserves the right, without being liable for any damages or obligation to inform the bidder, to:

a. Amend the scope and value of contract to the bidder.

b. Reject any or all the applications without assigning any reason.

15.2 Any effort on the part of the bidder or his agent to exercise influence or to pressurize the employer would result in rejection of his bid. Canvassing of any kind is prohibited.

36. Lumpsum Amount To Be Quoted For The Work

36.1 Bidder shall quote lump sum amount for the work in the prescribe form (Form FIN 2) provided in the tender documents and shall be uploaded electronically. There shall not be any indication of the bid amount in any of the documents/papers of technical bid uploaded in which case the tender shall be rejected outright.

The price bid shall not be used for expressing or putting forth any techno commercial conditions of the tender. Violation of this stipulation shall result in rejection of the tender after the opening of the price bid even if it may happen to be the lowest.

36.2 For payment purposes, upon execution of agreement by the successful bidder, a payment schedule (Billing breakup. See 37) shall be prepared by the agreement authority in accordance with the technical sanctioned estimate for this project and shall form the basis for billing.

36.3 GST will be applicable for this contract.

36.4 The lump sum amount quoted shall be inclusive of GST which may be paid or become payable on the completed work within the scope of this tender. In other words, the amount quoted shall be inclusive of GST prevailing as on the due date of the tender and taxes at applicable rates shall be deducted from the payment to the contractor as per rules without further correspondence. The deductions from contractor's payment shall include Income Tax, Labour Welfare Fund and GST as per the rate in force. However this shall not mean that only this amount shall be deducted. Any excess in taxes and duties with in the original contract period shall be borne by the Authority and any reduction in taxes and duties with in the period shall be deducted from the contractor's bills, on proof of remittance.

37. Attestation Of Corrections And Additions

Care shall be taken to prepare the tenders without corrections/over writings /erasing etc. However, if any corrections, additions or pasted slips shall become necessary, the same shall be signed by the tenderer.

38. Language Of The Tender

Tenders shall be submitted in English and all information in the tender shall be in English. Information in any other language shall be accompanied by its translation in English. However, the details as read in the English text will be governing. Failing to comply with this direction may be considered as a sufficient reason for disqualifying a tender. Any communication should be in writing.

39. Payment Terms

39.1 The break up for interim payment approved by the agreement authority shall form part of the agreement. The break-up shall be as detailed below;

Sl. No.	**Works**	**Percentage of payment**
1.	**Mobilization advance against bank guarantee for an equal amount**	**10%**
2.	**Completion of civil works**	**25%**
2(a)	On completing 50% of civil works	15%
2(b)	On completion of civil works	10%
3.	**Onsite delivery of equipments**	**35%**
3(a)	Installation of Tanks	15%
3(b)	Installation of Mechanical Equipment	15%
3(c)	Installation of Electrical Equipment	5%
4.	**After erection, and trial run**	**10%**
5.	**After obtaining test results**	**10%**
6.	**After obtaining PCB consent**	**5%**
7.	**After Defect Liability Period of 12 months**	**5%**
	Total	**100%**

All such interim payments shall be in line with the percentage progress indicated in the schedule of bar chart and as achieved at site from time to time.

39.2 The contractor shall prepare and submit the bills for payment with details of measurements for the quantum of work done. The measurements will be verified by competent Engineer in charge of the work and transfer to Measurement Book issued by authority for this purpose and submitted to the Executive Engineer in charge of the work.

39.3 No work will be paid for unless thoroughly good and fully in accordance with the specifications. Should through inadvertence bad works be passed and paid for, it will nevertheless be perfectly competent, for the Executive Engineer to strike the same out of the account at any future time and recover the value at any date previous to or at the time of granting the final certificate.

39.4 The Authority, however, reserves the right to decide and allow/pass the bill submitted by the contractor for payment based on the over all priorities and the delay/non-payments of part bill by the Authority within 30 days of its submission by the contractor shall not entitle him for any compensation against the delayed payments nor shall it be taken as a reason for not maintaining the progress of the work. There shall be a minimum period of 30 days between two consecutive bills raised by the contractor.

39.5 Break up for interim payment, vide Clause 39.1 shall form the basis of all payment, but if in the opinion of the Authority the break up furnished by the contractor is not in keeping with the proportionate value of the work at different stages, the authority may make their own assessment of the proportionate value of the work at the various stages and limit the interim payment to such assessed value.

39.6 Bill may be submitted by the contractor as soon as the stage of the work as per the break up for interim payment is completed and Executive Engineer shall take the requisite measures for having the same evaluated and the admissible claim as far shall be allowed. Certified progress report of the Executive Engineer shall be an accompaniment to the bill.

39.7 From the "on account" payment full deduction shall be made for materials if any, issued by the Authority and any other dues from the contractor. The contractor shall furnish along with such bill detailed measurements and specifications of all items involving the use of cement and M S rods or steel to enable the departmental officers to check and admit the issue of the departmental materials.

39.8 In case of any dispute arising out of the supply of ISO marked pipes, the Employer shall be indemnified by the contractor, to the effect that all liabilities shall be borne by the selected contractor and the Employer's responsibility shall end with the payment for the measured quantities in accordance with the agreement for the work.

39.9 **Interest For Delayed Payments**: The tenderer/contractor must clearly understand that the settlement of claim either by part bill will be made only according to the availability of budget provision and allotment of funds made with the Officer in charge of the work under the respective head of account in which the work is sanctioned and arranged and also subject to the seniority of such bills. No claim for interest or for damages whatsoever shall be made for the belated settlement of claims of bills. No such claims shall be admitted by the Authority.

39.10 As built drawings of the facilities installed shall be a prerequisite for the payment of 90% bill. Check list before making payment which would ensure quality of pipes and quality of work and workmanship should be adopted and its tracking should be done.

39.11. **Final Bill**

39.11.1 The final bill shall be submitted by the contractor within one month of the completion of the work as otherwise the Executive Engineer's measurement shall be accepted as final and binding.

39.11.2 The contractor shall prepare and submit detailed as laid/ built drawings of all structures, and pipelines, plants and machinery constructed/installed by him inproper scale and clearly marking all the dimensions, levels, chainages etc. of all such structures and such as built drawings shall invariably accompany the final bill of the contractor and without such detailed as built drawings the contractors work as per this tender will not be considered as complete. The final payment shall be released only after approval of such drawings and submission of 5 (five) additional copies of such approve drawings properly prepared and bound in satisfactory manner together with two soft copies in compact discs for preservation.

39.11.3 If any amount which by virtue of this contract, may become due to the contractor be not claimed for payment within three months from the date on which it falls due, the same shall be placed in deposit account and if the amount as placed remains for three years thereafter, the contractor or others to whom it may be legally due shall

forfeit the same and it shall be finally credited to Authority. The release of amount shall not be made if there is litigation with the contractor.

40. Penalty

The contractor for the work shall be liable to pay penalty for the delay in executing the agreement, commencing work etc. as per the provisions of G.O (P) No.84/97/PW&T dated 19.8.97.

The Engineer in charge shall also have power to measure up the work of the contractor and later such part as shall be unexecuted out of his hands, and to give it to another contractor to complete, in which case, any expense which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (of the amount by which it exceeds, a certificate in writing of the Executive Engineer, shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by Authority under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or a sufficient part thereof. Imposition of penalty shall be, however, without prejudice to the rights of Kozhikode Corporation to terminate the contract as per the provisions of the agreement. All other conditions are as per G.O,(P) No.84/97/PW&T dated19.8.97.

41. Liquidated Damages

Liquidated damages shall be levied at the rate of 0.5% of the cost of balance works for every one week of delay occurred in completing the whole work subject to a maximum of 10% of the contract value. Further, to ensure good progress during the execution of work, the contractor shall be bound, unless the contract provides otherwise, in all cases in which the time allowed for the work to reach any of the set stage of completion/ milestones as per the agreed time schedule of the work, exceeds one month, the contractor shall be liable to pay damages at the rate of 0.5% of the cost of balance works that should have been completed by that time, provided always that the entire damages to be paid under the provision of the 'clause shall not exceed 10% of the contracted value of work which should have been completed by then. All the damages payable under the provision of this clause shall be considered as liquidated damages, to be applied to the use of the Authority without reference to the actual loss sustained owing to the delay. Any appeal of the contractor against the liquidated damages charged against such lapses on his part shall be placed before and disposed of by the Authority. Any defects in the workmanship/quality of the work shall be corrected as per the decision of

the department officers. Fine shall be levied in the case of defective works as per the decision of the departmental officers.

42. Price Escalation

This contract does not have provision for price escalation under any circumstances. Even if extension of time of completion has been granted under this contract, under any relevant provision, no escalation in price shall be admissible.

42. No Claims On Account Of Fluctuation of Rates, Idling of Labour Etc.

42.1 No claim shall be entertained on account of fluctuation of rates of labour and materials, railway freight, income tax etc. at any stage.

42.2 No claim for idle labour, due to non-supply of materials by the Authority or for any other reason shall be entertained.

43. Testing Of Completed Work

All tests necessary to ensure that the structure, equipment, pipe lines and fittings which form part of the work, comply with the specifications, shall be carried out at the site at the contractor's cost. First 200m laid will be tested first in order to check the quality of pipes and work executed. After that testing can be done as per the instruction of the Employer's official in charge. The tests shall be carried out within one month of the completion of the work and shall satisfy the requirements included under the Technical Specifications. If the completed work or any portion thereof is found to be defective before the works executed by the contractor are taken over by the Authority, the Executive Engineer will give the contractor a notice in writing setting forth the particulars of such defects, and the contractor shall forthwith make the defective part, good or replace the same for satisfying the requirements of the contract. Should he fail to do so within the time specified by the Executive Engineer, the Executive Engineer may make good the defective part or replace the same at the cost of the Contractor and such replacement shall be carried out by the Executive Engineer to the same specifications as in the contract. In the event of contractor refusing to comply with the instructions of the Executive Engineer within the specified period, the contractor is liable to be penalized as per clause 40 & 41 above.

44. Guaranty Period

44.1 For L.S tenders, the guarantee period shall be 12 months after successful testing and trial running. For EPCM contracts, the guaranty period shall be 24 months from the date of completion certificate which is inclusive of the maintenance period of first 12 months from the date of such handing over.In cases where ISO specifications are allowed, the guarantee period shall be 60 months from the date of completion certificate.

44.2 If it becomes necessary for the contractor to replace or renew any defective portion of the work, the provision of this clause shall apply to the portion of the work so replaced or renewed until the expiration of 18 months from the date of such replacement or renewal or 24 months from the date of completion which ever is later. If the defects are not remedied within the notified time, the Executive Engineer may proceed to do the work at the contractor's risk and expense, but without prejudice to any other right, which the Executive Engineer may have against the contractor in respect of such defects. Until the final certificate of having completed the warranty period successfully has been issued, the contractor shall have the right of entry at his own risk and expenses by himself or duly authorized representatives whose names shall have previously been communicated in writing to the Executive Engineer, at all reasonable working hours for the purpose of inspecting the work and taking notes there from and if he desires, at his own risk and expense, making any tests, subject to the approval of the Executive Engineer.

44.3 The contractor should install the system and operate for minimum five years in which first year with replacement guarantee on all parts and consumables. The contractor should continue maintenance and successful operation of the plant through annual maintenance contract for further four years. This will also be included in the original contract with approved rate. Further operation and maintenance will be as per the decision of the Employer.

44.4 The replacement of bus bar, supplying of daily/Routine consumables for disinfection, filtering etc annual painting (if required and all other repairing works which are required for smooth running of the system within 5 years should be borne by the contractor as per the AMC terms and conditions. Electrical and diesel charges should be first paid by the contractor/bidder and then will be reimbursed by the Employer.

44.5 The electrodes used in the reactor should be replaced at regular interval as decided by the Employer or when it get consumed out due to the usage whichever

is earlier. Since the cost of electrodes for 5 years is included in the estimate, the contractor should supply the electrodes as per the direction of Employer at no additional cost as and when required so as to meet the discharge parameters prescribed in relevant KSPBC/CPBC/CPHEEO regulations.

44.6 Fully or partially automated (computerized) system will be preferred for the treatment system for better functioning.

45 Maintenance Period & Training of the Operations

After the completion of the work and issue of completion certificate by the Executive Engineer, the system shall be run, operated and maintained by the contractor for a period of 12 months (Defect Liability Period). The satisfactory and efficient functioning of all the components installed by the contractor for this project should be conclusively proved to the satisfaction of the Executive Engineer. During the period of maintenance, the chemicals and all other consumables and the required staff for the operations shall be supplied by the contractor at his cost.

Only power charges shall be borne by the implementing Authority. The contractor shall also train the Authority staff during the period of operation & maintenance in running and maintaining the system independently and in an efficient manner. During the maintenance period the Authority staff and contractors personnel shall be simultaneously engaged in the operation of the system.

46. Extension of Time of Contract

Time is considered as the essence of this contract. Any delay due to exceptionally adverse climate conditions or other special circumstances of any kind other than default on the part of the contractor shall fairly entitle the contractor for consideration of extension of time of completion for the work without any extra claim. However, such extension shall be at the sole discretion of the employer and without prejudice to the rights of the Authority to terminate the contract treating time as the essence of the contract. The Authority is not bound to take into account any extra ordinary circumstances unless the contractor has submitted full and detailed particulars within 15 days of the incident, which affected the progress of the work. Further, any such extension granted shall not relieve the contractor from the interest on the advance, if any, drawn by him. Nor shall he be eligible for the incentive for earlier completion of the

works during the extended period. All other conditions are as per G.O(P) No.84/97/PW&T dtd: 19.8.97)

47. Handing Over of Work and Clearance Of Site

For LS tenders, handing over shall be after successful testing and trial running of the facility. The DLP period shall start after successful completion and trial running and the handing over shall be after another 4 years of operation and maintenance period.

47.1 The contractor shall hand over all works executed under the contract to the Authority complete in all respects, and to the satisfaction of the Executive Engineer at the end of satisfactory completion of the maintenance period.

47.2 The Executive Engineer shall determine the date on which the work shall be regarded as having been completed as contemplated in sub clause above and shall, in support of his determination, grant a certificate to the contractor on an application being so made to him, that the work was duly executed and completed in all respects, on a date to be specified in the certificate and such certificate shall for all purposes be deemed to be the conclusive proof of the date on which the work was so completed. The Executive Engineer shall also from time to time determine the date on which any particular stage of the work shall have been completed and shall, on application, grant a similar certificate to the contractor who shall be bound to follow all such determination in all subsequent dealings with the Authority on the subject matter of the contract in regard to the work.

47.3 On completion of the contract, the contractor shall clear away and remove from the site all construction plant, surplus material, rubbish, debris and all temporary works of every kind and leave whole of this' site and work in a neat and clean condition to the satisfaction of the Executive Engineer in charge of the facility. No final payment in settlement of the account of the work shall be made to the contractor until, in addition to any other condition necessary for such final payment, the site clearance shall have been effected by him, and in the event of the failure of the contractor to comply with the provision of this Sub Clause within 7 days after receipt by' him of a notice to that effect, such clearance may be made by the Executive Engineer in-Charge at the expense of the contractor and in all such cases the Authority shall not, in any way be liable for any loss or damage to any property of the contractor left at the site caused by such removal, there from and such removal may without prejudice to any other mode of

removal be effected by means of public sale of such materials and property or by such other means as may be deemed fit and convenient to the Executive Engineer.

47.4 The contractor shall also furnish the following on instructions from the Executive Engineer.
(1) Photographs of different stages of all components and special type of works taken during the course of execution (at least at ten instances and not less than a total of 60 photos)
(2) Video taken at different stages during progress of works (at least thrice during the critical execution events and completion period).
(3) 3-Dimensional models (1 set) and perspective drawings (5 copies) prepared for the entire scheme.

47.5. Settlement, Arbitration Of Disputes And Non-Applicability Of Arbitration

47.5.1 Settlement of disputes by Arbitration shall not be applicable to this contract.

47.5.2 In the case of any disputes arising between the parties to this contract on any of the matters covered under this contract, the same shall be settled solely by a competent court having jurisdiction within the State of Kerala, and by no other Court.

FORM 'A'

INFORMATION REGARDING ELIGIBILITY
LETTER OF TRANSMITTAL

From:
…….
…….
…….
…….
To

Secretary
Kozhikode Municipal Corporation, Kozhikode

Sir,

Subject: Submission of bids for the work of
…….....

Having examined the details given in press notice and bid document for the above work, I/we hereby submit the relevant information.

1. I/we hereby certify that all the statement made and information supplied in the enclosed forms A to H and accompanying statement are true and correct.

2. I/we have furnished all information and details necessary for eligibility and have no further pertinent information to supply.

3. I/we submit the requisite certified solvency certificate and authorize the Secretary to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/we also authorize Secretary to approach individuals, employers, firms and corporation to verify our competence and general reputation.

4. I/we submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following works:

Name of work:
Enclosures

Date of submission: **Signature(s) of Bidder(s).**

(Seal of bidder)

FORM 'B'

FINANCIAL INFORMATION

I. Financial Analysis – Details to be furnished duly supported by figures in balance sheet/ profit & loss account for the last five years duly certified by the Chartered Accountant, as submitted by the applicant to the Income Tax Department (Copies to be attached).

Years

2015-16	**2016-17**	**2017-18**

i. Gross Annual turnover on construction works.
ii. Profit/Loss

II. Financial arrangements for carrying out the proposed work.

III. Solvency Certificate from Bankers of the bidder in the prescribed Form "B".

Signature of Chartered Accountant with Seal **Signature of Bidder(s)**

FORM "C"

FORM OF BANKERS' CERTIFICATE FROM A SCHEDULED BANK

This is to certify that to the best of our knowledge and information that M/s./ Shri…….having marginally noted address, a customer of our bank are/is respectable and can be treated as good for any engagement upto a limit of Rs……. (Rupees…… ……)

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

(Signature)
For the Bank

NOTE:
1. Bank's certificates should be on letter head of the Bank, sealed in cover addressed to tendering authority. Original or Attested copy for this work.

1. In case of partnership firm, certificate should include names of all partners as recorded with the Bank.

FORM 'D'

DETAILS OF ALL WORKS OF SIMILAR CLASS COMPLETED DURING THE LAST 3 YEARS ENDING LAST DAY OF THE MONTH OF JULY 2018

Sl No	Name of work/ Project and Location	Owner of sponsoring organization	Cost of work in Lakhs of rupees	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation/ arbitration cases pending/ in progress with details*	Name & address/ Telephone number of officer whom reference may be made	Remarks
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

***Indicate gross amount claimed and amount awarded by the Arbitrator.

Signature of Bidder(s)

FORM 'E'

PROJECTS UNDER EXECUTION OR AWARDED

Sl. No	Name of work/ Project and Location	Owner of sponsoring organization	Cost of work in Crores of rupees	Date of commencement as per contract	Stipulated date of completion	Up to date percentage progress of work	Slow Progress if any and reasons thereof	Name & address/ Telephone number of officer whom reference may be made	Remarks
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Certified that the above list of works is complete and no work has been left out and that the information given is correct to my knowledge and belief.

Signature of Bidder(s)

FORM 'F'

PERFORMANCE REPORT OF WORKS REFERRED TO IN FORMS "C" & "D"

1. Name of work/project & location
2. Agreement no.
3. Estimated cost
4. Tendered cost
5. Date of start
6. Date of completion
    a. Stipulated date of completion
    b. Actual date of completion
7. Amount of compensation levied for delayed completion, if any
8. Amount of reduced rate items, if any
9. Performance Report

Dated: **Signature of the Bidder**

FORM "G"

STRUCTURE & ORGANISATION

1. Name & address of the bidder
2. Telephone no./Fax no./email
3. Legal status of the bidder (attach copies of original document defining the legalstatus)
    a. An Individual
    b. A proprietary firm
    c. A firm in partnership
    d. A limited company or Corporation
    e. Joint venture
4. Particulars of registration with various Government Bodies (attach attestedphotocopy)

Organization/Place of registration	**Registration No.**
a)	
b)	
c)	

5. Names and titles of Directors & Officers with designation to be concerned with this work.
6. Designation of individuals authorized to act for the organization
7. Was the bidder ever required to suspend construction for a period of more than six months continuously after he commenced the construction? If so, give the name ofthe project and reasons of suspension of work.
8. Has the bidder, or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.
9. Has the bidder, or any constituent partner in case of partnership firm, ever been debarred/black listed for tendering in any organization at any time? If so, give details.
10. Has the bidder, or any constituent partner in case of partnership firm, ever been convicted by the court of law? If so, give details.
11. In which field of Civil Engineering construction the bidder has specialization and interest?
12. Any other information considered necessary but not included above.

Signature of Bidder(s)

FORM 'H'

DETAILS OF TECHNICAL & ADMINISTRATIVE PERSONNEL TO BE EMPLOYED FOR THE WORK

Sl No	Designation	Total Number	Number available for this work	Name	Qualification	Professional experience and details of work carried out	How these would be involved in this work	Remarks
1	2	3	4	5	6	7	8	9
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Signature of Bidder(s)

KOZHIKODE MUNICIPAL CORPORATION, KOZHIKODE

(A) Tender for the work of **SUPPLY CONSTRUCTION INSTALLATION TESTING COMMISIONING AND OPERATION OF SEWAGE TREATMENT PLANT FOR KOZHIKODE MEDICAL COLLEGE WITH SEPTAGE TREATMENT FACILITIES FOR SURROUNDING AREAS**

i. To be submitted by <time & date>
ii. To be opened at <time & date> in the office of Secretary, Kozhikode Municipal Corporation, Kozhikode

I/We have read and examined the notice inviting tender, schedule A, B, C, D, E ,F, G & H,Specifications applicable, Drawings & Designs, General Rules and Directions, Special conditions, Schedule of Quantities & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for Kozhikode Municipal Corporation, Kozhikode within the time specified in Schedule 'F' viz., schedule of quantities and in accordance in all respect with the specifications, designs, drawing and instructions in writing referred to in Rule-1 of General Rules and Directions and with such materials as are provided for, by, and in respect of accordance with, such conditions so far as applicable.

We agree to keep the tender open for ninety (90) days from the due date of its opening and not to make any modification in its terms and conditions.

A sum of Rs. 5.00 Lakh has been deposited in prescribed manner as Earnest Money Deposit (EMD). If I/We, fail to furnish the prescribed performance guarantee within prescribed period, I/We agree Secretary, Kozhikode Municipal Corporation, Kozhikode without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I/We fail to commence work as specified, I/We agree that Secretary, Kozhikode Municipal Corporation, Kozhikode shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said performance guarantee absolutely. The said Performance Guarantee shall be a guarantee to execute all the works referred to in the tender documents upon the terms and conditions contained.

Further, I/We agree that in case of forfeiture of Earnest Money or Performance Guarantee as aforesaid, I/We shall be debarred for participation in the re-tendering process of the work.

I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Secretary, Kozhikode Municipal Corporation, Kozhikode, then I/We shall be debarred for tendering in Kozhikode Municipal Corporation, Kozhikode in future forever. Also, if such a violation comes to the notice before date of start of work, I/We shall forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

I/We hereby declare that I/We shall treat the tender documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Date: Signature of Bidder

Postal Address:

Witness:

Address:

Occupation

Form of Earnest Money Deposit (Bank Guarantee Bond) (if applicable)

WHEREAS, Bidder..... (Name of Bidder) (Hereinafter called "the Bidder") has submitted his tender dated..... (Date) for the construction of..... (Name of work) (Hereinafter called "the Tender")

KNOW ALL PEOPLE by these presents that we .....registered office at..... (Hereinafter called "the Bank") are bound unto Secretary, Kozhikode Municipal Corporation, Kozhikode in the sum of Rs..... (Rs. in words

.....) for which payment well and truly to be made to the said Secretary, Kozhikode Municipal Corporation, Kozhikode the Bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this..... Day of..... 20....
THE CONDITIONS of this obligation are:

2. If after opening of tender; the Bidder withdraws, his tender during the period of validity of tender (including extended validity of tender) specified in the Form of Tender;
3. If the Bidder having been notified of the acceptance of his tender by the Secretary, Kozhikode Municipal Corporation, Kozhikode

a) Fails or refuses to execute the Form of Agreement in accordance with the Instructions to the Bidder, if required;

OR

b) Fails or refuses to furnish the Performance Guarantee, in accordance with the provisions of tender document and Instructions to the Bidder,

We undertake to pay to the Secretary, Kozhikode Municipal Corporation, Kozhikode either up to the above amount or part thereof upon receipt of his first written demand, without the Municipal Secretary, Kerala having to substantiates his demand, provided that in his demand the Secretary, Kozhikode Municipal Corporation, Kozhikode will note that the amount claimed by him is due to him owing to the occurrence of one or any of the above conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date* ..... after the deadline for submission of tender as such deadline is stated in the Instructions to the Bidder or as it may be extended by the Secretary, Kozhikode Municipal Corporation, Kozhikode notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE ..... SIGNATURE OF THE BANK

WITNESS ..... SEAL

(SIGNATURE, NAME AND ADDRESS)

*Date to be worked out on the basis of validity period of 180 days from the last date of original receipt of tender

PERFORMA FOR PRELIMINARY AGREEMENT

(To be executed on stamp paper of value Rs.200/- and submitted along with tender).

Preliminary agreement entered into on this……. / **day of …….. Two thousand Eighteen between Kozhikode Municipal Corporation, Kozhikode.)**(Hereinafter called owner on one part and**…….....……**
….(name and address of the Contractor) (Hereinafter called the Contractor) on the other part for the execution ofthe agreement as well as the work of …… dated …….. And whereas the notice inviting tenders it is stated as follows. Before commencing the work of within a week of the date when the acceptance of tender has been intimated to him, shall be remitted to Kozhikode Municipal Corporation, Kozhikode, an amount of 5% of the work order value as Performance Security Deposit. 50 % of this amount shall be in the form of Bank Guarantee from a Scheduled/ Nationalized bank and execute the contract agreement within seven days from the date of the letter of acceptance or ten days from the date of work order whichever is earlier. The validity of BG shall be up to the period of completion of work / the extended period of completion of work with an additional claim period of three months.

If he fails to do this or fail to maintain a specified rate of progress, the EMD shall be forfeited to Kozhikode Municipal Corporation, Kozhikode and fresh tenders shall be called for or the matter otherwise disposed. If as a result of such measures due to the default of the tender to pay the requisite deposit sign contracts to take possession of the work any loss to the Kozhikode Municipal Corporation, Kozhikode results, the same will be recovered from him as arrears of revenue but should it be a saving to Kozhikode Municipal Corporation, Kozhikode the original contractor shall have no claim whatever to the difference.

Recoveries to this or any other account will be made from the sum that may be due to contractor on this or any other contracts or under the Revenue Recovery Act or otherwise as the Secretary, Kozhikode Municipal Corporation, Kozhikode may decide.

Now therefore this present witness and it is mutually agreed as follows:

1.The terms and condition for the said contract having been stipulated in the said tender form to which the contractor has agreed, a copy of which is appended, and which forms part of this agreement, it is agreed that the terms and conditions stipulated there in shall bind the parties to this agreement, except to the extent to which they are abrogated or

altered by express terms and conditions herein, agreed to and in which respect the express provisions herein shall supersede those of the said tender form.

2. The Contractor hereby agree and undertake the perform and fulfil all the operation and obligations connected with the execution of the said contract work viz. –

…….for Kozhikode Municipal Corporation, Kozhikode,

3. If the Contractor does not come forward to execute the original agreement after the said work is awarded and letter of acceptance issued in his favour or commits breach of any of the Conditions of the Contract as stipulated in the Notice inviting Tenders as quoted above within the period stipulated, Kozhikode Municipal Corporation, Kozhikode may rearrange the works otherwise or get it done otherwise at the risk and cost of the contractor and the loss so sustained by Kozhikode Municipal Corporation, Kozhikode can be realizing from the contractor under the Revenue Recovery Act as if arrears ofland revenue as assessed, quantified and fixed by an adjudicating authority consisting of Kozhikode Municipal Corporation, Kozhikode or any other officer or officers authorized by Secretary, Kozhikode Municipal Corporation, Kozhikode taking into consideration the prevailing rates and after giving due notice to the Contractor. The decision taken by such authorized officer or officers shall be final and conclusive and shall be binding on the contractor.

4. The contractor further agrees that any amount found due to Kozhikode Municipal Corporation, Kozhikode under or by virtue of this agreement shall be recoverable from the Contractor from his E.M.D. and his properties, movable and immovable as arrears of land revenue under the provision of the Revenue Recovery Act for the time being in force or in any other manner as Kozhikode Municipal Corporation, Kozhikode may deem fit in this regard.

In witness where of ……..…....., Secretary, Kozhikode Municipal Corporation, Kozhikode and the Contractor, have set their hands on the day and year first above written, signed by Sri.....……. Secretary, Kozhikode Municipal Corporation, Kozhikode

In the presence of witness

1. .....

2. .....

Signed and delivered by Sri....., Contractor,

in the presence of witness.

1.....

2.....

CONSTRUCTION, SUPPLY, INSTALLATION, TESTING, COMMISSIONING AND OPERATION & MAINTENANCE FOR FIVE YEARS OF THE SEWAGE TREATMENT PLANTS FOR KOZHIKODE MEDICAL COLLEGE WITH SEPTAGE TREATMENT FACILITIES FOR SURROUNDING AREAS WITH ELECTROLYTIC TECHNOLOGY

9.0 CONTRACT CONDITIONS

9.1 LAW GOVERNING THE CONTRACT

9.1.1 All contracts or terms thereof entered into between the Authority and the contractor under these conditions of contract shall be governed and regulated in general by the relevant laws in force in the territory of India relating to contracts.

9.1.2 The contractor shall strictly conform to the provisions, for the time being in force, of any laws relating to works or any regulations and bye-laws made by any local authority or any water and lighting companies or any undertakings within the limits of the jurisdiction of which it is proposed to execute the work or to obtain connection with their systems or undertakings for the purpose of such work, and where the contractor considers that variations in the drawings or specifications of such work are necessary to enable him to comply with the provisions of the law or regulations or bye-laws, as aforesaid, he shall give to the Agreement Executing Authority and the Executive Engineer a notice in writing specifying the variations, and no action in this behalf shall be taken by the contractor until he receives instruction in writing from the Executive Engineer in respect there of. The Contractor shall be bound to give to the authorities concerned such notices as may be provided in the law, regulations or bye-laws as aforesaid, and to apply all fees and taxes payable to such authorities in respect thereof.

9.2 COMMENCEMENT OF WORK

9.2.1 The contractor shall commence the work within 15 days after the receipt, by him, of an order in writing to this effect from the tendering authority and shall proceed with the same with due expedition and without delay, except as may be expressly sanctioned or ordered by the tendering authority or be wholly beyond the contractors' control.

If the contractor fails to start work within the time specified by the Employer after signing the agreement or fails to maintain the specified rate of progress, the security deposit shall be forfeited to Employer and the matter will be disposed of suitably by the Authority. If such measure results in any loss to Authority, such loss shall be recovered from the contractor as arrears or revenue but should it be a savings to the Authority, the original contractor shall have no claim whatsoever to the difference. Recoveries on this or any

other amount will be made from the sum that is already due or may become due to the contractor on this or any other existing contracts or under the Revenue Recovery Act, or otherwise as the Authority may decide.

9.2.2 It shall be the joint responsibility of KMC and contractor to get appropriate sanction from related Authority.

9.3 OCCUPATION OF LAND

No land belonging to or in possession of the Authority shall be occupied by the contractor without the permission of the Authority. The contractor shall not use or permit to use such land occupied by him for the purpose other than the execution of the works

9.4 WATER, POWER AND APPROACH ROAD

The contractor shall, at his own cost, make arrangements for obtaining supply of water and power necessary for the work.

9.4.1 The Authority may supply to the contractor part/or whole of the quantity of water required for the execution of the work, from the existing water supply system, if any, near the site of the work if feasible on such, terms and conditions and on such charges as shall be determined by the Authority observing the relevant rules prevailing in KMC for such connection and payable by the contractor, provided that the contractor shall at his own expense, arrange to effect the connection and lay additional pipelines to the site.

9.4.2 Not withstanding the provision contained in Clause 9.4.1, the Authority shall not guarantee the supply of water and no claim for compensation for any failure or short supply of water by the Authority shall be entertained.

9.4.3 The Authority shall render necessary assistance to the contractor for obtaining the power connection, but the expenses for such connections and Electrical Energy charges shall be borne by the contractor.

9.4.4 For testing of pipelines and water retaining structures during the progress of work, the contractor must arrange his own supply of water.

9.4.5 The Authority does not undertake to construct or make available any approach road or other means of approach to the proposed work site and the tenderer shall get acquainted with the available means of approaches to the proposed site and quote for

the various items. The Authority shall not be liable for any claim raised later, on the plea of non-availability or non-access to the site. .

9.5 TEMPORARY SHEDS AT WORKSITE

9.5.1 The contractor shall at his own expense, provide himself with site office sheds, store house and yard in such situations and in such number as is requisite, in the opinion of the Executive Engineer, for efficiently carrying out the work and the contractor shall keep at each of such sheds, store houses and yards, sufficient quantity of materials and plant in stock so as not to delay the carrying out of the work with due expedition and the Executive Engineer and his assistant shall have at all reasonable times, free access to the said sheds, store houses and yards for the purpose of inspecting the stock of

materials and plant stored therein, and any materials or plant objected to by the Executive Engineer shall be forthwith removed from the shed, store house or yards by the contractor. The contractor shall at his own expense provide and maintain suitable arrangements and equipment as may be deemed necessary by the Authority for the proper execution of the work.

9.5.2 When temporary sheds, stores etc. put up by the contractor are no longer required in the opinion of the Authority, the contractor shall remove them at his own expense and in such manner as the Executive Engineer may direct. In the event of any failure on the part of the contractor to remove any such temporary work, the Executive Engineer shall cause the same to be removed and all the costs of such removal including the cost of supervision and other incidental charges shall be recovered from the contractor.

9.5.3 If temporary huts provided by the contractor on the land of the Authority for the accommodation of labour engaged by him in connection with the work are no longer required after the completion of the work, it shall be the duty of the contractor to hand over to the Authority vacant possession of the said land, and if the contractors labour refused to vacate and has to be evicted by the Authority, all expenses incurred by the Authority in connection therewith shall be met by the contractor or be recovered from him.

9.6 SETTING OUT

9.6.1 The contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, levels, dimensions and alignments of all parts of the work and for the provision of all necessary instruments, appliances and labour in

connection therewith. If at any time during the progress of the work, any error shall appear or arise in the position, levels, dimensions or alignments of any part of the work, the contractor on being required to do so by the Executive Engineer shall at his own expense rectify such error to the satisfaction of the Executive Engineer. The checking up of any setting out or any line or level by the Executive Engineer or his assistant shall not in any way relieve the contractor of his responsibility for the correctness thereof and the contractor shall carefully protect and preserve all bench marks, site and rails, pegs etc. used in setting out the work.

9.6.2 The contractor shall keep at his own cost all portions of work free from water or dampness due to spring, seepage or inclement weather and in a neat and sanitary condition.

9.7. EXECUTION OF WORK

9.7.1 The decision of the Chief Engineer shall be final, conclusive and binding on all questions relating to the meaning of drawings and specifications and to the quality, workmanship and materials used on the work.

9.7.2 The whole of the work shall be executed in perfect conformity with the

specifications and drawings of the work approved by the Authority. If the contractor performs work in a manner contrary, to the specifications and drawings or any of them, he shall bear all costs arising or ensuing there from and shall also be liable to the Authority for any loss.

9.7.3 The whole of the work specified and provided for in the contract or that may be necessary to be done in order to form and complete any part thereof shall be executed in the best and most substantial workman like manner with materials of the best and approved quality of their respective kinds, according to the particulars contained in or implied by the specifications and as referred to in any additional particular instructions and drawings as may be found requisite to be given during the execution of the work and to the entire satisfaction of the Executive Engineer.

9.8. WORK DURING NIGHT AND SUNDAYS AND HOLIDAYS

9.8.1 The contractor shall not carry out any work between the hours of sunset and sunrise without the previous permission of the Executive Engineer or his assistant in writing.

9.8.2 No work shall be done on Sundays and holidays without the written permission of the Executive Engineer or his assistant.

9.8.3 However, when work is unavoidable or necessary for the safety of life, property or works, the contractor shall take necessary action forthwith and report to the Executive Engineer immediately.

9.9 FACILITIES FOR INSPECTION

9.9.1 The contractor shall afford the Officers of Kozhikode Corporation every facility for entering in and upon any portion of the work at all hours for inspection or for any other purpose and shall provide all labour, materials, planks, ladders, pumps, appliances and things of every kind required for the purposes aforesaid and the Superintending Engineer or his assistant shall at all the times have access, free of cost, to every part of the work and to all places at which materials for the work are stored or being prepared.

9.9.2 The contractor shall give at least seven days notice in writing to the Executive Engineer and his Assistant whenever any work or materials are intended to be covered up in the earth in bodies or walls or otherwise to be placed beyond the reach of measurements so that the work may be inspected or the correct dimensions thereof may be taken before the work is so covered or placed beyond the reach of measurement and where the contractor defaults to give such notice the same shall at the opinion of the Executive Engineer or his assistant be uncovered and measured at the expenses of the contractor or in the alternative, no payments shall be made for such work or materials.

9.9.3 Should the Superintending Engineer or any other Engineer / Supervisor authorized in writing by him to supervise the work, at times, consider it necessary for the purpose of enabling him to make any inspection or tests or analysis or to verify or ascertain the quality or strength of any part of the work or of any

materials the contractor shall if and when so required to do by the Executive Engineer or the person authorized as aforesaid, open up the work or the materials for inspection or testing or analysis, or pull down, or pull out the work into any number of parts and make such openings into, under or through any part of the work, as may be directed and provide all things which in the opinion of the Executive Engineer or the person authorized as aforesaid, may find necessary to enable the inspection or tests or analysis of the work or any part thereof or of the materials or workmanship to be made and the contractor shall close up, cover, re-build, and make good the whole at his own cost, as and when directed by, and to the satisfaction of the Executive Engineer, provided always that the work, in the opinion of the Executive Engineer is found to be satisfactory and in

accordance with the contract, the expenses incurred by the contractor for such examination, inspection or test shall, upon a certificate in this behalf by the Executive Engineer, be borne by the Authority.

9.10 SUSPENSION OF WORK

9.10.1 The contractor shall not suspend any work without the prior written permission of the Executive Engineer in charge of the work under any circumstances. Any such suspended work shall be treated as incomplete and abandoned by the contractor and the Authority shall have the right to get such works completed through any other manner at the risk and cost of the contractor.

9.10.2 The contractor shall, on an order issued by the Executive Engineer that for any reason the work shall not be commenced or shall be suspended or stopped before completion, the contractor shall be paid for the work actually done and materials actually supplied up to the date of stoppage but the Authority shall be held in no way responsible for any further liability.

9.11 ALTERATION IN THE WORK TO BE AUTHORISED

9.11.1 No alteration in, or additions to, or omissions from or abandonment of any part of the work shall be deemed to be duly authorized except under written instructions from the Executive Engineer and it shall be the duty of the contractor to obtain in time such written instructions in every case.

9.11.2 If any work over and above that in the contract is required to be executed at the site the contractor shall have no right to be entrusted with the execution of the work and the same may be carried out through another contractor or contractors or by other means at the discretion of the Authority.

9.11.3 The Executive Engineer shall have full powers to send persons upon the premises to execute fittings, other works etc., not included in the contract for whose operations the contractor shall afford every reasonable facility during ordinary working hours, provided that such operations shall be carried out in such a manner as not to impede the progress of the work, included in the contract, but the contractor shall not be responsible for any damage which may happen to or be occasioned by any such fittings or other works, provided that he complies with the Executive Engineer's instructions in connection

there with and provided that the damage is not caused by himself or his employees. The contractor shall, at all times, co-operate, assist, attend on, and afford facilities for such specialists, as may be employed by the Executive Engineer or other works, in connection with the work. The contractor shall also cause such special work or protect it as instructed to avoid injury during progress of the work. For failure, so to protect, the contractor must make good any damage caused. If any part of his work depends for proper execution upon or results from the work of the other contractor, the former shall inspect and promptly report to the Executive Engineer any defect in the work of the latter likely to render it unsuitable for proper execution and results. The failure of the contractor entrusted with the work so to inspect and report shall, for all purposes be deemed to constitute an affirmative approval of the work of the other contractors as being fit and proper for the receipt of his work, except as to defects which may develop in the work of the latter contracts after the execution of his work.

9.12 PRECAUTIONS DURING PROGRESS OF WORK

9.12.1 The contractor shall be responsible to see that the levels, profiles, bench marks, masonry pillars or other marks set up by the Authority for guidance in the execution of the work are not disturbed, removed or destroyed and if any such marks as in the opinion of the Executive Engineer or his assistant, found disturbed, removed or destroyed, they will be replaced by the Authority at the cost of the contractor.

9.12.2 During the execution of the work, the contractor shall at his own cost provide adequate materials for all works relating to shoring, timbering, strutting, scaffolding etc. and execute the same in such a way as to ensure, in abundant measure, the stability and safety of all structures, excavations and works and further ensure that no physical injury or harm is likely to be caused to any person or no damage or loss is caused to any property. When two or more contractors are engaged on work in the same vicinity, they shall work together in a spirit of co-operation and accommodation. The contractor shall not take or cause to be taken any steps or action that may cause disruptions, discontent or disturbance to the works, labour and arrangement of other contractors in the neighboring or other project localities. In case of any difficulties amongst the contractors, the Executive Engineer shall conduct his work so far as it affects the others.

9.12.3 Existing roads or water courses shall not be blocked, cut through, altered, save to the extent permitted by the Executive Engineer. All compensation claimed by the authorities concerned for any unauthorized closure, cutting through, alteration, diversion or obstruction to such roads or water courses by the contractor be deducted from any sums which is due to or may become due to him in terms of the contract, or otherwise according to law.

9.12.4 The contractor shall be responsible for taking all precautions to ensure the safety of the public, whether on the property belonging to the Authority or others and shall post such look-out men, as may in the opinion of the Executive Engineer, be required to comply with the regulations pertaining to the work.

9.12.5 The contractor shall be responsible for safety arrangement of all equipment used for construction and shall employ trained workmen conversant with the safety regulations. The contractor shall employ only tested equipment and tools for safety and shall periodically repair them to the satisfaction of the Executive Engineer. All test certificates shall be made available to the Executive Engineer at the site of the work. If at any time, in the opinion of the Executive Engineer or his assistant, this provision is not complied with the contractor shall forthwith replace equipment and tools.

9.12.6 The contractor shall display notices and arrange for proper fencing at such places where hazardous work is being carried out. The contractor shall provide at his own expense on the work to the satisfaction of the Executive Engineer proper and sufficient fire fighting equipment, first aid appliances etc. which shall at all times be available for use.

9.12.7 The contractor shall at all times comply with all rules and regulations made by the Government, local bodies and such directions as may be issued by the Authority from time to time in regard to safety, first aid and health measures. The contractor shall be legally and financially liable for any lapse in taking precaution during execution of works.

9.13. PROCEDURE TO RECTIFY DEFECTIVE WORKS

9.13.1 If it shall appear to the Executive Engineer or his assistant, at any time during the progress of the work or at any time prior to the expiration of the guarantee period of the work, that any work has been executed with unsound, imperfect or unskilled workmanship or with materials of inferior description, or that any materials or articles provided by the contractor for the execution of the work are unsound or of a quality inferior to that contracted for, or otherwise not in accordance with the contract, the contractor shall, on demanding in writing by the Chief Engineer or his assistant to specify the work, materials or articles, complained of and within the period of time mentioned in the demand, pull down, take up, or take out the work so complained of or objected to, remove from the site or separate from other materials or sort out the materials or articles or part thereof shall have been included any (on account) payment to the contractor, the same shall be taken in to account and deducted from any subsequent payment due to the contractor. The contractor shall also remove from the work and site any equipment

fixed or otherwise objected to by the Executive Engineer or his assistant or any other persons authorized in writing by him.

9.13.2 The contractor shall forthwith rectify or remove and reconstruct the works so specified either in whole or in part, as the case may require, or as the case may be, and provide proper and suitable materials or articles for material or articles complained of or objected to. If the contractor fail to remedy any defect within the period specified in demand mentioned in sub clause above and in the manner required, or if he shall fail to remove from the site any materials or articles condemned as unsound or otherwise not in accordance with the specifications or to substitute suitable articles for the materials complained of or objected to, the Executive Engineer or his assistant may

cause such work to be carried out and such materials or other articles to be replaced by such means as he think fit, and all expenses consequent thereon, or incidental thereto, auxiliary thereof, shall be met by the contractor and borne by him and shall be recoverable from him by the Authority or may be deducted by the Executive Engineer from any moneys due or that may thereafter become due to the contractor.

9.13.3 Should the Executive Engineer consider that the work, although not executed in strict accordance with the specifications may be allowed to stand, payment for the same shall be made at such reduced rate as may be fixed but this procedure is quite optional on his part and shall have the concurrence of the Chief Engineer.

9.13.4 In case quality of work done is found to be poor, contractor will be liable to compensate for cost of rectification/replacement, and shall be blacklisted from participating in future tenders.

9.14 SUPPLY & TESTING OF MATERIALS

9.14.1 The Contractor shall supply all the materials including pump sets, compressors, electrical panel boards, electrical and wiring materials, pipes and specials covered under the contract at his own cost. The pipes, specials, pumps etc. should be tested at the factory by one of the Third party inspection agencies acceptable to Kozhikode Municipal Corporation (KMC) and witnessed or by the technically qualified officers of KMC if the contract value exceeds Rs. 100 lakhs and by departmental officer deputed by KMC if the contract value is less than Rs. 100 lakhs. Inspection certificates should be produced along with the materials. This third party inspection is mandatory for all pipes, specials and pumping and electromechanical equipments supplied by the contractor. Also ISI/ISO marked materials should alone be accepted, wherever ISI/ISO specifications is available for such item. In respect of ISO marked pipes the contractor shall furnish third party inspection certificates from internationally recognized inspection agencies at no extra

cost to the KMC. Any disputes between the contractor and the supply in fixing the inspection agencies shall be a matter for settlement among themselves and the KMC shall not be a party to such disputes. The lump sum amount quoted shall be inclusive of the cost of all materials and inspection as specified herein. AEE/EE/SE having minimum 5 years service before retirement shall only be deputed for pre-delivery inspection conducted in manufactures unit.

9.14.2 Before using any material for the work, the contractor at his own cost, shall submit to the Executive Engineer for his approval such samples of materials as are proposed to be used. The materials shall strictly conform to the specifications approved by the Authority. Notwithstanding anything contained in this clause, the contractor shall be held fully responsible for the quality and soundness of all the materials and machinery that are supplied by him for execution of the work and completion of the project and the Executive Engineer's approval and inspection by third party inspection agency before delivery shall not in any way absolve him of his responsibility in this matter.

9.14.3 The contractor shall test or obtain the approved analysis of or weigh all materials required by the specification to be tested or analyzed or weighed

where so required by the Executive Engineer and shall, if any when so required to do, test the whole or each part of the work or the materials in such manner at such times and such place or places, whether before or by the specifications or as may be directed by any of the persons aforesaid.

9.14.4 The contractor shall, if and when so required by the Executive Engineer to do, prepare and / or submit samples of works and materials for the approval of the Executive Engineer such samples shall be retained by the Executive Engineer and no materials which are required to be so tested or analyzed or weighed or of which samples have to be submitted, shall be used in the work, until tests, analysis, weights or samples as the case may be shall have been approved in writing by the Executive Engineer.

9.14.5 All materials for the work must comply with the requirements or specifications laid down in the tender form and must satisfy the tests and / or analysis laid down in the specifications of the Bureau of Indian Standards/International Standards Organization or such other recognized specifications as the Executive Engineer may direct as being equivalent thereto, and in either case, with such additional tests and I or analysis as the Executive Engineer may order or in the absence of such standards or specifications, with such requirements, tests and analysis as in the opinion of the Executive Engineer, are fair and suitable.

9.15 TOOLS AND PLANT SUPPLIED BY AUTHORITY

9.15.1 It shall be the duty of the contractor to provide adequate tools and equipment needed to do the work efficiently and expeditiously. In case any required item of equipment or machinery is available with the Authority the same may be supplied to the contractor on hire at the discretion of the Executive Engineer at the rate fixed by the Executive Engineer and on conditions current in the Authority. The contractor shall bear the running expenses excluding the pay of the Authority staff attached but including cost of restoring the same in good condition at the time of return, due allowance being made for fair wear and tear.

9.15.2 In the event of any departmental material including plant and equipment being made available, the contractor shall arrange for transportation and safe up- keep of the same.

9.15.3 No extension of time will be granted for delay in the procurement of construction equipment and / or spare parts by the contractor.

9.15.4 The contractor shall take responsible care of all tools and plant belonging to the Authority and issue to the contractor for the purpose of the work and shall be liable for any damage or loss caused to the same by him, his agents or his workmen or others whilst the same were in his charge. The contractor shall sign valid receipts for the tools and plant issued to him by the Executive Engineer from time to time and on completion of the work, shall be bound to carry out repairs and shall be liable for any damage done thereto.

9.16 SUBLETTING OF CONTRACT

The contractor shall not at any time assign, sublet his contract or any part thereof to any person or allow such person to become in any way interested therein in any manner what so ever without the prior permission in writing of the Executive Engineer in charge of the work. Any contravention of this condition shall entitle the Authority to rescind the contract and shall also tender the contractor liable for payment to the Authority in respect of any loss or damage arising out of or ensuing from such recession of the contract. Provided further that where the subletting of the work by the contractor, in any case, is permitted' by the Authority, the contractor shall not, at any time, be absolved of any obligation or responsibility under the contract or any part thereof and shall continue to be responsible for all acts or omission and commissions of the sub contract, his agents, servants or workmen as fully and effectually as if the same were acts of

omissions and commissions of the contractor, his agents, servants or workmen, as the case may be.

9.17 CONTRACTOR'S AGENT:

9.17.1 The contractor shall, when he is not personally present at the site of the work invariably place and keep at such site a properly qualified agent, duly authorized and empowered to act on his behalf and to receive on his behalf the orders and instructions required or permitted under the contract to be given to the contractor by the Executive Engineer or his subordinates to supervise the work. All such orders and instructions given to, and all acts done by agents shall be binding on the contractor as if such orders and instructions were given to him or, such acts had been done by him.

9.17.2 Before absenting himself, the contractor shall furnish the name, the designation and the address of the Agent.

9.17.3 Prior to the appointment of such agent, the contractor shall submit to the Executive Engineer the name and other relevant details of the person intended to be appointed as his agent and no appointment shall be made until the Executive Engineer has approved the same and notified his approval in writing to the contractor and whenever the contractor desires to change his agent the same procedure as for the appointment of a new or fresh agent shall be followed.

9.17.4 From the moment the agent so approved and appointed takes charge of the work, he shall be held to be fully authorized and empowered to present and act for and on behalf of the contractor for all or any of the purpose of the contract, and not withstanding the absence of any formal authority or definite' instructions from the Contractor to the said agent or any defects therein, or the imposition of any restrictions or limitations on the power or authority of such agent by the contractor, nothing whatsoever shall in any way affect, qualify or limit the full authority or power of such agent, or absolve the contractor of his liabilities or obligations under the contract.

9.17.5 The contractor shall forthwith remove from the site and works and not to re -

employ without the written permission of the Executive Engineer, obtained in his behalf, any agent whose removal the Executive Engineer have asked for in writing, or any assistant whom he may consider incompetent or is sufficiently qualified or to have been guilty of misconduct or negligence and whose removal the Executive Engineer may have asked for in writing.

9.18 SUPERVISORY STAFF OF THE CONTRACTOR

9.18.1 The contractor shall not employ any person who was in the service of the Authority or the Government without definite written sanction of the Authority. The staff employed at the site by the contractor shall be the same as he has agreed for in the relevant format included in this tender document. Any change from the same shall have proper written acceptance of the Executive Engineer.

9.18.2 The contractor shall at all times place and keep on the work an adequate number of efficient and competent staff to give necessary directions to his workmen in the execution of the work and to see that the workmen execute the work in a sound and proper manner and shall employ only such supervisors, workmen and labourers in or about the execution of the work, as are careful and skilled in their various trades and callings.

9.18.3 The contractor shall forthwith remove from the work any supervisor, workmen or labourer objected to by the Executive Engineer, and if and whenever so required by the Executive Engineer the contractor shall submit the correct return showing the name of all staff and workmen employed by him or about the work.

9.18.4 If, in the opinion of the Executive Engineer, the contractor is not employing on the work such number of staff and workmen as is reasonably necessary for the, proper completion of the work within the time prescribed he shall forthwith communicate his opinion in writing to the contractor, and the contractor shall within seven days of the receipt of the said communication, employ such additional staff and labour as may be required by the Executive Engineer and any failure on the part of the contractor to comply with such instructions shall entitle the Authority to rescind the contract.

9.18.5 The contractor shall engage not less than one Engineering Graduate and one Engineering Diploma holder at the work site at his cost and any failure in this regard will be treated as breach of contract and shall entitle the Authority to penalize the contractor/rescind the contract.

9.19 DAMAGES PAYABLE BY THE CONTRACTOR

9.19.1 DAMAGE TO PROPERTY AND PERSON

1. The contractor shall, at his own expenses and to the satisfaction of the

Executive Engineer, reinstate and make good or be liable for any compensation for any injury, loss or damage occasioned to any property or right whatsoever, including the property and right of the Authority, servants or employees of the Authority, being injury, loss or damage arising out of or in any way connected with, the execution or purported execution of the contract, and further the contractor shall indemnify the Authority, private person, in respect of any such injury including ,any injury resulting in death or disability to person or property, including all claims which may arise under the Workmen's Compensation Act, or under any other law for the time being in force or otherwise.

2. The contractor shall (except if and so far as the specifications otherwise provide) indemnify and keep indemnified the Executive Engineer for all losses and claims for injuries or damages to any person or property whatsoever including surface or other damage to land being or crops being on the side suffered by tenants and occupiers which may arise out or in consequence of the construction and maintenance of the works and against all claim, demands, proceedings, damages, costs charges and expense whatsoever in respect thereof or in relation thereto, provided always that nothing therein contained shall be deemed to render the contractor liable for or in respect of or to indemnify the Authority against any compensation or damages for or with respect to

a. the permanent use or occupation of the land by the work or any part thereof (save in respect of damage to crop as aforesaid).

b. the right of the Authority to construct the work or any part thereof on, over, under in or throughout the land.

c. interference whether temporary or permanent with any right of light, airway or water or other easement or quasi-easement which is the unavoidable result of the construction of the work in accordance with the contract.

d. injuries or damages to person or property resulting from any act or neglect done or committed during the currency of contract by the Authority /Departmental officers, servants or other contractors (not being employed by the contractor) or in respect of any claim demand, proceedings, damage, cost, charges and expenses in respect thereof or in relation thereto.

3. If compensation has to be paid to court attachment or judgment etc. due to damage of person or property, such amount will be recovered from the contractor / tenderer.

4. The contractor shall insure all the employees employed in the work site as per rules against any accidents and further claim. KMC will not be responsible for any such accidents/claims of employees of the contractor.

9.19.2 METHOD OF RECOVERY

1. Damages payable by the contractor under the terms of the contract may be deducted by the Executive Engineer from part of his security deposit or from any other sums due, or which may become due to him from the Authority or through revenue recovery proceedings.

2. In every case in which under any clause or clauses of this contract, the contractor shall have rendered himself liable to damages amounting to the whole of his security deposit, the Executive Engineer shall have powers to rescind the contract altogether and to have the work completed without further notice, at the contractor's risk or expense as the Agreement Authority/Executive Engineer may deem best suited to the interest of the Authority and the contractor shall have no claim to compensation for any loss that may accrue from any material he may have collected or engagements he may have entered into, on account of the work and the Executive Engineer shall have powers to deduct whatever amount may be expended on the completion of the work, from any sums that may be due or become due from the Authority to the contractor on account of this or any other work or recover such sums from him and his assets, movable and immovable under the provision of the Revenue Recovery Act for the time being in force, as if they were arrears of land Revenue or otherwise as the Authority may choose. And in case the contract shall be rescinded under the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum of any work actually performed under this contract unless and until the Executive Engineer shall have certified the performance of such work and the value thereof and he shall only be entitled to be paid the value so certified.

3. In the event of the Executive Engineer's putting in force the powers vested on him under the preceding clause, he may, if he so requires it, take possession of all tools, plant, materials and stores or any portion thereof, on the place where the works were to be performed or on other land of the Authority adjoining thereto, paying or allowing for the same in account, at the contract rates, or if not specially provided for therein at current market rates, otherwise the contractor may be required to remove such tools, plant and materials or stores from the premises, and in the event of his failing to do so, the Executive Engineer may remove them at the contractors expense or sell them by auction on account of the contractor. The Executive Engineer may devote all, or such portion as may be requisite, any guarantee or reserve fund or any moneys due to or become due to the contractor for this or any other work to make good, bad or indifferent work, on the part of the contractor in such manner as he may think desirable.

4 If it shall appear to the Executive Engineer or his subordinate in charge of the work, that any work has been executed with unsound imperfect or unskilled workmanship, or with materials of an inferior description, the contractor shall on demand in writing forthwith rectify, relay, remove or reconstruct the same in whole or in part, as the case may require, at his own cost, and in the event of his refusing to do so within a period to be specified by the Executive Engineer or his subordinate or if he shall fail to remove, from the site of the work within a specified period any material or article which is considered by the same officers as unsound or of bad quality or not agreeable to the terms of the contract and to provide immediately suitable materials or articles in lieu of these condemned, then the contractor shall be liable to pay damages at the rate of one percent on the amount of the estimate for every day not exceeding ten days that he fails to comply with the written demand of the Executive Engineer or his subordinates. And in the event of non-compliance of the written demand even after the lapse of ten days the contract is liable to be terminated at the risk and cost of the contractor without further notice.

5.All compensations or other sums of money payable by the contractor to the Authority under the terms of this contract with the Authority or under any other contract with the Authority, shall without prejudice to any other mode of recovery, be recoverable from the contractor by way of deduction or payment, out of the sale proceed of a sufficient part of the security deposit held in Government Securities or in National Savings Certificate or out of the interest accrued thereon or out of the said security deposit held in cash or out of any sums which may be due or may subsequently become due, to the contractor from the Authority, on any account what so ever and in the event of the value of his security deposit being reduced by reason of any such deductions the shortage shall be made up by effecting extra recovery from subsequent bills or sales.

9.20 RELICS AND EXCAVATED MATERIALS

9.20.1 All gold, silver and other materials of any description and all precious stones, coins, treasures, relics, antiquities and other similar things which shall be found in or upon the site shall be the property of the Government and the contractor shall duly preserve the same to the satisfaction of the Authority and shall, from time to time, deliver the same to such person or persons as the Authority may appoint to receive the same.

9.20.2 The contractor shall not sell, or otherwise dispose of or remove, any sand, stone, clay, ballast, earth, rock or other substances or materials which may be obtained from any excavation made in or upon the site, or any building or produce standing upon the

site at the time of obtaining the delivery or possession thereof and all such substances, materials, buildings and produce shall be and shall continue to be the property of the Authority provided that the contractor may, with the permission of the Executive Engineer use the same for the work at such cost as may be determined by the Executive Engineer.

9.21 REPORTING OF ACCIDENT

The contractor shall be responsible for the safety of all employees or workmen employed or engaged by him on and in connection with the work and shall forthwith report to the Executive Engineer or his assistant all cases of serious accidents/injuries to any of them, however caused and whatever occurring on the work and shall make adequate arrangements for rendering all possible aids to the victims of the accidents.

9.22 WORKMEN'S COMPENSATION ACT

In every case in which, by virtue of the provisions of Sub Section (1) of Section 12 of the Workmen's Compensation Act 1923, if the Authority is obliged to pay any compensation to a workman employed by the contractor in the execution of the work, Authority shall recover from the contractor the amount of the compensation so paid and, without prejudice to the rights of the employer under Sub Section (2) of Section 12 of the said Act, the Authority shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due from the Authority to the

contractor, whether under these conditions or otherwise. The Authority shall not be bound to contest any claim made against him under Sub Section (1) of Section 12 of the said Act except on the written request of the contractor and upon his giving to the Authority full security for all the costs for which the Authority may become liable in consequence of contesting such claim.

9.23 WAGES TO LABOUR

9.23.1 The contractor shall comply with the provisions of the Minimum Wages Act and the rules made there under in respect of all employees or workmen employed or engaged by him on road construction or in building operations or in stone breaking or stone crushing for the purpose of carrying out the contract.

9.23.2 If, in compliance with the terms of the contract, the contractor supplies any labour to be used wholly or partly under the direct orders and control of the Authority whether in connection with the work being executed by the contractor or otherwise for purposes of

Authority such labour for the purpose of this clause, be deemed to be persons employed by the contract.

9.23.3 If any money shall, as a result of any claims or applications made under the said Act, be directed to be paid by the Authority, such moneys shall be deemed to be moneys payable to the Authority by the contractor, and on failure of contractor to repay the Authority any moneys as aforesaid within 7 days after the same shall have been demanded, the Authority shall be entitled to recover the same from any money due to the contractor under the contract or any other contract with the Authority.

9.23.4 The Authority shall also be entitled to deduct from any money due to the contractor (whether under the contract or any other contract with the Authority) money paid or payable by the Authority by way of any compensation under the said Act or on account of costs or expenses in connection with any claims thereto and the decision of the Executive Engineer on any question arising out of the application of this clause shall be final and binding upon the contractor.

9.23.5 In respect of all labour directly or indirectly employed, in works for the performance of the contract as part of this agreement, the contractor shall comply with or caused to be complied with all rules framed by the Authority from time to time for the protection of health and sanitary arrangements..

9.24 LABOUR RETURNS

Monthly labour returns shall be submitted by the contractor to Executive Engineer in the proper forms so as to reach him not later than the first of every month. In addition to the above, the contractor shall also maintain daily and weekly returns of labour employed by him and these shall be made available for verification by the officers as and when called for.

9.25 CONTRACT DOCUMENTS AND MATTERS TO BE TREATED AS CONFIDENTIAL

All documents correspondences, decisions and orders concerning the contract shall be considered as confidential and / or restricted in nature by the contractors and he shall not divulge or allow access to them by any unauthorized person.

9.26 MATERIALS TO BE SUPPLIED BY THE AUTHORITY

It shall be the responsibility of the contractor to arrange for materials and the Authority shall not issue any material to the contractor.

9.27 CONTRACTOR'S RESPONSIBILITY FOR STORES

The materials such as Cement, MS Rods, tor steel and other materials including pipes and specials required for the work shall be procured by the contractor and the lump sum amount quoted should be inclusive of the cost of cement, steel and all other materials. The cement supplied for use shall be as per ISS 269/1976 and steel as per ISS 1786/1985 with latest amendments, if any. The materials should bear the relevant ISI/ISO certification marks. Before using any material for the work, the contractor, at his own cost, shall submit to the Executive Engineer for his approval such samples of material as are proposed to be used. The materials shall strictly conform to the specifications approved by the Authority. Notwithstanding anything contained in this clause, the contractor shall be held fully responsible for the quality and soundness of all the materials and machinery that are supplied by him for the execution of the work and completion of the project and the Executive Engineer's approval shall not in any way absolve him of his responsibility in this matter. The standard tests as per ISS to ensure the quality of cement, steel and other construction materials shall be got done by the contractor at their cost as per the direction of the officers of to ascertain the quality. The Authority reserves the right to super check the results. If the materials supplied are found to be not passing the tests, the same shall be rejected by the Executive Engineer and the contractor shall be bound to dismantle and remove such constructions already made using such substandard quality materials if found during the erection of the work and the contractor shall be fully responsible and liable for such losses to the Employer.

9.28 MATERIALS AND PLANT AT WORKSITE

All materials and plants brought by the contractor in or upon the site or on the land occupied by the contractor in connection with the work and intended to be used for the execution thereof shall not be removed from the site of work with out the permission of the Executive Engineer.

10. GENERAL TECHNICAL SPECIFICATIONS

10.1 GENERAL

10.1.1 Generally, the specifications of all materials and work pertaining to this contract shall be governed by the relevant Indian Standards and by MDSS. In the absence of Indian Standards, the British Standard Specifications shall be followed. The specifications furnished hereunder are only to enlighten the tenderer on the requirements of KMC and are not intended to be against any other specifications stipulated by BIS or

other standards and common practices widely adopted in the country at present. In case of a doubt regarding the specifications, the Engineer in charge will clear the doubts and give final decision based on the written request of the contractor. The decisions intimated in writing shall be binding on the contract work.

10.1.2 The successful completion of this contract calls for site surveys, investigation, planning, hydraulic and structural design of the components, assessment of capacity/standard of mechanical, electromechanical and electrical items to be procured, preparation of procurement schedule, preparation of implementation schedule etc. The tenderer shall see that he always sticks on to conservative designs based on time tested and well accepted practices as per the guidelines and norms prescribed by BIS, CPHEEO or such other institutions.

10.1.3 REPORTS, DESIGN AND DRAWINGS

1 Reports, designs and drawings etc. connected with the work shall be furnished by the contractor for approval, minimum in triplicate copies or as called for by the Engineer in charge.

2 Contractor shall prepare and submit to the approving authority seven additional copies of the approved drawings immediately on receipt of approval for transmission to various field offices.

3 On completion of approval of all items connected with the project, the contractor shall prepare three copies of bound volumes of the approved documents and furnish to the approving authority. The preparation and binding of this document should be in such a manner that during the long period of future reference and recorded life, it shall not get disintegrated nor legibility lost.

10.1.4 ECO-FRIENDLY SYSTEM OFFER

The system offered and as completed shall be environment friendly and shall not affect / alter the environment beyond any permissible limits stipulated by concerned institutions.

10.1.5 MAN MADE STRUCTURES, OTHER UTILITIES - AFFECTING THE WORK

When the works under this contract are executed situations may arise when the works are affected by other manmade structures either in service or abandoned. It is also likely that other utility services installed by various Government bodies are affected by the works under this contract. It shall be the duty of the contractor to ensure whether

adequate sanction has been obtained from the authority concerned for the work with the help of KMC Authority before the works of such affected portions are undertaken. Any damage caused to any of the manmade structure or any of the utility services including roads will have to be made good by the contractor at his cost. The contractor has to restore the original position if he has to demolish any structure like culverts, compound walls, all roads etc during the course of work at his own cost.

10.2 EARTHWORK EXCAVATION

1 Earthwork excavation means earthwork in all classes of soils / rocks whenever removal shall be not by blasting. Earthwork excavation shall be done with adequate care so that underground service lines or adjacent structures are not damaged and appropriate protective measures such as shoring / strutting / sheet piling etc. are adopted for such items as required and approved by the Engineer in charge of the work. The width of trench should be as per the requirement and as per standard data book and a minimum cover above crown of pipe should be maintained as per clause
10.13. If the width of trench exceeds the minimum requirement as noted above, due to faulty workmanship / protection/shoring etc. the additional payment for the extra damaged road width payable to PWD/NH local bodies etc. shall be recovered from the contractor's bill.

Excavation by blasting shall be got done only through persons holding valid license for use of explosive material and for blasting purpose. Further all rules prescribed by the Inspectorate of Explosives shall be strictly adhered to whenever blasting is resorted to. Blasted material like the excavated rock shall be the property of KMC. Disposal of the materials up to a distance of 10 km from the site as well as cartage of excavated material during excavation and back filling up to a maximum distance of 5.0 km will have to be done whenever essential by the contractor at no extra cost.

10.3 FILLING / BACK FILLING

Filling / back filling shall be done only with approved materials. It shall be compacted to get the following results. The density of the filled materials at different depths shall not be less than 95% of the natural field density in case of back fill and shall not be less than 95% of maximum dry density obtained in proctor compaction test or such other approved tests whenever filling is done to get the desired formation ground level. It shall be ensured that the density thus obtained under compaction is uniform at all depths of the fill. The contractor is bound to bear the cost of any test conducted to ascertain the above

condition in case of doubt. The filling/backfilling done along PWD roads or such properties owned by other department/institutions, the same shall be further governed by specifications of such owner.

10.4 SHORING

Shoring shall be essential in excavation in all classes of soils whenever depth of excavation exceeds 1.50m and laborers have to work in trenches or close to edges of trenches as per the direction of Engineer in Charge. In ordinary soils and loose soils, shoring shall be done for trenches of shallower depths also considering the chances of collapse of sides. Shoring shall be done as approved/directed by the Engineer in charge of work.

10.5 FENCING

Fencing shall be done in the approved manner along the side of pipeline trenches on roads or other places for preventing accidents on both sides, if required in the opinion of the Engineer in charge.

10.6 FORMATION OF ROADS

Formation of roads shall be done as per IRC rules and regulations for the use of desired class of vehicles mentioned in the scope of the work. Whenever road formation comes in the scope of the work, it shall be understood that all cross drainage work, side drain works, radius of curvature and super- elevation etc. are included in the scope.

10.7 RUBBLE MASONRY

Rubble masonry works using approved quality blasted rubble either as random rubble masonry or coursed rubble masonry shall be permitted. Minimum width of the random rubble masonry shall not be less than 450mm in any case. Only cement mortar 1:6 or richer shall be used for such works. Mixing by weight at the above ratio for mortar shall be permitted only when the fine aggregate is in dry condition. Exposed surfaces or rubble masonry shall be pointed using 1:3 cement mortar to have a pleasing appearance provided it is left un-plastered with cement mortar.

10.8 BRICK WORK

Brick masonry using wire cut bricks / first class country burned bricks having a minimum crushing strength of 35 Kg / cm2 satisfying other tests specified by BIS and least

dimensions not less than 70mm alone shall be permitted. Brick masonry works shall be of minimum 200 mm width, constructed in English bond with cement mortar 1: 6 or richer and plastered with cement mortar 1: 4 or richer in all cases. However, in each case of parapets or other dwarf walls of height less than 700 mm, thickness of masonry can be reduced

from 200mm provided pilasters of minimum 200 x 200 mm are constructed monolithic with such walls at a center to center spacing of maximum 3000mm.

10.9 PLAIN AND REINFORCED CONCRETE

10.9.1 DESIGN ASSUMPTIONS

IS 3370 Code of Practice for concrete structure for storage of liquids Part I: 1965(or latest edition) General requirements
Part II: 1965(or latest edition) Reinforced concrete structures. Part IV: 1967(or latest edition) Design tables
IS 2502/1963(or latest edition) Code of practice for bending and fixing of bars for concrete reinforcement.

All RCC/Steel structures shall be based on the relevant IS Codes. Strict adherence must be established to accepted codes of Practice relating to design. Minimum cover to reinforcement for RCC work shall be provided as per IS 456-2000(or latest edition). The effect of seismic forces shall be taken into account in the design as per the relevant code of practice.

10.9.2 CEMENT

The contractor will have to procure the cement for the work. The cement used in the work of pumping station or water front structures should be sulphate resistant - cement of reputed companies having ISI mark. The KMC will have the option of rejecting the cement procured by the contractor and ask for replacements, in case of any doubt on quality and age of cement supplied at site. Random/grab sampling and test of the cement will be got done by KMC.

10.9.3 REINFORCING STEEL

Only Corrosion Resistant Steel (CRS) is to be used for the steel structures. The contractor has to procure all the steel required for the work. The steel so procured should

be from reputed companies like SAIL, TISCO etc. and the KMC will have the option to select the brand and to ask for replacement, if the material is found not having adequate quality. The MS/TOR rods supplied for the work shall be cleaned and scrapped to be free of scales rust etc., before placing in forms for RC.C work.The test result has to be submitted before starting the work

10.9.4 AGGREGATES

The coarse and fine aggregates shall comply with IS 388-1980 or latest edition and may be used after sufficient tests have been carried out and approved by the Executive Engineer. All aggregates shall be stored on hard impervious surface to ensure exclusion of all foreign materials.

10.9.5 WATER

The water for mix shall be clean and free from harmful matter as per IS standards and taken from a source approved by the Executive Engineer.

10.9.6 ADMIXTURES

Only where a beneficial effect is produced shall any admixture to be used and that too after tests have been carried out to convince the Executive Engineer that no harmful effect will be produced by the use of such admixture and after approved by the Executive Engineer. Time tested admixtures shall be permitted to be used for concrete based on testimonial of performance to improve the quality of concrete with respect to its strength, water tightness or for other specified purposes as required for the work.

10.9.7 MIXING

The grade of concrete shall be as per IS 456:2000 or its latest revision. All water retaining or water front structures and machine foundations shall be made in RCC mixes not leaner than M25. The mixing time shall be between 2 to 4 minutes. The contractor should produce mix design for all grades of concrete to be used for the work and get approval from the Executive Engineer before commencement of concreting.

10.9.8 CONCRETING

The concrete mix shall be in specified proportions satisfying the maximum aggregate size/water cement ratio and required cube strength and workability. Such concrete must

be adequately vibrated to form solid mass without voids. External vibration by the use of pneumatic hammers shall be deemed adequate except for thin sections.

10.9.9 TRANSPORTATION AND PLACING

Transportation and deposition of concrete mix shall be done rapidly and accurately with minimum re-handling. The mix must not be dropped from such a height as may cause segregation and air entrapment. When the mix is placed in position, no further water shall be added to provide easier workability. No concrete mix shall be used for the work if it has been left for a period exceeding its initial setting time before deposited and vibrated into its final position in the member. Sufficient number of cubes must be made for testing as per the relevant BIS code specifications. It shall be tested as per the specification and a complete register of entries shall be maintained by the contractor. It shall be brought to the notice of the Engineer in charge as and when directed by the departmental officer. The cost of all such testing shall be borne by the contractor.

10.9.10 CONSTRUCTION JOINTS

Construction joints shall be avoided wherever possible, and if found necessary, should be of such form to encounter direct compression. A stepped joint being preferred in such a case.

10.9.11CURING

Curing shall be done as per relevant provisions in the IS code to allow the concrete attain strength through normal hydration and to avoid excessive shrinkage or harmful effect to the member. The method adopted shall be effective and any special method used must be approved by the Executive Engineer.

10.9.12 REMOVAL OF FORM WORK

Removal of form work shall be done as per the provisions in the BIS and as per direction of the Executive Engineer and in such a manner that no damage is caused to the deflection to minimum deflection, when unsupported and as per the direction of the Executive Engineer.

10.10 DOORS, WINDOWS AND VENTILATORS

10.10.1 Wooden doors and windows and ventilators shall be made with teak wood only and the size of doors, frames, shutters etc shall be not less than the sizes specified in MDSS, PWD standard data book etc. All parts of the door shutter or frame shall contain only hard wood seasoned. Wooden doors and shutters shall be provided for interior doors of office rooms/ private rooms etc.

10.10.2 Steel doors, windows and ventilators shall strictly conform to the specifications of BIS. Steel doors, windows and ventilators shall be permitted only for locations where aggressive conditions damaging the doors do not exist and when appearance of the same do not adversely affect the pleasing appearance of the main view and aesthetic condition of the structure. Steel windows and ventilators shall have crossbars for preventing through passage of solid materials of least dimension of 120mm in open position provided in aesthetically pleasing manner.

10.10.3 For areas directly facing the main views of the structure, aluminium doors, windows and ventilators shall be provided for improving the front view of the structure so far as there are no aggressive surroundings damaging the life or the pleasing appearance. All aluminium sections shall be anodized as per ISS.

10.10.4 PVC doors of specifications conforming to those of BIS or of better quality may be used for water closets, bathrooms or other locations where splashing of water may affect the life of other type of doors.

10.11 PLASTERING OF EXPOSED SURFACES

All exposed concrete surfaces shall be plastered with cement mortar 1:4 or richer mixes. Exposed surface means exposed to air or water or any other gaseous or liquid medium. Surfaces of concrete structures other than water retaining structures can be permitted to be left un plastered under the following conditions:

(i) The surface left un plastered is perfectly even without markings of form work or undulations or unevenness greater than 0.5 mm.

(ii) The surface texture is perfectly uniform and the appearance is pleasing.

10.12 TESTING OF WATER RETAINING STRUCTURES.

All water retaining structures shall be filled with water and tested for water tightness before the commencement of plastering. For water retaining structures the requirement of the test shall be deemed to be satisfied if the external faces show no sign of leakage and remain apparently say, over a period of observation of seven days after filling up to maximum water level and allowing seven days period for absorption, if the structure does not satisfy the condition of the test and the daily drop of water level is decreasing, the period of test may be extended for a further period of seven days, and, if the

specified condition of the tests are satisfied, the structure shall be considered to have withstood the test.

10.13 PIPES AND PIPELAYING

The material and class of pipes used for the contract shall be as specified in the Scope of Works or tender drawings in the "Scope of Works." In case the pipes have not been specified for an item of work, the contractor shall put forth his proposal in accordance with CPHEEO guidelines and rules of BIS and get prior approval from the Engineer in charge. Pipe laid underground
shall have a minimum earth cover of 1.00 m above its crown and in such a manner that the bedding angle is not less than 1200, and the loads of pipe carrying liquid and the overlaying substance transmitted to the soil uniformly through the entire barrel of the pipe. For AC pipes, such cover above the crown shall be 1.20m at the alignment over which heavy traffic is expected. Whenever special fill materials are required to achieve this goal, sandy soil / river sand shall be provided at no extra cost by the contractor and on the approval obtained from the Engineer in charge. Wherever the cover for the pipe is less than 1.00 m, approved protective measures shall be taken and necessary works executed to see that the pipes are not damaged due to any external loads. In cases where the pipes are laid at ground level, adequate
protective works ensuring the safety, serviceability and durability of pipes as approved by the Engineer in charge shall be undertaken as part of the contract. When pipes are over the ground, the support shall be designed and spaced in such a manner that the total stress induced in the pipe shell material at any section does not exceed the safe permissible values. In no case, the socket or spigot shall be allowed to transmit weight of other parts. For design purposes, minimum vertical and horizontal loads of 150 kg/m shall be assumed to act on the pipeline over and above the other known loads. Pipes rising vertically or at angles greater than 20° to the horizontal and which cannot carry / transmit the load through the shell of the barrel uniformly shall be only of flanged pipes. These pipes shall be supported appropriately both vertically and horizontally to ensure the positional fixity in the desired axis in such a manner that no part of shell of the barrel is subjected to stresses above safe permissible values.

During laying of pipe line, the open end of pipes shall be kept closed with dummies, blank flanges or end plugs at closure/suspension of work to prevent entry of soil, or, other unwanted material inside the pipe. No pipe shall be left open for period exceeding 30 minutes even in the presence of responsible personnel. Laying of pipes should be done in accordance with relevant IS codes with its latest amendment and revisions.

10.13.1bGENERAL

This specification covers supply, testing and delivery of pipes of required length. The pipes are to be designed to withstand the effect of internal water pressure, external loads and surge pressure.

The intending tenderers should produce an undertaking with the manufacture of pipes and specials regarding the capability to cope up with the contract, specification/quality etc. and submit it along with the render.

Quality of materials and manufacture

Quality of materials and manufacture of pipes and specials should confirm to the relevant BIS or ISO Specification and shall have the respective certification marks of the Standard organization

Marking on pipes

Each pipe shall be legibly marked with the following details.

i. Manufacturer's name or trade mark
ii. Nominal size (as per relevant ISS) Pipe description - class and grade.
iii. Relevant ISI/ISO Certification markings

All dimensions and specifications shall strictly adhere to the relevant I.S codes/ISO Standards and as amended up to date.

Testing of pipes

The field test pressure to be applied shall not be less than the greatest of the following.

1. 1.5 times the maximum sustained operating pressure
2. 1.5 times the maximum pipeline static pressure
3. Sum of maximum sustained operating pressure and maximum surge pressure
4. Sum of the maximum static pressure and surge pressure subject to a maximum for any pipe and fittings incorporated.

HYDRAULIC DESIGN OF PIPELINES

Hydraulic design of pipelines etc. where design based on Hazen William's formula as recommended by the Water Supply Manual is used, selection of the formula shall be done to get the higher design values.

Designation of fittings

The following information shall be clearly marked on each fitting.

(1) Nominal size and weight / wall thickness
(2) Classification based on pressure
(3) Manufacture's name.

10.14 SUPPLY OF MATERIALS

10.14.1 SUPPLY OF PIPES

All pipes as per the scope of the work supplied should be factory tested and test certificate as per relevant specification/latest code of practice should be produced along with the pipe supplied. The testing of pipes and the authentication of test certificate should be done by an approved third party inspection agency agreeable to KMC and witnessed by the technically qualified officers of KMC if the contract value exceeds Rs.100 lakhs and by a Departmental Officer deputed by KMC if the contract value is less than Rs. 100 lakhs. In case the pipes are imported from abroad, samples for metallurgical and mechanical tests shall be taken from pipes selected at random and the final acceptance of the pipes will be based on the results of such tests conducted at any of the reputed laboratories.

10.14.2 SUPPLY OF SPECIALS

The supplied specials should be tested as per relevant specification and latest code of practice. The certificate of testing should be authenticated by the technically qualified officers of KMC or a third party agreeable to KMC.

10.14.3 SUPPLY OF EQUIPMENTS

The works to be executed under this contract shall call for procurement of a number of mechanical items and equipments. The contractor shall procure any equipment / item only after the Authority has approved the manufacturer of the same. Any item / equipment procured and used shall, as far as possible bear certification marks of BIS, BSS or such other standard institutions of international repute and shall be brand-new only. Further care shall be taken that any part / component of such an equipment, which require periodic replacement shall be readily available in the market. Equipments requiring periodic replacement of non-standard, unpopular or odd items shall not be procured or used for the fulfillment of this contract. Equipments requiring periodic

maintenance shall be identified and a preventive maintenance schedule prepared for such equipments and handed over to the Authority.

10.14.4 ELECTRICAL INSTALLATIONS:

All electrical installations shall be done as per the I E rules and with the concurrence of the Electrical Inspectorate and /or Kerala State Electricity Board. All electrical works shall be done only through approved / licensed persons having qualification, experience and expertise to do the work. It shall be the contractor's sole responsibility to get any clearance from the Electrical Inspectorate.

10.14.5 ELECTRICAL AND ELECTRO- MECHANICAL ITEMS

All electrical and electromechanical items shall be procured from the manufactures approved by the Authority. Any item procured shall bear certification marks of BIS / BSS or another institution of international repute. For any equipment / system requiring periodic maintenance, preventive maintenance schedule shall be prepared and handed over to the Authority as part of fulfillment of this contract.

10.14.6 VALVES

(a) Valves shall be as per IS Specification. Valves shall be double-flanged valves unless specifically permitted by the Engineer in charge. It is permitted to use valves of small diameter than the pipe diameter where it is used provided the valve diameter is not less than 67% of the pipe diameter and approved tapers are provided on both sides to ensure that the changes in the cross sectional area is attained gradually. Valves shall have hand wheel except where provisions of hand wheel shall hinder some other specifications requirements. Valves of diameter 400 mm and above shall be geared / butterfly valves with electrical actuators. Valves shall be provided with an appropriate seating so that weight is not transmitted to the adjacent pipe body. Anchoring of pipes at bends or such other locations shall be done in such a manner that the joints of the bend with the straight pipes are not embedded in concrete and easy working of the joints is possible. Scour valves shall be as per the standard specification.

10.14.7 BENDS & SPECIALS

Bends may be in horizontal plane, vertical plane or in both planes and at angles varying from 11 1/4 ° to 90°. Care must be taken to avoid 90° bends as far as possible and in case it becomes inevitable, permission for the same must be obtained from the Engineer in charge, before laying of pipeline at that section. Bends and specials shall be procured

from manufacturers whose products are time tested and have the approval of BIS. The name of manufacturer/or registered trademark and hydraulic proof test shall be marked

on all such specials/fittings. As a special case, non-standard MS fabricated bends/specials will be permitted according to site conditions for non-standard bends with the approval of the Engineer in-charge of the work.

10.14.8 CAST /DI IRON MANHOLE COVERS AND FRAMES

The basic requirements of the manhole covers to be used shall be of Heavy Duty grade and Square shape for water supply and circular for drainage work. The manhole covers shall be that manufactured from appropriate grade of cast iron, which shall not be inferior to FE 150 conforming to IS 210 (1978) or latest edition. The manufacture and workmanship shall conform to clause 5 of IS 1726-1991, IS 210-1978 & IS 4905-1968 or their latest versions. Suitable locking devices including that with a Galvanized chain and lock or any such foolproof devices as approved by the Engineer before the supply and erection, the manhole cover/frame shall be provided. The minimum dimension of the manhole cover shall not be less than 60 cm and shall be coated with approved quality of materials as per IS 1726-1991. Each manhole cover and frame shall have embossed on them an identification mark i.e., the mark "KMC" to denote Kozhikode Municipal Corporation together with the manufacture's name/trade mark.

10.14.9 MECHANICAL EQUIPMENT
The mechanical equipment to be installed in intake structures are as noted below:

(i) Pumps and Motors

The pumps and motors supplied and installed at intake structures and at any pumping stations of the project shall be of reputed make with low life cycle cost and energy efficient, as per specifications. The design of pump set shall be in such a way that energy consumption during the starting and operating conditions are minimum. Pumps shall have optimal efficiency for the specified / desired discharge as per tender through out the design life of pump set. The selection of number of pump sets shall be made in such a way that at least 100% stand bye is available at any time if the number of pump sets required at each station is not otherwise specified. In case of more than one pump working in combination, either in parallel or series, the different working conditions shall be separately studied and the best energy – economy condition shall be selected. The analysis on operation conditions, the design and the performance characteristics of the pump sets shall be furnished to the Engineer in Charge as a submittal and his prior approval of the same is essential before the actual procurement and installation. In case

the tenderer is not the manufacturer of a particular item, he shall disclose the manufacturer of each and every item he proposes to procure for the project. In ever y such case, he shall present a list of not more than two manufacturers from whom he is planning to procure the items in the order of preference. For preventive maintenance of the pumps, motors and switch gears, consumable spares for the next two years after the completion and commissioning of the work shall be provided by the contractor. The contractor shall also furnish the list of vendors from whom such spares can be procured in future.

(ii) Motors, Gears etc.

Motors, gears or such other equipments having constantly moving parts while in service, if installed out door, shall invariably be kept only in metallic boxes / other protective enclosures to protect the equipment from intense sun light, rain and dust. Such items should be quite durable and free from deterioration due to environmental conditions.

(iii) Electrical Panel Boards & Switch gears

It shall be the responsibility of the contractor to supply and install suitably designed electrical panel boards as per attached specifications, which shall have necessary provision for taking the power supply from KSEB. All such panel boards shall satisfy and comply with the rules and regulations of the Electrical Inspectorate. The contractor shall carry out all such electrical works through a licensed electrical contractor as per the requirements of I E rules. The design and details of the electrical system at each station together with the specifications of the proposed panel board, circuit breakers, fuse units etc, shall be submitted to the Engineer in charge for his approval, before actual commencement of work and submission to the Electrical Inspector ate. All such items shall be of reputed make and the manufacturer /supplier of each item shall be specified in the submittal along with all other relevant details. The panel boards shall be painted with anti corrosive epoxy paint approved colour and each installations shall be suitably indicated with name plated on the panel boards. The electrical panels, motors etc. shall be suitably indicated with name plates on the panel boards. The electrical panels, motors etc. shall be suitably indicated with name plates on the panel boards earthed as per IE rules. It shall also be the duty of the contractor to obtain necessary clearance and approval of the electrical inspectorate in all the electrical and electro-mechanical equipments provided for the project as a part of this contract. Instances may occur when it may become necessary for providing transformers for drawing power from KSEB and in all such cases, the supply and erection of transformers, yard structures, switchgears and panel boards shall have to be done as a part of this contract as per IE Rules and Regulations. The contractor shall fully envisages these things and shall have to execute

all such works through licensed personnel and obtain the clearance of Electrical Inspectorate for the proper commissioning and functioning of the system.

10.15 VALVE CHAMBERS

Valve chambers shall be constructed as per the dimensions provided on the Scope of Work. The construction shall be done only as per the drawing approved by the Engineer in charge. The material used for construction shall be best quality wire cut bricks and both sides plastered / RR with inside plastering / RCC depending upon the design load conditions, availability of space environmental impacts etc. Underground valve chambers along motorable roads shall be of RCC. The design of the valve chamber including that of the cover slab indicating the location, size and class of the manhole cover etc. must be furnished to the Executive Engineer before the actual construction, and, his approval must be received before the commencement of the work at site.

10.16 ANCHOR BLOCKS

All the bends in pipelines (from 11 1/40) shall be provided with suitably designed Anchor blocks. The design of Anchor blocks shall be prepared as per the Water Supply Manual and relevant I.S. Codes and got approved by the Engineer in charge before execution.

10.17 DISCHARGE OF EFFLUENT

Discharging any effluent which may either be a bye product of the system or waste from the system, as a result of trial run or otherwise, shall be done carefully not inviting opposition / resistance / objection from any corner. If such discharge requires any form of treatment or any type of civil or other structures for the preservation of original environment conditions, the tenderer shall include such works also in his offer even though such a work has not been envisaged in this document.

10.18 ARCHITECTURAL FEATURE

Architectural features of the structures constructed shall be pleasing, attractive and matching to the site conditions. Selection of colour combinations, ornamental works, materials used for such ornamental works etc. shall be done bearing in mind the following properties as (1) fading phenomenon, (2) resistance to severe climatic conditions (3) strength to withstand unexpected forces that may act on the material / member etc.

10.19 NON DESTRUCTIVE TEST FOR STRENGTH:

Any constructed structure or erected equipment shall be subject to a non destructive test to ensure or certify about its capacity to yield the desired service if required by the Engineer in charge. Such tests shall be the ones specified by the ISS / BSS / CPHEEO Manuals or a more severe test. An equipment / component shall be deemed to have satisfactorily passed such a test only if the Engineer in Charge of the works is satisfied on the performance under test conditions.

10.20 TRAINING TO AUTHORITY STAFF

The Engineer in charge will furnish a list containing the names and designations of the various staff to whom the training in the operation, maintenance and attending to emergent situations are to be given. When the contractor is satisfied that sufficient training both in theoretical and practical aspects have been imparted to the staff thus deputed, shall issue a certificate in that respect which shall be forwarded to the Engineer in Charge. The training shall preferably be in the place of the project work. However, if requested, the contractor shall be permitted to give part of the training to the Authority staff at his place of choice after due consideration of all aspects.

CONSTRUCTION, SUPPLY, INSTALLATION, TESTING, COMMISSIONING AND OPERATION & MAINTENANCE FOR FIVE YEARS OF THE SEWAGE TREATMENT PLANTS FOR KOZHIKODE MEDICAL COLLEGE WITH SEPTAGE TREATMENT FACILITIES FOR SURROUNDING AREAS WITH ELECTROLYTIC TECHNOLOGY

1. Scope of Work

Supply, installation, testing and commissioning of the Sewage Treatment Plant of Sewage Treatment Plant For Kozhikode Medical College With Septage Treatment Facilities For Surrounding Areas, Kozhikode including all mechanical and electrical equipment, instrumentation, control panel, pipes, valves, fittings, supports, cables etc. complete in all respects including maintenance of the plants during defect liability period (1 years) and preparation and submission of final drawings and obtaining final consent to operate from concerned department. All statutory approval should be obtained by the contractor before starting the work. If any fee necessary to get NOC from various agencies, contractor should first pay the fee and the Employer will reimburse the same on submission of supporting bills/ copy of challans on completion of the entire work.

. Any defects noticed during the warranty period shall be properly rectified to the satisfaction of the Authority by the contractor at his own risk.

The contractor shall arrange the commissioning of the plant using external agents, if required. DLP shall be reckoned from the date of successful commissioning of the plant. The maintenance of the plant during the DLP shall also be under the scope of this contract. Additional requirement arising from progressive occupancy shall also be taken care of.

The scope includes:-

a) Complete Investigation of Site and the Sewage for the design.
b) Sewage characteristic evaluation for process design.
c) Design of suitable components to treat the sewerage as per the standards of Kerala State Pollution Control Board.
d) Temporary pumping arrangements during the construction period
e) Construction and commissioning of STP and effluent recycling system as per the approved design.

f) Treating the effluent water to the Pollution control standards for the recycling with necessary tertiary treatment.

g) All Civil, Electrical, and Mechanical works for the successful commissioning of the STP.

h) Landscaping works – design and execution.

i) Trial running and Commissioning in all respect.

j) Design and construction of recycling system and recycling the treated water for the gardening, Toilet flushing, as coolant for the A/C chiller unit with in the medical college campus

k) Operation and Maintenance of Plant for 5 years

l) Drying of the sludge and packing of the sludge and its removal during the O& M period.

The completed construction process should be digitalised in videos and a picture, with time frame, for the training purpose of Kozhikode Medical College & Kozhikode Corporation officials also included in the scope of work. It is the responsibility of the contractor to maintain the quality of the entire work done by him successfully and carry out operation and maintenance for a period of 60 months after commissioning .When the O &M period is over the scheme should be handed over to Kozhikode Medical College or as directed by the agreement authority at that time. During the maintenance period, the power charges alone will be borne by KMC and all other expenditure shall be at the cost of the tenderer. The 3 - Dimensional miniature model of the new proposed plant, and other components have to be prepared and to be submitted. The minimum size of the model should be 1.5x3 meter. The same shall be displayed as directed by the Employer.

The building for which the STP is proposed are briefly described as follows:

1. Govt. Medical College Calicut, established in 1957 in Kozhikode District with a landing area of 1.1 km2. At present the hospital lacks organized sewerage system and proper treatment facilities. Even though there are separate conduits for carrying toilet waste, the hospital predominantly depends on storm water

drains for disposal of waste water including sewage. Revamping the existing system which has expired the design life doesn't provide any favorable results. At present it is maintained in such a way that rainwater is being collected and conveyed to the sewage treatment plant. The sewage and major quantity of waste water from the hospital is directly released to the insufficient oxidation ponds in the low laying regions, from where it gets overflows to the residential areas.

2. The proposed scheme includes the construction of two sewage treatment plants of 2 MLD & 1 MLD capacities along with the associated sewerage network within the hospital compound.2 MLD treatment plant is designed to accommodate 100 KLD septage collected from surrounding areas.

2. Particular Specifications

The specifications mentioned below, the designs, drawings & quantities arrived at and uploaded for reference are based on the Detailed Project Report submitted by the Consultant. The bidder is required to make an independent evaluation on the process design based on the effluent characteristics for suitability & the discharge parameters of PCB. If any bidder requires modifications from the DPR which is prepared by the consultant and vetted by the Technical Sanction Committee, it should done only with the Consent of the TS authority. Under no circumstance shall the rate in the Financial Quote by the bidder exceed the PAC mentioned in this tender. The bidder is completely responsible for the proper functioning of the plant taking into the consideration the variations in the inlet wastewater characteristics and the outlet standards prescribed by the relevant KSPCB/CPCB at that time.

1) General

All the equipment, plant, machineries, materials and total work shall be to the approval of the Consultant and to the entire satisfaction of the Client / Engineer – in – Charge.

The contractor has to submit all relevant details of equipment, plant, machineries and materials, required, in Prescribed Form / Format, supported by samples (as far as possible), catalogues / brochures, technical details, performance curves, test / confirmation certificates from the manufacturer(s), as soon as the work is awarded, and get it approved by the consultant and client, before procuring the equipment, machineries and materials.

The proposal for equipment, plant, machineries and materials shall be from the Listed Manufacturers / Brands, detailed / specified at the end of this section, which will be an integral part of Contract Agreement.

For an Item only one Manufacturer / Brand will be approved for the project. Alternative Proposal, if any, due to any reason, for any item, shall strictly to the approval of Client and Consultant.

2) Investigation of site

The bidder has to conduct investigation of site in detail including the soil investigation for the foundation of the structures required suiting the soil bearing capacity of the sub strata soil, the maximum depth to be provided for the gravity collection of the sewer inlet , the size and shape of the plot, etc has to be studied carefully. The preliminary soil tests conducted and the shape of the plot is attached herewith. The tenderer has to convince themselves before designing the various components. The size of the site available for the construction of the STP is also attached

3) Sewage characteristic Evaluation:

The character of raw sewage to be analysed after taking 3 samples per day atleast 3 Days in one week in order to ensure realistic value Various parameter including heavy metal content in the sludge etc to be analysed and reported before engineering Design of the Plant. The sewages flowing to the sewers are from the medical college hospital. There are also house hold wastes from College hostel, quarters etc and kitchen wastes from the canteens, minute quantities of biomedical wastes flown through the wash basins from the operation theaters and laboratories. There is also a laundry functioning in the campus and the outflow requires treatment. The design has to be finalized considering all these parameters. All the units should be considered while designing the treatment. The primary inlet parameters considered for design in the DPR is specified below. This result is indicative and the tenderer has to test the samples before designing.

4) **Design of suitable components to treat the sewerage as per the standards of Kerala Pollution control Board**.

The STP components should be designed to treat the Quantity of sewage flow envisaged described in design Design Details below as per the DPR prepared by the Consultant. The contractor has to identify the peak factor and time, raw

sewage characteristics, etc before starting Engineering Design .The sewerage and the output water has to be having a standard recommended by the Kerala State Pollution Control Board. The output water proposed for gardening, Toilet flushing, and to use in the A/C chiller units should confirm the latest standards of Pollution control board. The Effluent must satisfy with the KSPCB standards for such purposes.

5) **Construction of plant:**
The contractor is advised to have a site visit and verify the site levels. The STP should be designed, such that the complete process is completed with least of power consumption, also STP should be at sufficient height to avoid flooding during monsoon.

6) Parameters to be Considered to Calculate O&M Cost For 1 Year

Sl. No.	Item
1	Alum
2	Hypo Chlorite
3	Other Chemicals if any
4	Enzymatic Remediation
5	Operators(designed for 20 hours a day)
5(a)	Skilled operators – 2 no's
5(b)	Unskilled operators – 2 no's

*The bidder can quote the O&M rate for the consecutive years considering 10% annual increase.

7) The Details in Bill of Quantities shall be read in conjunction with Tender / Technical Specifications and Tender Drawings. Any work or details shown in one and not mentioned in others shall be treated as the part of the Contract, as if it is occurring in all other complementary documents. The higher specifications seen only in any of the above documents will over rule the specifications in other complementary documents.

a) Design Details

Based on topography of the site the hospital is divided into 2 clusters

i. Waste Water Generation:

Sewage Treatment Plant of capacity 2MLD is proposed for cluster 1 as per the requirements of the cluster & availability of land and fund. For cluster 2, Plant capacity of 1 MLD is proposed.

ii. Inlet waste water characteristics used for design

Parameter	Range
pH	5.5-8.0
TSS	200-800 ppm
BOD	50-1000 ppm
COD	100-3000 ppm
Oil & Grease	0-30 ppm
TDS	<2100 ppm
Turbidity	20-100 NTU

iii. The effluent characteristics should meet the relevant KPSCB & CPCB norms for disposal on land or water bodies.

iv. Treatment Technology

The treatment technology selected is Electrolytic process. The heart of the treatment is the electrolytic reactor. Simplistically, the reactor containing the four elements viz., anode, cathode, electrolyte & current bring about the destruction of organics through the process of electrolysis followed by Electro coagulation, floatation and removal of suspended impurity.

Every non bio stable compound exhibits bond energy. When the force applied is greater than the bond energy, there is break down of the compound. Bond energy destabilization happens in the cell and the organics are broken down into carbon ash and hydrogen gas. Destruction of organics takes place through bond depolarization. The dissolved impurity is thus converted to suspended impurity and volatiles go as gases. So, in this process, the

dissolved impurity is broken down and converted to suspended impurity and gases. Once broken down, this suspended impurity is removed from the system by coagulation, floatation and subsequent precipitation.

The anode is in Aluminum and this dissolves in the water. Aluminum hydroxide is formed due to the electrolysis process. This acts as a powerful coagulant and brings all the suspended particles “together”. This process is called Electro Coagulation and this takes places simultaneously in the reactor

This coagulated mass is floated up the reactor and removed as scum. This process is called Electro Floatation. In electrolytic process, hydrogen is generated in the cathode and this aids the floatation. In addition, floatation zone is created in the reactor. This process is called Electro Floatation and this ensures that most of the suspended particles, oil and grease are removed as scum from the top of the reactor. The process is a combination of three unit operations occurring in a single reactor in one time zone – Electrolysis + Electro Floatation + Electro coagulation.

v. Process Description

The proposed Treatment System consists of the following units:

2MLD STP with 100 KLD Septage Facility.

- Septage-Receiving Chamber
- Septage-Screen Channel
- Septage- Collection Tank

<u>For 2MLDPlants</u>

- Receiving Chamber
- Screen Channel
- Collection Tank
- Electrolytic Reactor
- Electrolytic Settling Tank
- Filter Feed Tank
- Pressure Sand Filter (PSF)
- Activated Carbon Filter (ACF)
- Treated Water Tank
- Disinfection

- Solid Holding Tank
- Filter Press

For 1MLD Plant

- Receiving Chamber
- Screen Channel
- Collection Tank
- Electrolytic Reactor
- Electrolytic Settling Tank
- Filter Feed Tank
- Pressure Sand Filter (PSF)
- Activated Carbon Filter (ACF)
- Treated Water Tank
- Disinfection
- Solid Holding Tank
- Filter Press

The design details are arrived by the consultant as per the DPR and the specifications are mentioned in the BOQ attached for reference

a) Receiving Chamber

The entire sewer lines which comes out from the buildings are connected to a single pipeline shall be drawn to the receiving chamber through gravitational flow. Both black water from WCs and grey water from bath room, toilets etc. shall be directly fed in to the Receiving chamber.

b) Screen Channel

The principal role of the fine screening is to remove floating materials from the sewage that could damage subsequent process equipment, eliminate materials that may inhibit the beneficial reuse of bio solids and reduce overall treatment process effectiveness. Approximate removal rate of BOD and TSS in the fine screen is in the range of 5- 10% and 5-30% respectively. Manually cleaned fine

screen are used. The collected material of screening is sent to landfill area for safe disposal.

c) Collection Tank

Enzymatic remediation shall be done in the collection tank. Enzyme remediation is the process of addition of bio culture, which will help ensure prevention of solids build-up and odour prevention and enhancing the sewage for the subsequent processes in the STP. The powerful bacteria colonize the collection tank and grow on surfaces thus making it literally free from liquid level fluctuations in collection tank. This significantly reduces the solids buildup in the collection tank, helps in —preparing‖ the organics for subsequent destruction in the Electrolytic Reactor.

d) Electrolytic Reactor

Every non bio stable compound exhibits bond energy. When the force applied is greater than the bond energy, there is break down of the compound. Bond energy destabilization happens in the cell and the organics are broken down into carbon ash and hydrogen gas. Destruction of organics takes place through bond depolarization. The dissolved impurity is thus converted to suspended impurity and volatiles go as gases. The Electrolytic Reactor should be accompanied with rectifier-transformer-heat sink and associated electrical systems with DC bus bars and cables suitable for 400 amps @ 12 v operations. The reactor have froth removal system through rotating screw conveyor drive head with flaps.

e) Electrolytic Settling Tank

Settling is process by which particulates settle to the bottom of a liquid and form sediment. A sedimentation tank allows suspended particles to settle out of water or wastewater as it flows slowly through the tank, thereby providing some degree of purification. A layer of accumulated solids, called sludge, forms at the bottom of the tank and is periodically removed. Settler tank is provided followed by Electrolytic reactor.

f) Filter Feed Tank

The clarified water is passed to the filter feed tank. From here the treated water is pumped to the carbon and sand filters, where the suspended solids, colour and odour will be removed. The filter feed tank (FFT) is provided for 120 minutes detention time. The make of Filter Feed Tank is GLS/GRP. The tank is designed to maintain a residence time of 4hrs.

g) Pressure Sand Filter (PSF)

The treated water which is collected in the filter feed tank shall be pumped into the Pressure Sand Filter using the Filter Feed Pumps. They are the most popular method for removal of turbidity from water. The Pressure Sand Filter consists of a multiple layer of sand with a variety in size and specific gravity. These Filters are designed to remove turbidity and suspended particles present in the feed water with minimum pressure drop. Raw water flows down wards through the filter bed and as the suspended matter, which is treated by addition of a coagulant like alum or poly electrolyte, is retained on the sand surface and between the sand grains immediately below the surface. There is steady rise in the loss of head over a period of time and the flow reduces once the pressure drop across the filter is excessive. The filter is then taken out of service and cleaning of the filter media is effected by flow reversal also called as backwash. To assist in cleaning the bed, the backwash operation is sometimes preceded by air scouring by way of agitation through the under drain system. The air scouring agitates the sand with a scrubbing action, which loosens the intercepted particles.

h) Activated Carbon Filter (ACF)

Filtered wastewater from Pressure sand filter is then passed through the Activated Carbon Filter. They are generally employed in the process of removing organic compounds and/or extracting free chlorine from water, thereby making the water suitable for discharge. Activated carbon is commonly used for removing organic constituents and residual disinfectants in water supplies. This not only improves taste and minimizes health hazards; it protects other water treatment units such as reverse osmosis membranes and ion exchange resins from possible damage due to oxidation or organic fouling. Activated carbon is a favored water treatment technique because of its multifunctional nature and the fact that it adds nothing detrimental to the treated water. Most activated carbons are made from raw materials such as nutshells, wood, coal and petroleum. Carbon filtering is a method of filtering that uses a bed of activated carbon to remove contaminants and impurities, using chemical adsorption. Each particle/granuleof carbon provides a large surface area/pore structure, allowing contaminants the maximum possible exposure to the active sites within the filter media.

i) Treated Water Tank

Disinfection of wastewater is done to prevent infectious diseases from being spread and to ensure that water is safe for human contact and the environment. The treated effluent is then disinfected with chlorination using the hypochlorite solution. A Chlorine dosing units is provided as standby.

j) Disinfection

Final stage of treatment is disinfection. Disinfectants are antimicrobial agents that are applied to destroy microorganisms that are living on the objects. These are added to treated water tank. Water chlorination is the process of adding chlorine (Cl2) or hypochlorite to water. This method is used to kill certain bacteria and other microbes in tap water as chlorine is highly toxic.

In particular, chlorination is used to prevent the spread of waterborne diseases such as cholera, dysentery, and typhoid. Different processes can be used to achieve safe levels of chlorine in drinking water. Chlorine is available as compressed elemental gas, sodium hypochlorite solution (NaOCl) or solid calcium hypochlorite (Ca(OCl)2 . While the chemicals could be harmful in high doses, when they are added to water, they all mix in and spread out, resulting in low levels that kills germs but are still safe to drink.

k) Solid Holding Tank

Solid Holding tank is provided to store and facilitate uniform pumping to the filter press process. Total Sludge produced at settling tanks is separated into solid holding tank.

l) Filter Press

Filter press is simply a kind of machine, which performs Filtration & separation during its Press operation. Sludge from solid holding tank is directed into filter press for further volume reduction. A filter press consists of a series of chambers containing square or rectangular filter plates supported in a frame. Once the filter chambers are loaded with slurry, the plates are forced together with hydraulic rams that generate pressures typically in the region of 70,000kg/m2. Each plate is covered by a material or membrane that acts as initial filter when the press is in operation. As the solid filter cake builds up, the cake adds to the removal of fine particles. The solution coming through the filter, called the filtrate, will be very pure. Filtrate can be drained away for safe disposal or again taken as inlet in collection tank.

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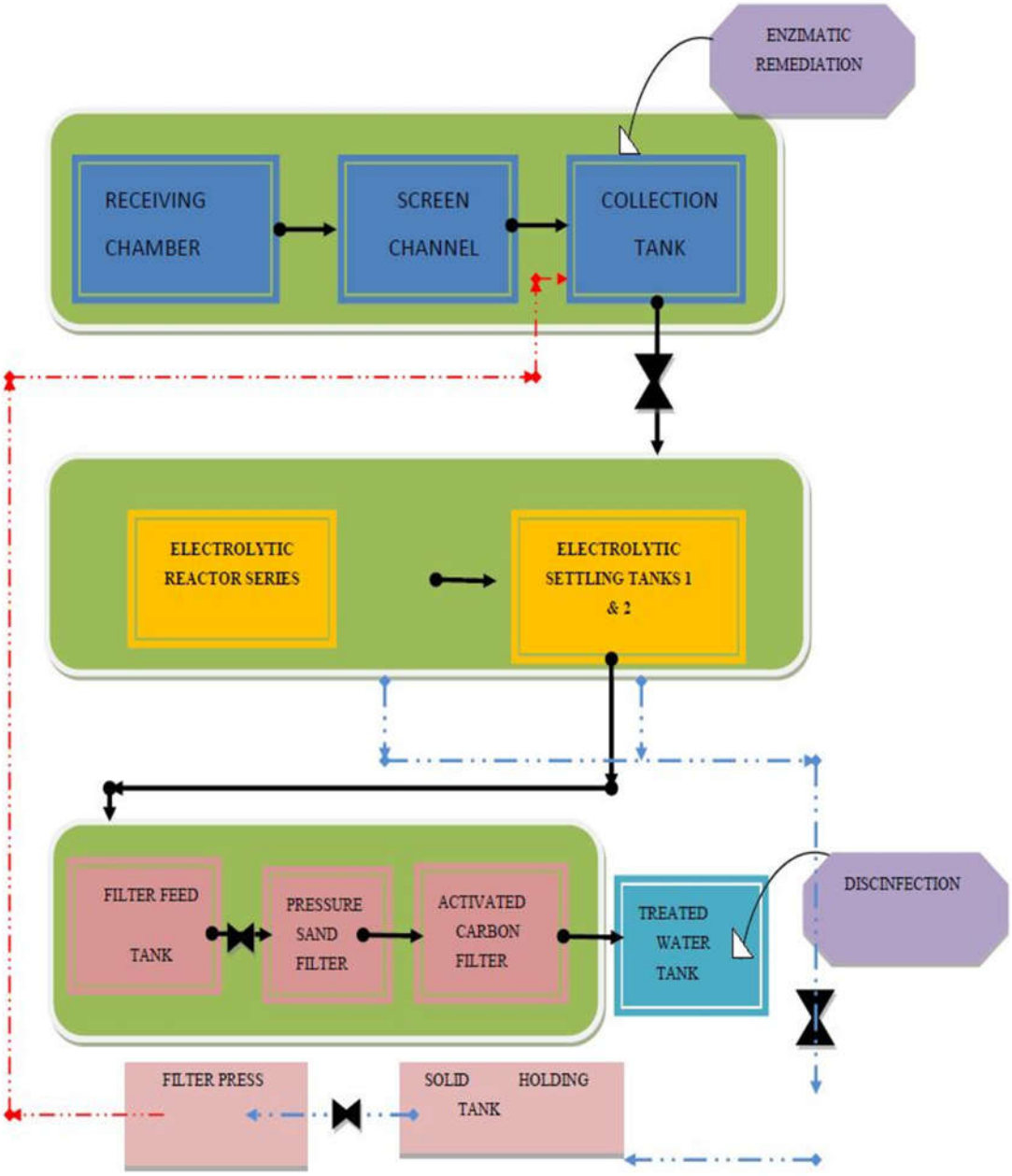
3. Process Flow Chart



4. **Hydraulic Flow Diagram** : *attached*

5. **Site Plan** : *attached*

Kozhikode Municipal Corporation

2. GENERAL CONDITION

2.1. The contractors shall meticulously inspect the proposed site/ alignment, survey the required areas, the pipeline have to cross, etc. and assess all the items of work to be done for the satisfactory completion. The tenderer shall examine and anticipate all incidental works that are not explicitly stated in this document before quoting the work. The tenderer shall scrutinize each item and inspect the site to the satisfaction before quoting.

2.2. The drawings attached with the tender documents are only for giving the tenderer a general idea of the nature and the extent of works to be executed, and shall not be taken as accurate. The actual size, quantity and units required for the satisfactory completion has to be considered and executed. The rates quoted by the tenderer shall be deemed to be for the execution of works taking into account the "Design Aspect" of each item and in accordance with the "Construction Drawings" to be submitted by the contractor and got approved during execution of the works.

2.3. The quoted rate shall be for finished items and shall be complete in all respects including the cost of all materials, labour, tools & plants, machinery etc. The quoted rate should include and all taxes, duties, levies, octroi, royalty charges, statutory levies etc. applicable from time to time. The quoted rate shall be inclusive of any other item required but not mentioned here involved in the operations described above. The rate shall include the pumping out or bailing out water if required, encountered from any source such as rain, floods, and subsoil water table being high or due to any other cause whatsoever. The Authority shall not supply any material, labour, tools & plant etc. unless explicitly mentioned so.

2.4. All preliminary designs, relevant details, lay out and preliminary general drawings of the proposed civil, electrical and mechanical works shall be submitted along with the tender for comparison in case there are any modifications proposed (Ref 2. Particular Specifications above). Tenderer should disclose the names of suppliers of each major item if he is not a manufacturer of the same. The full particulars regarding method of execution of work or any other relevant information shall be furnished to enable the authority to have a correct evaluation.

2.5. The quantity of work mentioned in this volume should be carried out fully. The incompletion or omission of any item during execution on valid reason should be approved by the Engineer in charge. For such work/ item a proportional amount for the quantity not carried out in each item shall be deducted from the contractor’s bill at either the rate approved in breakup of payment or the .estimate rate whichever is higher.

2.6. Once the work is awarded the tenderer shall prepare the detailed design and drawings of all structural, plumbing, mechanical, electrical and architectural works and shall submit to the Superintending Engineer or Officers delegated for the purpose and get the approval before execution. Necessary consultancy fee in this regards shall be paid by the contractor. The work shall be carried out only in accordance with the approved drawings. All the drawings of a particular component shall be submitted before the commencement

of that component. The drawings shall be full with every detail and shall be properly correlated. In case any difference noticed between the drawings, the final decision, in writing of the Engineer shall be obtained by the contractor and the contractor shall be binding to do accordingly. The drawing of all fabrication works such as clarifier bridge, ladder, hand rail, water level indicator, windows, gates etc. shall be prepared and got approved by the engineer in charge before fabrication and erection. Any fabrication work without approved drawing shall not be allowed. One copy of all the drawings with the signature of the approving authority and with any changes/ modification done in the field as approved by engineer in charge and shall be kept along with the bound volume of drawings and submitted on completion of the work.

2.7. All materials to be used on works shall bear I.S. certification mark unless specifically permitted otherwise in writing. In case I.S. marked materials are not available (not produced); the materials used shall conform to I.S. or CPWD specifications, as applicable in this contract. In such cases the Engineer shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified as “First Quality" by the manufacturers shall be used unless otherwise specified. Proper proof of procurement of materials from authentic manufacturers shall be provided by the contractor to the satisfaction of Engineer. The registered contractors / firms who are not the manufactures / authorized suppliers of the Mechanical and Electrical equipment for the water treatment plant shall furnish the names of the manufacturer / authorized suppliers, with whom they have made arrangements for the supply erection and maintenance of such equipment required for the plant. Testimonials from the manufacturer / suppliers, showing their previous experience in the supply, erection and maintenance of similar kinds of work and signed by the authorized signatory from the manufacturer / supplier supporting the contractor or the firm guaranteeing the supply / erection and maintenance of such equipment and also a letter addressed to the Superintending Engineer by the suppliers / manufactures to the above effect. For items, where so instructed by the Executive Engineer, samples shall be procured or prepared and submitted before starting the particular items of work for prior approval and nothing extra shall be payable on this account.

2.8. The tenderer shall submit the design, technical specification, all relevant drawings, leaflets, characteristics curve and efficiency chart of the pump sets signed by the manufacturer. The details of manufacturer, brand name, batch number and number related to all equipments shall be furnished. The tenderer shall inspect the site, ascertain the head of each pumpsets, take measurement and asses the actual requirement of cables, pipes, specials, earthing materials etc. The design and drawing of the electrical work shall be in accordance with the IE rules and relevant IS code of practice and specifications. It is the responsibility of the tenderer to get approval for the design and drawings from the Electrical Inspectorate, Kerala State Electricity Board etc. The tenderer shall provide necessary guarantee for the performance of pump sets and all other accessories and equipments for a minimum period of one year from the date of commissioning of the installations after trial running and formal taking over by KMC. Any part of supply found defective during the guarantee period after successful commissioning must be replaced by the contractor at their own cost with in one week of getting intimation from KMC. All electrical works shall be required done through person who is having valid A class electrical license. It is the responsibility of contractor to take power connection from the service main line of KSEB. The statutory fees if any payable to KSEB for the permanent connection will be paid by KMC.

2.9. All materials to be used in the work shall be tested as per provisions of the mandatory tests in the relevant IS specifications. Tests shall also be conducted if there is a doubt in the quality of any of the material supplied or stored for a long time during the work. The contractor shall carry out tests to ensure bearing capacity after the lay out is approved before finalizing the foundation. The contractor shall also repeat the test if there is any change is soil strata are found during excavation of any of the component which will affect the stability of the structure. The contractor shall carry out the tests on concrete like cube tests, design of mix etc as instructed by the engineer in charge whenever there is change of source of material supplied to ensure quality. The Engineer may relax the condition regarding testing if the quantity of materials or work is small. The tests shall be carried out at reputed institutions where testing facility is available, as per the direction of Engineer in charge. The testing fee of all the above tests shall be paid by the contractor. At least one testing machine for compression test of cube, properly calibrated, shall be available at site for testing the concrete cube samples. All necessary field tests directed by the Engineer in charge shall be done and the expenses shall be borne by the contractor.

2.10. At any rate it should be understood that it shall be the contractor's sole responsibility to ensure that the foundations, structures, pipe lines, electrical and mechanical equipment are 100 % safe, durable and functioning. Defects if any found during the period of guarantee shall be attended immediately failing which the department will attend them at the cost of supplier and the amount expended shall be deducted from the contractor.

3. General technical specification

3.1. General

The specifications detailed hereunder are addition/modification to the specifications given above. In the case where the specification are not available for any particular item, It should be carried out as specified according to Manual on sewage and sewerage treatment by CPHEEO, 1999(or latest edition), Standard data book of PWD/PHED (Kerala), CPWD and according to the technical circulars issued by Kerala Water authority from time to time respectively. If specification is not available in any of the above, the work shall be executed as per latest relevant standards/codes published by B.I.S. (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, upto the date of opening of tenders. For the items not covered under any of the specifications stated below, the work shall be executed as per Manufacturer's specifications/ General Engineering Practice / local usage, as per direction of Engineer in Charge.

3.2. Civil works.

3.2.1 Design Considerations:

The contractor shall be responsible for the safety of structures, correctness of design and drawings. Complete detailed design calculations of foundations and superstructure together with general arrangement drawings and explanatory sketches shall be submitted to the Engineer-in-charge. The design considerations described hereunder establish the minimum basic requirements of plain and reinforced concrete structures, masonry structures and structural steel works. However, any particular structure shall be designed for the satisfactory performance of the functions for which the same is being constructed.

All buildings and structures shall be designed to resist the worst combination of the following loads/ stresses under test and working conditions: dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials dynamic load, vehicular load and uplift pressure etc. Dead load, live load, wind load, and earthquake load shall be taken as per relevant BIS codes. The dynamic load due to working of machines/ equipments shall be considered in the design of structures as given by the manufacturers or in IS code, which ever is more. IRC Class A (wheeled vehicle) loading shall be considered for design of structures under the roads or where there is an entry of vehicle (like store, chlorine house).

Liquid retaining/conveying structures including the members covering the same (such as roof of a chamber, channel etc.) shall be designed by uncracked method of design as per IS:3370 and IS: 6494. Basement RC walls and slabs below ground shall also be designed by uncracked method of design as liquid retaining structures. Shear shall be checked by working stress method as per IS: 456. All underground or partly underground liquid containing structures shall be designed for the following conditions:

m) Liquid depth up to full height of wall including free board : no relief due to soil pressure from outside to be considered;
n) Structure empty (i.e. empty of liquid, any material, etc.): full earth pressure and surcharge pressure wherever applicable, to be considered;

o) Structures shall be designed for uplift in water logged ground during rain in empty condition. Factor of safety against uplift shall be 1.2.

p) Walls shall be designed under operating conditions to resist earthquake forces from earth pressure mobilization and dynamic water loads;

q) Underground or partially underground structures shall also be checked against stresses developed due to any combination of full and empty compartments with appropriate ground/uplift pressures below base slab. The design shall be such that the minimum gravity weight (empty conditions) exceeds the uplift pressure at least by 20%.

3.2.2. Excavation

The excavation for all the structures is to be done in all kinds of soil and soft rock including ordinary soil, hard soil, ordinary rock, medium rock, etc. which can generally be excavated by spade, pick-axe and shovel and chiseling medium and hard rock. This shall also include removal of embedded rock boulders. The earth work in excavation shall be done as per specification or as directed by Engineer-in-charge up to required depths and levels and alignments. Roots or trees found during the excavation shall be cut and smeared with coal tar. The sides of the excavated trenches shall be vertical and in straight line and bottom uniformly leveled, watered and consolidated. If the excavation is deeper than 2 m in firm soil the sides of the trenches shall be increased by allowing steps of 30 cm on either side so as to keep the slope 0.25: 1. In loose soft or slushy soil the width of the step shall be suitably increased or the sides sloped or shoring and strutting may be done as per the Engineer's instructions. For excavation for pipe line work, the sides and the bottoms shall meet the required slope,

shape and gradient. The cutting shall be done from top to bottom. Under no circumstances undermining or under cutting shall be allowed. The final surface shall be neatly levelled and well compacted. The earth from the cutting shall be directly used for filling either in plinth or on grounds as directed by Engineer-in- charge. If the trenches are made deeper than specified level due to oversight or negligence on the part of the Contractor the extra depth shall be filled up by lean concrete of mix 1:3:6 (1 cement; 3 coarse sand and 6 coarse aggregate of nominal size 40mm) and if the trench is made wider than shown in the drawings the Contractor has to bear the cost. The trenches shall be free from water and muck, while the foundation work is in progress.

If hard rock is found during excavation it should be removed to the required depth by chiseling. Blasting will not be allowed if there is another structure or other assets existing or being constructed at a distance 15m or below. The protected blasting will be allowed only with prior written permission of the Engineer in charge. Whenever the rock is chiseled the undulations should be leveled by filling with nominal mix concrete not leaner than M15 using 20mm nominal size broken stone. Dowell bars are to be provided where the foundation of structures rest in hard rock. For this TMT bars of minimum diameter 25mm should be used and the minimum depth of boring in the rock shall be 100cm. The bars should extend at least 50cm above the leveling course and suitably bend to accommodate in the foundation as directed. The hole drilled for placing dowel bar should be of minimum diameter 32mm, and this shall be filled with cement grout after fixing the dowel bar. The excavated stacked earth shall be used for refilling the trenches and sides of foundation in 200mm to 250 mm layers and the balance surplus shall be first filled in layers in plinth and the remaining surplus shall be disposed off by uniform spreading within the site/ outside the site as directed by the Engineer. To the utmost extent available, selected surplus spoils from excavated materials shall be used as backfill. Filling material shall be free from clods, salts, sulphates, organic & other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces, not larger than 150 mm size, mixed with properly graded fine material consisting of gravel or earth to fill up the voids and the mixture used for filling.
As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris and filled with earth in layers 20 cm to 25 cm, each layer being watered, rammed and properly consolidated before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer. Filling shall be carried out with approved good material. The material and source shall be subject to prior approval of Engineer. The approved fill material shall be cleared of all bushes, roots plants, rubbish etc. Top soil containing salts, sulphate and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed by Engineer. Surplus fill material shall be disposed off by uniform spreading within the site as instructed by the Engineer. Backfilling material for trenches/pits must be compacted unless specified and built up as to minimize future settlement as much as is reasonably possible. For this, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures.

3.2.3. Concreting

All RCC works should conform to IS:456 and All Steel works should conform to IS: 800. All RCC works of Water retaining structures should conform to IS: 3370. The materials for concrete shall be governed by IS: 456. Grade and type of cement to be used in the work shall be SRC or as approved by the Engineer in Charge before use.

Any cement damage by water or otherwise, defective cement shall have to be removed from the site of work at once. Fine and course aggregate shall be free from injurious amounts of soft and flaky particles and free from vegetable, organic, clayey matter, loom mice, salt and other deleterious materials. The sand shall be clean, sharp and gritty to touch and be freed from earth and other impurities by washing. The source from which sand is to be obtained shall be subject to the approval of Engineer-in-charge. As far as possible clean river sand may be used as fine aggregate for concreting. But in case if the river sand of required quantity is not available, manufactured sand (M sand etc.) can be used provided it confirms to IS:383 (part 2). The certificate of the manufactures shall be produced. Necessary test should be carried out to confirm the quality and grading at reputed institution if directed by the engineer in charge and the testing fee is to be paid by the contractor.

Mix design is normally a prerequisite to any concreting job and shall be done in an approved testing laboratory as and when the materials are supplied. The cost of all such tests, sampling etc. shall be borne by the Contractor. The minimum grade of concrete shall be M30 for all water retaining structures and foundation or structures coming under soil. For all other concrete the minimum grade shall be M25 unless otherwise specified. The environmental exposure condition shall be taken as severe and moderate respectively as per IS: 456.

Reinforcement steel bars HYSD / TMT bars conforming to IS: 1786 shall be used. The tenderer shall inform the Engineer in charge prior to start of work, regarding the type of steel to be used by him, in the works and provide the samples of all diameter of bars used at site. Necessary test as directed by Engineer in charge should be carried out at reputed institution as directed by the engineer in charge in the samples to affirm the quality. The cost of all such testing shall be borne by the contractor. Only the bars approved by him shall be used in the work.

The water to be used in making and curing of concrete, mortar etc. shall be free from objectionable quantities of silts, organic matter, injurious amount of oils, acids, salts and other impurities etc. as per IS:456. Sufficient quantity of water shall be stored at site before every concrete by the contractor. The Engineer-In-Charge shall have the right to order the test materials entering into R.C.C. work to determine their suitability for the purpose. The cost of all such test shall be borne by the contractor. All the faulty materials so found shall be removed from the site of the work by the contractor at his own cost within the specified period as fixed by the Engineer-In-Charge.
The minimum clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows: At each end of reinforcing bar, not less than 25 mm nor less than twice the diameter of the bar whichever is more. For a longitudinal reinforcing bar, cover in a column neither less than 40mm, nor less than the diameter of the bar. In case of columns of dimensions 20 cm or under, with reinforcing bars of 12 mm in diameter, a cover of 25 mm may be used. For longitudinal reinforcing bar in a beam cover neither less than 25 mm nor less than the diameter of the bar shall be provided. For footings and other principal structural members in which the concrete is deposited directly against the ground, cover to the bottom reinforcement shall be 75 mm. If concrete is poured on a layer of lean concrete the bottom cover may be reduced to 50 mm. For concrete surfaces exposed to the weather or the ground water after removal of forms, such as retaining walls, footing sides and top etc., not less than 50 mm for bars larger than 16 mm diameter and not less than 40 mm for bars

16 mm diameter or smaller. Increased cover thickness shall be provided for surfaces exposed to the action of harmful chemicals (or exposed to earth contaminated by such chemical), acid, alkali, saline atmosphere, sulphurous smoke, etc. For liquid retaining structures the minimum cover to all steel shall be 40mm or the diameter of the main bars, whichever is greater. Protection to reinforcement in case of concrete exposed to harmful surroundings shall also be given by providing a dense impermeable concrete with approved protective coatings, as specified by the Engineer. The spacing and cover shall be given strictly according to the provision in the code in all other cases. The correct cover shall be maintained by cement mortar cover blocks. Reinforcement for footings, beams and slabs on sub-grade shall be supported on pre cast concrete blocks as approved by engineer. The spacing blocks should be made as per the direction of engineer in charge well before the commencement of concrete. The use of pebbles or stones shall not be permitted.
The reinforcement shall be as per detailed drawings approved by the Department. Substitution of reinforcement will not be permitted except upon written approval from the Engineer. Erected and secured reinforcement shall be inspected, jointly measured and recorded. The contractor shall be responsible for the accurate fixing of the reinforcement and shall not pour any concrete until the reinforcement has been inspected in position and approved by Engineer. The contractor shall take full precautions to prevent the displacement of reinforcement during concreting.

Contractor shall furnish on the site of work sufficient number of centering, moulds or templates for its expeditious execution. All formwork shall be fabricated in compliance with the best modern practice, so that the finished surface is even, unblemished free of fins and true to line, level and shape as shown in the drawings. The forms shall comply with the requirements of IS: 456. Forms and centering shall be left in place until the concrete has set sufficiently to permit the removal without danger to the structure as specified in IS: 456. The shuttering and form must be sustainable and unyielding, built to correct dimensions and water tight to the entire satisfaction of the Engineer to preserve the concrete from damages or distortion during setting.

The cement, sand and stone chips shall be mixed properly in mechanical mixer in such a manner as to avoid loss of water. The concrete shall be mixed until it is of even colour and uniform consistency throughout. As soon as the concrete is mixed it should be removed to the work in iron vessels as rapidly as practicable. All concrete placed in-situ shall be compacted with power driven or pneumatic internal type vibrators unless otherwise approved by the Engineer in writing, and shall be supplemented by hand spading and tamping where required. Slump test will be carried at site if necessary during execution of work. As far as possible concrete for any particular portion shall be done in one continuous operation. Construction joints shall be provided, where directed and approved by the Engineer-in-charge. Such joints shall be kept minimum and shall be right angles to the direction of main reinforcement. Expansion joints shall be provided wherever directed by the engineer in charge, on where necessary as per standard specification and practice. The concrete should not be dropped from a height over 1.5m. Cement slurry shall necessarily be added over base surface (or) for continuation of concreting for bond. Before commencing subsequent concrete on the one left incomplete, all the loose particles, laitance etc. shall be removed and surface shall be covered with thick cement slurry. The concrete compacted manually shall be laid in layers not more than 15 to 20cm. The successive layer shall follow within 30 minutes or earlier. The R.C.C. slabs shall be cast monolithic with the supporting beams.

The Engineer-In-Charge shall have the right to order the test materials entering into

R.C.C. work to determine their suitability for the purpose. The cost of all such test shall be borne by the contractor. All the faulty materials so found shall be removed from the site of the work by the contractor at his own cost within the specified period as fixed by the Engineer-In-Charge. All steel used in the reinforcement shall be tested and the test report submitted for examination to the Engineer. It should be conforming to the latest I:S specification or its equivalent.

The concrete laid shall not be disturbed and shall be kept thoroughly damped and shall be cured properly according to IS: 456. The contractor shall be responsible for carrying out curing of R.C.C. work with suitable mechanical (electric motor/diesel Engine Operated) device capable of lifting water up to top of OHSR or to the topmost roof. The work shall only be started after such arrangement is installed at site and got approved from Engineer.

Compression test shall be made on 15 cm cubes. The cubes should be made, cured, stored and tested from every batch of concrete. The cubes shall be cast from one batch of concrete, preferably two set of three cubes. There shall be identification marks on each cube. One set should be tested after seven days and the other at twenty eight days. If only one set of cubes are made, they should be tested at 28 days. The minimum frequency of sampling and testing shall be as specified in IS: 456. A complete register of entries shall be maintained by the contractor. The contractor shall have facilities at site for testing the compression strength of the cube.

The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer before the work is considered as complete
The Engineer-In-Charge may require a reasonable number of tests to be made on the concrete during the progress of the work. Not less than 3 specimens shall be made for each test. The specimen shall be cured under field conditions. If the specimen fails to comply with the requirement set out above the Engineer-In-Charge will have the right to order the demolition of such work as he may think to have been carried out in weak concrete at the cost of the contractor and no payment shall be made for the faulty construction.

3.2.4. Foundation

The foundation should start from firm ground of specified bearing capacity only. All the data and details as provided in the NIT about soil are indicative only and bidders are advised to verify them before submission of their offers. No extra payment shall be made against any discrepancies occurring during construction due to change in bearing capacity or change in sub soil condition. Bearing capacity of soil shall be determined as per IS: 6403 before designing the foundation. The bearing capacity shall be tested through reputed institutions as directed by the engineer in charge before the commencement of the work as per the approved lay out and the designs may be done accordingly. The bearing capacity shall be tested during excavation of foundation if directed by the engineer in charge. The testing fee is to be paid by the contractor.

Foundation depths and the type of footings shall be appropriately computed from the above soil exploration data obtained during the soil testing and got reviewed and

approved by department. Leveling course of mix not leaner than M10 of minimum thickness 10cm using 40mm nominal size broken stone should be provided below the foundation of all concrete structures. The design and construction of foundation shall be done according to the general specification in IS: 1904. The design of foundation shall be done according criteria of earth quake resistant structures confirming to IS: 1893. The foundation for the brick superstructure can be either concrete or random rubble. The foundation of concrete columns shall be concrete alone with mix not leaner than M30. Uplift pressure due to ground water table shall also be taken into account in design wherever necessary (Especially in case of sump where lifting under totally submerged condition should not occur).

The minimum depth of foundations for all structures, equipments, buildings and frame foundations and load bearing walls shall be as per the recommendation of BIS provided adequate bearing pressure is available at that depth. Adequate protective measures shall be taken by the Contractor to see that the excavation for the building foundation does not affect the adjoining structure's stability and safety. Contractor will be responsible for the same. The raft slab if used for foundation shall be laid over at least 10 cm thick concrete mix not leaner than M10 using nominal broken stone of 20 mm size as coarse aggregate. The foundation slab shall be designed both for radial and circumferential moments to be analyzed as a circular slab with central opening with ring concentrated load along the foundation beam and uniformly distributed load as upward soil pressure using plate load theory. The same shall be checked for earthquake pressure. In case the bearing capacity is very low that raft foundation is not technically feasible or it is otherwise decided by Department to have pile foundation, the foundation will be laid as pile foundation and shall be binding on the contractor. The contractor shall conduct the initial routine test as per IS 2911 at his own cost, to determine the safe load bearing capacity of piles.

3.2.5. Random rubble masonry

The foundation of super structure wherever concrete foundation is not available shall be in Random rubble masonry (as per clause 10.7. of vol. 1). The stones used in face shall not be less than 22.5 cm wide in plan. Face stones shall be laid as headers and stretchers alternatively to break joints by at least 7.5 cm. No pinning shall be allowed in face. Height of stone shall not exceed length or breadth. Chips shall be wedged in wherever possible to avoid thick beds of mortar. The masonry shall be kept watered for minimum two weeks.

The minimum depth of foundation shall be 60cm and basement shall be 45cm.Damn proof course shall be provided wherever necessary as directed by the Engineer in charge. Dry random rubble pitching of minimum depth 30cm shall be used on sloping ground for protection and also as walkway to various units or valve chambers at ground level. The length, breadth and location will be as directed by the Engineer in charge.

3.2.6. Super structure

The super structure shall be constructed in brick/solid cement blocks. The bricks/solid cement blocks shall be tested and approved by the Engineer in charge before the work. Mix for cement mortar 1:6 shall be used as specified in the respective items of work. All courses unless other wise specified or ordered by the Engineer, shall be truly horizontal and the walls shall be taken up truly plumb. Mortar joints shall never exceed 10 mm in thickness and this thickness shall be uniform throughout. All concrete solid block work shall

be built tightly against columns, floor slabs or other structural member. No tension shall be allowed in solid block masonry.

3.2.7. Lintels and sunshades.

Lintels shall be provided in all openings like the one for doors, widows, ventilators, rolling shutters etc. The lintel on the outer walls of main buildings like filter house, chemical house, pump house, etc shall run all around without breaking. As far as possible cut lintels shall be avoided in other places also.

The sunshades shall extend at least 45cm on either side of the opening. Sunshades shall be provided for ventilators also if the roof is not extended to prevent the entry of rain water. The sunshades in front side of the building should be designed for an aesthetic appearance.

3.2.8. Plastering

All exposed concrete surfaces from 30 cm below ground level up to top shall be plastered with cement mortar 1:4 or richer mixes (ref. clause 10.11 of volume 1 of this NIT). However the concrete surfaces coming in contact with water of the water retaining structures shall be plastered with cement mortar 1:3, minimum 12 mm thick and adding water proof compound of approved quality and with neat cement flushing coat, if not covered with tiles. The concrete surface shall be properly hacked, washed, cleaned and applied with thick cement slurry before applying. All brick work/solid concrete block work unless otherwise specified will be plastered externally and internally with 12 mm cement plaster 1:4. The plastering work shall include for making grooves, bands. Water cutting etc. wherever required and nothing extra shall be paid for the same. The curing shall be started overnight after finishing of the plaster work. The plaster shall be kept wet for a period of 7 days. During this period, it shall be protected from all damages.The random rubble construction shall be pointed with cement mortar 1:4.

3.2.9. Roof

R.C.C. roof slab of minimum M 25 grade concrete of adequate thickness shall be constructed. The roof may be treated with water proofing treatment as per CPWD specification. In general the building height (finished floor to bottom of roof) is 3.6 m unless specified otherwise in the drawing. There shall be parapet wall for the every terrace. There should be parapet/ hand rail protection for every open terrace to a minimum height of 70 cm. There shall be ladder or any other means of access shall be provided to reach the open terraces. Provision may be given for rain water harvesting. Rain water harvesting of the roofs may be done if possible. There shall be sufficient slope in the roof. The rain water gutters and down pipes shall be fixed confirming to IS: 2527. The drain pipes shall be minimum 75 mm diameter and sufficient number may be provided so that the rain water will be drained at once. All buildings shall be provided with damp proofing for basement and floors and water proofing for roofs in specific requirements.

3.2.10. Flooring

Flooring of rooms in ground floor shall be done only after consolidating the earth by watering ramming etc. Flooring should be done with cement concrete mix not leaner than M10 of thickness 7.5cm or above using nominal broken stone 40mm broken stone &

plastered over with 12mm thick cement mortar 1:3 one coat floated hard & trovelled smooth if the flooring comes above the earth. The finishing may be done above this only. The flooring work shall include for laying the flooring in strips / simple designs wherever required and nothing extra shall be paid for the same. In case flooring in pump house 40 mm heavy duty patent stone flooring shall be provided directly over R.C.C. slab in strip placed in suitable manner to avoid construction cracks. The floor finishes shall be tiles, red oxide, paving stone etc. Damn proofing and termite proofing shall be done for all flooring.

3.2.11. Painting.

All plastered surfaces of super structure if not covered with tiles or other means shall be painted over with acrylic emulsion paint in two coats over the priming coat of colour specified by the Engineer in charge. The surface may first coated with white cement one coat and then with cement primer one coat above the white cement coating. All interior walls shall be finished with minimum two coats of acrylic emulsion. The outer walls and other surfaces exposed to sun and rain shall be finished with minimum two coats of antifungal acrylic emulsion paint. All steel or metal surfaces if not coated with other materials shall be painted over with enamel paint of colour specified by the Engineer in charge. The surface may first coated with zinc chromate primer one coat and then finished with enamel paint, minimum two coats.

The metal parts coming in contact with water or submersed in water may be painted over with epoxy paint two coats over the primer coat. Zinc rich epoxy primer and epoxy paint of approved quality shall be used for external and internal painting. No primer shall be applied without prior approval from the Employer's Representative. The max of zinc rich epoxy primer shall be prepared at work site not earlier then 15 minutes before applying the same on pipes and special surfaces. One coat of zinc rich epoxy primer of DFT 75 micron shall be applied along with two coats of epoxy paint DFT 40 micron and DFT 30 micron respectively. No thinner shall be added to ready mix paint without previous approval of the Employers' representative and the finishing coats on top of the primer coat shall only be applied after allowing the film to cure for at-least 48hrs. After application of zinc rich epoxy primer the surface should be cleaned by duster and inspected. If during inspection any portion is found rusting the same shall be removed by emery paper and coated with zinc rich epoxy primer. Mixed paint should be used within 3 to 4 hours of mixing and fresh mixing shall be done for every new application. Every successive coat of paint shall be given only after 48 hrs. of previous coat. Before applying the next coat the surface should be properly cleaned by duster. Under water structural steel work shall be finished with epoxy paint before erection except for the surface coming in contact with concrete. Special care shall be taken for cleaning of comers. Painting shall be carried out during dry weather and according to the manufacture's specification and relevant IS code.

The make, shade and color of the paints shall have to be approved by the Engineer in-charge before use for decorative purpose. Engineer may ask for different shades to be provided for different components or different parts of the same component which the Contractor shall have to do. Cost of priming coat as directed, scaffolding etc. shall be included in the tender rate.

3.2.12. Tile Dadoing

This section covers the requirements for furnishing of all materials, labour tools and

equipment for completion of virtrified tile dado including preparation of surface. The Virtrified tile slabs for walls shall be of the approved make colour, texture and sizes conforming to IS 15622. The thickness of the tiles shall not be less than 7.5mm. For flooring vitrified porcelain tiles of approved make, colour, texture and sizes with shine finish grade 'A' shall be used. The thickness of the tiles shall be 8.6mm and 9.9mm for sizes 300x300mm and 600x600mm respectively. The tiles shall be of uniform colour and shade without crazing. They shall be true to size and shape and free from cracks, twists uneven and chipped edges and corners and other defects. The underside of the tiles shall be ribbed or some other formation so that the tiles adhere properly to the base.

Unless specified otherwise in the item, 12-mm thick cement mortar shall be applied and allowed to harden. The plaster/base shall be roughened with wire brushes or by scratching diagonal at closed intervals. The tiles should be soaked in water washed clean, and a coat of cement slurry applied liberally at the back of tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines. The tiles shall be set in required pattern and jointed. The joints shall be as fine as possible. The joints shall be cleared off the cement grout with wire brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush jointed with white cement mixed with pigment required to match the shade of the tiles. The dado shall be kept wet for sufficient curing and finished clean.

3.2.13. Aluminium Doors and windows

This section covers providing & fixing at all heights / all floors with all leads 25 micron anodized aluminium sections for doors / windows / glazing manufactured from best extruded aluminium sections confirming to IS: 733. The sections shall be cut to length, joints mitered, corners grinded with joints, the outer frame waterproofed, shutter frame stiffened with corner angle cleats. Stiffening rod of 10mm shall be provided in the frame for fixing the frame to RCC columns / masonry sides, RCC lintels on top and PCC sills or floor. The frame work fixed with standard approved fastenings or hinges as per specifications with all the sections pretreated for removal of any rust and prevention of any further rust all complete and direction by the Engineer-in-charge. The work is for supplying all materials, labour, accessories, tools and equipment for installation of anodized/powder coated aluminium glazing doors and windows including fabrication, fixing and fittings etc. The codes and standards generally applicable to the work of this section are listed herein under: IS: 1948 Aluminium doors, window and ventilators. IS: 1949, Aluminium windows for industrial buildings. IS: 7088 Recommended practice for anodizing aluminium and its alloys IS: 733 Wrought aluminium and aluminium alloy bars, rods and sections (for general engineering purpose). IS: 1285 wrought aluminium and aluminium alloy, extruded round tube and hollow sections (for general engineering purpose), IS: 1761 transparent sheet glass for glazing and framing purposes. All Aluminium sections shall confirm to IS (India) Alloy Specification – 63400. Aluminium sections used shall be of approved quality manufactured by the firms like Indal , Bhoruka, Hindalco, Jindal subject to approval of Engineer, and shall be of thickness specified in the item.

Before fixing the doors and windows, the contractor shall submit shop drawings and samples for the approval of the Engineer. Shop drawings shall clearly show all work including mechanical systems, the arrangement of components, other details, all dimensions and thickness, anchoring devices and accessories. Frames shall be square and flat, the corners of the frames being fabricated to a true right angle. Handles, peg stays, tower bolts, locking device, hinges and pivots, floor springs, automatic door

operators shall be provided. Snap of (Clip on) anodized /powder coated aluminium beadings and glazing clips shall be provided as per design and size approved by the Engineer. All aluminium glazing shall be anodized conforming to IS: 7088 to the light fast shade approved by the Engineer. Anodizing shall be minimum 15 microns thick of mat texture, suitably protected during transportation, storage and erection. Powder coating if specified shall be not less than 50 Micron.

The windows and doors are to be fixed with the external finished surface (either stone cladding / external plaster) and hence all the necessary EPDM rubber or wood packing/ rough ground fasteners of fisher, polyurethane backer road of minimum 10mm size, neutral grade silicon weather sealant minimum 10 x 6mm (between the frame and wall or other surface all around) shall be provided within the rate quoted so as to make the junctions fully water tight/air tight as per the drawings. Approved make selected clear glass (clear / frosted) / wired glass of specified thickness (5 to 12mm) as mentioned in the drawings shall be used in doors. Wired glass / frosted glass louvers shall be provided wherever shown in the drawings after grinding the edges.) Necessary hardware like locking arrangement with pin cylinder locks, dead locks, mortised locks, SS baby latch (occupied / vacant) SS push / pull or mortised handle, heavy quality hinges / pivot, concealed tower bolts, etc., of approved make & design (by Architect) as per the drawings and as per BOQ. Floor springs and door closer shall be measured and paid as per mentioned in BOQ. All gaskets used shall be 100% EPDM / siliconised rubbers gaskets of approved colour for long life guarantee. Hydraulic door closer of approved make with minimum one year guarantee as and where shown in the drawings and as directed The frame sides of appropriate size shall be drilled at the marking with an electric drill to house the expansion bolts. Expansions bolts shall be inserted in the holes, struck with a light hammer till the nut is forced into the anchor shell. The frames shall be set in the openings by using wooden wedged at supports and shall be plumbed in position. The frames shall installed straight, level, without distortion and anchored to the supports. Glass used for glazing shall be float quality glass of approved quality manufactured by the firms like Modi (GG), AIS(Tata), Saint Gobain(SG) and shall be of minimum thickness 4mm for windows & ventilators and 5.5mm for doors. Each piece of glass shall be delivered with factory labels intact, indicating glass type, quality and thickness. Labels shall not be removed until installation has been accepted. Glazing gasket channels and beads of P.V.C. or rubber shall be provided for all the doors and windows. Setting block shall be of neoprene of rubber width and high enough to provide minimum edges clearance for glass. The glass shall be protected from breakages immediately upon installation by applying suitable warning markings. Frame at door perimeter shall be fitted with non-porous polymeric weather stripping and door bottom shall have an adjustable elastomeric weatherstrip. All aluminium doors and windows shall be opening type only and sliding windows or doors will not be allowed.

3.2.14. Rolling shutters

Collapsible steel rolling shutters confirming to IS: 6248, fabricated from steel of approved quality shall be supplied and fixed with side guide bottom rails brackets, door suspension shaft rolling springs, locking arrangement and housing box of the top including painting etc. as directed. The rolling shutters shall be MS solid laths or grill with all the accessories such as top cover. The rolling slats shall be in one piece and be made of heavy gauge steel sheets minimum 20 G in thickness. A cylindrical hood shall be provided on the top to enclose the shutter when it is open. The rolling shutters shall be provided with suitable locking arrangements and deep channel guides. In case galvanized rolling shutters are specified the rolling shutter shall be made of hot

dip galvanized slats hood, deep channel guides all preferably in one piece. The channels, guides shall be fixed with holding down bolts with M20 mix. Rolling shutters shall be hand operated pull and push type if area of opening is less than 10m_2 and gear operated if area is larger than 10m_2. They shall be provided with ball bearings for smooth and efficient operation. In case of large rolling shutters and depending upon local wind conditions, the rolling shutters should be provided with special locking type of wider channel guides or it shall be provided with central movable channel supports to take up the design wind pressures in the area.

Before fixing the rolling shutter, the contractor shall submit drawings for the approval of the Engineer. The drawings shall clearly show all dimensions and thickness, anchoring devices and accessories.

3.2.15. Hand rails

All walk ways, platforms, verandah, stair cases, ladders, roof of water tanks, filter chambers etc. inside and outside the building shall be provided with handrails. Before fixing the hand rails, the contractor shall submit drawings and samples for getting the approval of the Engineer. The drawings shall clearly show all dimensions and thickness, anchoring methods.

GI hand rails

The GI hand rails shall be with GI pipes of minimum 32 mm internal diameter, laid in three rows and fixed in posts of minimum height 75mm, placed at minimum 1.8 m center to center. The posts shall be either MS angle section of size 65 mm x 65mm x 8mm or RCC pillars of minimum 150 mm diameter. The post shall be firmly fixed to the floor as per the direction of Engineer in charge. The GI pipe shall be painted with two coats anti corrosive paint of colour as directed by the Engineer over one coat of zinc chromate primer. The welding shall be perfect and the junctions shall be ground properly.

Stainless steel hand rails

The SS hand rails shall be made of 304 grade16 SWG stainless steel. For the hand rail there shall be three rows of SS round pipes. The top row pipe shall be of minimum diameter 40mm and other two rows of pipe shall be minimum 25 mm diameter. Stainless steel column pipe of minimum 50mm diameter shall be placed at minimum 2m intervals. The height of hand rail shall be minimum 75cm. The columns shall be of minimum diameter 63mm in the corners and endings. The pipes and columns shall be provided with SS end caps. The column pipe/post shall be fixed firmly to the concrete base using SS base plates fixed with minimum 4 numbers of bolt and nut. For the stair case hand rails the end columns shall be balustrades of minimum diameter 75mm, and minimum height 800mm.

3.2.16. MS Fabrication works

The clarifier bridge, the clamps of pipes in over head tanks, pipe gallery etc shall be fabricated using MS sections of approved quality as per IS: 2062. Minimum thickness of steel members including angles shall not be less than 6 mm except for the frames of panel board where it shall be minimum 4mm thick. The steel section shall be straightened and cut to lengths specified and measured with a steel tape. The cut ends shall be finished smooth. No two pieces shall be welded to make up the required length of a member. Steel work shall be hoisted and placed in position carefully. The mechanical appliances such as lifting

tackle, winch and derrick, etc. shall be used. The drawing of all the fabricated steel structures shall be submitted well in advance and got approved by the engineer in charge before the commencement of fabrication. The samples of sections to be used shall also be submitted and got approved before fabrication. The drawings shall clearly show all work including the arrangement of components, other details, all dimensions and thickness, anchoring devices and jointing. Frames shall be square and flat, the corners of the frames being fabricated to a true right angle. The welding shall be perfect and the junctions shall be ground properly.
All the MS work shall be suitably painted with enamel paint and the MS work submerged in water shall be finished with epoxy paint.

3.2.17. Ladders.

Ladder access shall be provided, if concrete stair case is not provided, to the roof of building, inspection platforms, roof of water tanks or any floor if directed by the Department. Ladders shall be provided if the height to be accessed is more than 60cm. Ladders shall be provided to access the floor of the OHSR's and sump. Before fabricating the ladder, the contractor shall submit drawings and samples for getting the approval of the Engineer in charge. The drawings shall clearly show all dimensions and thickness, type and size of sections used and anchoring methods. The width of ladders shall be minimum 50cm and the rise between steps shall be below 20cm. Hand rails shall be provided to ladders.

MS ladders

MS ladder shall be fabricated using MS sections of approved quality as per IS: 2062. The minimum width shall be 60cm. The ladder shall be with steps in chequered plate of minimum width 10cm welded to the side frame. The side frame shall be with angles of minimum width 65mm. The ladder should have hand rails shall be provided. The ladder shall be strongly built. The ladder shall be painted with enamel paint as specified.

Stainless Steel ladders

Stainless Steel ladders shall be provided in place where the ladder is drowned in water like inside OHSR and sump. The SS hand ladders shall be made of 304 grade 16 SWG stainless steel. The ladder shall of minimum width 50cm. The ladder shall be with steps in SS pipes of minimum 40mm width 10cm welded to the side frame. The side frame shall be with SS round pipes of minimum diameter 40mm. The hand rails of the ladder shall be SS pipe extended in 'U' shape in the top end and firmly fixed using bolt and nut in the concrete.

Supply and installation of electrical equipments.

All supply and installation of electrical equipment shall comply with the requirements of Indian Electricity rules, 1956 and Indian Electricity Act-1910 as amended up to date and bye laws of authority of State Government or KSEB. The installation work shall be carried out as per specification and in accordance with the construction drawings and shall conform to requirements called for in the Indian Electricity Rules 1956 with its latest amendment, Indian Electricity Acts and all relevant codes and practices issued by the bureau of Indian Standard as amended up-to-date. The work shall also comply with the provisions of the general or local set of legislatures and regulations of any local or other statutory authority which may be applicable. The design and drawings of the electrical work

should be strictly in accordance with IE rules and relevant IS code of practice and specification. Electrical equipments like Pumps, Motors, Transformers, Circuit breakers and all other connected electrical equipments shall be conforming to BEE standards to achieve energy conservation.

It is the responsibility of the Tenderer to get the power connection from KSEB. The electrical scheme with estimate and connected drawing shall be prepared and submitted to the Chief Electrical Inspector through a licensed electrical contractor of appropriate class and got approved by CEI before starting the electrical works. Preparation of necessary documents through authorized contractors for submission to KSEB for obtaining power connection is also part of this work.

All papers and drawing required for getting power connection including wiring diagram, necessary certificates, papers duly signed by electrical licensee and preparation of agreement in the stamp papers shall be prepared and submitted on completion of the work .It is the responsibility of the tenderer to get the approval for the design and drawings from the Electrical Inspectorate and KSEB. The statutory fees if any payable to KSEB will be paid by KMC or Kozhikode Medical College. Electrical works shall be carried out only through persons who have valid Electrical license to do such work issued under IE rules

Wiring

All wirings for light and power circuits shall be in PVC conduits recessed in wall / ceiling. Conduits shall be of suitable material complying with IS: 2509 and IS: 3419 for rigid conduits and IS: 6946 for flexible conduits. The interior of the conduits shall be smooth and free from obstructions. The rigid pipes shall be ISI marked. The minimum wall thickness of the rigid non-metallic conduits shall be 1.6 mm up to 25 mm diameter conduit. No conduit less than 20 mm in diameter shall be used. Accessories for non-metallic rigid type of conduits shall be grip type. Casing and capping shall be of good quality PVC, free from defects like deformations, unevenness, blisters, cavities, etc. All 5A and 15A switches for wiring shall be manufactured in accordance with IS:3854 and shall be piano type unless otherwise specified. Only three pin-type receptacles manufactured in accordance with IS: 1293 shall be used with third terminal connected to the earth. All receptacles shall be provided with a switch mounted on the same enclosure.

All 6A receptacles shall be flush type and shall have 5 pins with 1 pin for earth connection and 2 pins each for Phase and neutral connections. 16A receptacles shall have 6 pins (suitable for connecting both 6A and 16A plug tops) with 2 pins each for phase, neutral and earth connections. Samples of all the materials to be used in the work shall be submitted to the Engineer-in-Charge for approval. In case of any materials other than those approved is detected, the same shall be replaced by the contractor with the approved quality, free of cost. Outlet boxes for socket, switches fixtures and regulators etc. shall be of minimum 18 gauge (for size up to 20 cm x 30 cm) and 16 gauge (for size above 20 cm x 30 cm) or specified in the schedule of items. Junction / outlet boxes shall be used in roof slab where concealed wiring has been adopted. The junction / outlet / switch boxes shall be painted with anticorrosive paint before installation. Cover plates shall be of Formica or approved equivalent with colour to suit the wall. Cover plates shall be fixed by cadmium plated brass screw and suitable C.P. brass cup washers. An earth terminal with stud and washers shall be provided in each MS box for termination of protective earth conductors. Any item(s) not

specified, but required in the work as directed by the Engineer-in-Charge shall be supplied and erected.

All wires for point wiring and the single core wires specified for sub main and circuit wirings shall be PVC insulated 1100 V grade as per IS: 1554. FRLS copper multistoried wires of approved brand. Wires shall be The smallest size of conductor for lighting circuits shall have a nominal cross-sectional area of not less than 1.5 sq.mm, while minimum size of power wiring shall be 2.5 sq.mm. All wires shall be ISI marked. Conductors shall be of stranded copper. Flexible cables shall be PVC insulated having a minimum size of 14/0.0193 mm. All flexible wires shall be mechanically protected by tough rubber or PVC sheath. Power cables for use in 415 V system shall be of 1100 V grade, aluminium stranded conductor, PVC insulated, PVC sheathed single wire armoured and overall PVC sheathed. All power cables for 11kV and 33 kV shall be aluminium conductor, XLPE insulated, screened, PVC bedded galvanized steel flat armoured (non-magnetic material in case of single core cable) and PVC sheathed cable. All 415 V cables shall conform to IS: 1554 and HT cables shall conform to IS: 7098. Unarmoured cables will be used only where specified. The multicore cables shall, however, be PVC insulated and sheathed armored aluminium underground cables of approved brands. The samples of all material shall be submitted and got approved by the Engineer in charge before installation.

3.2.18 PUMPS FOR SEWAGE PUMPING

GENERAL DESIGN CONDITION SUBMERSIBLE NONCLOG PUMPS FOR SEWAGE PUMPING

The pumps shall be of non-clogging equipped to operate satisfactorily for pumping sewage from sump well to STP. Lean Flow, Mean Flow and peak flow to be managed. Accordingly, pump configuration with 100% standby should be provided.

Sump well to STP

The pump shall be submersible with the suction and delivery branches cast inline on the bottom half of the casing, the top half should be constructed to allow easy dismantling there by providing the facility of inspection and repair to the equipment without any difficulty. The rotating elements of pumps will be dynamically balanced and over stressing should not occur due to sudden failure of power & reverse rotation should not damage the pump. The pump shall be so designed as to have a maximum flow capacity of not less than 110%

CODES AND STANDARDS

The designed performance requirement, material requirements, manufacturer, inspection and testing of the pumps shall generally comply with the requirements of all applicable Indian/British/American/DIN/ISO standard, in particular the following:
IS 5120 : Technical requirements – Ro to dynamic special purpose pumps
IS 5600 : Sewage and drainage pumps
IS 9137 : Code for acceptance for centrifugal, mixed flow and axial flow pumps

DESIGN AND CONSTRUCTION

a) Each pump shall be a mono unit, equipped with a motor on single shaft, with rating so

selected as to have at least 15% margin over the maximum power required by the pump throughout its range of operation.

b) Motor shall be of submersible squirrel cage induction motor type, F class, Oil filled, suitable for 415 volts (+6%-15%) & 50Hzs (+/-3%).

PUMP CASING

a) Casing shall be so designed to allow free passage of specified maximum size of solid.
b) Casing shall be designed to withstand the maximum shut off pressure developed by the pump
c) The casings shall be cast, free from blow hole, sand holes, other detrimental defects. The casing shall be complete with suction and discharge connections.
d) For pumps adequate seal arrangement shall be made to keep leakage of liquid from casing to column assembly to minimum and adequate drain shall be provided in column assembly to permit escape of the leakage flow. The casing shall also include the bearing housing of the bottom pump shaft bearing.

IMPELLER

The impeller shall be non-clog type, cast in one piece and specially designed to pass large solids or unscreened liquids. The clearance between stationary and moving parts should be such as to allow sustained performance without excessive maintenance.

PUMP SHAFT

Shaft size selected shall be such that critical speed is at least 20% away from the operating speed and the runway speed.
The shaft shall be ground and polished to final dimension and of ample size to withstand all stresses resulting from rotor weight, hydraulic loads and across the line starting.

BEARINGS

Adequate nos. of properly designed bearings shall be furnished. Bearing for fixed type sump pumps shall be oil lubricated and bearings shall be antifriction type. Thrust bearing of adequate design shall be furnished for taking the entire pump thrust arising from all probable condition of continues operation throughout its “Range of operation” and also the shut off condition life of thrust bearing shall be 20,000 working hour minimum for the load corresponding to the duty point.

WEARING RING/ PLATE (As required)

Renewable wearing rings/ plates shall be provided either on impelle or on the casing or on both impeller and casing.

BOLTS NUTS AND WASHERS

All bolts, nuts and washers shall be of SS-304.

PRESSURE INDICATION DEVICE

Each installation shall be equipped with pressure gauges of good quality make to give indication of delivery pressure. The pump pressure gauges should be designed in such a way that the readings shall not be affected due to mechanical vibration. The connections sizes shall be 12mm and diameter size 150mm in addition to above each pump shall be fitted with electronic pressure transducer with electronic digital display type indicator in control panel to indicate the delivery pressure of the pump.

MATERIAL AND CONSTRUCTION
Material Of Construction Of Pump Shall Be Such As To Resist Erosion & Corrosion.
Material Of Construction Of Various Components Shall Be As Under

Pump casing : CI
Impellers : CI
Pump shaft : AISI -410
Nuts, Bolts & Washers : SS-304

INSPECTION AND TESTING
All the inspection, examination and testing shall be carried out in accordance with relevant IS/BIS/ISO and standard specification.

LABORATORY TEST
Laboratory pump test shall be carried out as per IS: 9137, with latest amendment each pump to assess the pump discharge Vs head, Horse Power (hp) and efficiency figure. The pump casing shall be subjected to a pressure test of 1.5 times the working pressure at duty point

FIELD TEST
If need the field test be carried out as per IS: 9137, with latest amendment these test may be witnessed by the Engineer-In-Charge or his authorized representative. If they desire the tolerance as specified in relevant IS code of practice shall not be quoted efficiency of pump during the testing.

GUARANTEES PERFORMANCE & TECHNICAL PARTICULARS

The contractor shall submit the details of guaranteed performance and technical particulars as required and the preliminary out line drawing indicating principal dimension and weight of pumping equipment and cross section drawing indicating the assembly of pumps & major parts thereof with materials of construction and special features, complete descriptive and illustrated literature on the equipment and accessories offered& proposed to be used before initiation of procurement and approval of QAP.

4. STANDARD SPECIFICATIONS

4.1 GENERAL

4.1.1 P r e a m b l e

These Specifications cover the items of work in structural and non- structural parts of the

Works coming under purview of this document. All work shall be carried out in conformation with this. In general, provisions of Indian Standards, Indian Roads Congress Codes, MOST Specifications for Roads and Bridge Works (III Revision) and other national standards have been followed. These Specifications are not intended to cover the minute details. The work shall be executed in accordance with best modern practices. All codes and standards referred to in these Specifications shall be the latest edition including all applicable Official Amendments and revisions thereof.

4.1.2 Inclusive documents

The provisions of special conditions of contract, those specified on the tender as well as approved execution Drawings and notes or other Specifications issued in writing by the Engineer shall form part of these Specifications.

4.1.3 Order of precedence, clarifications and interpretation

4.1.3.1 When the various Specifications and codes referred to in preceding portion are at variance with these Specifications and with each other, the following order of precedence will generally be accepted.

1. Written instructions of the Engineer.
2. Special Conditions of Contract, Special specifications, Item wise Technical Specifications if provided, and Execution Drawings.
3. Provisions of Standard Specifications.
4. I.S. Codes.
5. IRC Codes, M.O.S.T., Specifications, etc.
6. The Manual on Water Supply and Treatment and the Manual on Sewerage and Sewage Treatment issued by CPHEEO, Ministry of Urban Development, New Delhi.

4.1.3.2 The attention of the Contractor is drawn to those Clauses of IS codes which require either Specification by Engineer or the mutual agreement between the supplier and purchaser. In such cases it is the responsibility of the Contractor to seek clarification on any uncertainty and obtain prior approval of the Engineer before taking up the supply/construction.

4.1.4 Measurement and Payments

The methods of measurement and payment shall be as described in IS Codes. Should there be any detail of construction or materials which has not been referred to in these Specification or in the bill of quantities and Drawings but the necessity for which may be implied or inferred wherefrom, or which are usual or essential to the completion of the work in the trades, the same shall be deemed to be included in the rates and prices quoted by the Contractor for the work.

4.1.5 Unacceptable work

All defective Works are liable to be demolished, rebuilt and defective materials replaced by the Contractor at his own cost. Defective materials demolished from work site for bad work have to be removed from work site by the contractor, at his own expense, latest within a week, failing this, the Engineer shall get it removed from the site in a manner he

deems fit and the expenditure towards this shifting shall be recovered from the bills of the contractor with penalty as deemed fit by the engineer. In the event of such Works being accepted by carrying out repairs etc. as specified by the Engineer, the cost of repairs will be borne by the Contractor.

4.1.6 Water supply and Sanitary Works

All items covered under the above head shall conform to the detailed Specifications given for each of the items in addition to the by-laws of the local bodies within whose jurisdiction the Works are executed. The Works shall be carried out as per the relevant IS Codes, the Manual on Water Supply and Treatment and the Manual on Sewerage and Sewage Treatment issued by CPHEEO, Ministry of Urban Development, New Delhi and as per the instructions of the Engineer.

4.1.7 M a i n t a i n i n g Utility Service and Traffic

4.1.7.1 Public Utilities

4.1.7.1.1 Drawings scheduling the affected services like water pipes, sewers, oil pipelines, cables, gas ducts etc. owned by various authorities including Public Undertakings and Local bodies shall be verified by the Contractor for the accuracy of the information prior to the commencement of any work.

4.1.7.1.2 Notwithstanding the fact that the information on affected services may not be exhaustive, the final position of these services within the Works shall be supposed to have been indicated based on the information furnished by different bodies and to the extent the bodies are familiar with the final proposals. The intermediate stages of the Works are, however, unknown at the design stage, these being dictated by the Contractor's methods of working. Accordingly, the Contractor's programme must take into account the period of notice and duration of diversionary Works of each body as given on the Drawings and the Contractor must also allow for any effect of these services and alterations upon the Works and for arranging regular meetings with the various bodies at the commencement of the Contract and throughout the period of the Works in order to maintain the required co-ordination. During the period of Works, the Contractor shall have no objection if the public utility bodies vary their decisions in the execution of their proposals in terms of programme and construction, provided that, in the opinion of the Engineer, the Contractor has received reasonable notice thereof before the relevant alterations are put in hand.

4.1.7.1.3 No clearance or alterations to the utility shall be carried out unless specially ordered by the Engineer.

4.1.7.1.4 Any services affected by the Works must be temporarily supported by the Contractor who must also take all measures reasonably required by the various bodies to protect their services and property during the progress of the Works.

4.1.7.1.5 The Contractor may be required to carry out certain Works for and on behalf of the various bodies and he shall also provide, with the prior approval of the Engineer, such assistance to the various bodies as may be authorized by the Engineer.

4.1.7.1.6 The work of temporarily supporting and protecting the public utility services

during execution of the Works shall be deemed to be part of the Contract and no extra payment shall be made for the same.

4.1.7.1.7 The Contractor may be required to carry out the removal or shifting of certain services/utilities on specific orders from the Engineer for which payment shall be made to him. Such works shall be taken up by the Contractor only after obtaining clearance from the Engineer and ensuring adequate safety measures. The Contractor should obtain prior written permission from the service departments such as Telecom, KSEB etc., before digging. In addition, the service departments should be informed before commencing the work to enable the service department to depute their officials to help in either disconnecting or restoring such services, as the case may be. Any revenue loss occurring due to the negligence of the contractor shall be made good by him. The rate for shifting/repair/replacement of utilities will be on the basis of Schedule of Rates of concerned departments.

4.1.7.2 Arrangement for Traffic during Construction

4.1.7.2.1 General

The Contractor shall at all times carry out work on the roads in a manner creating least interference to the flow of traffic.

4.1.7.2.2 Traffic Safety and Control

1. The Contractor shall take all necessary measures for the safety of traffic during work and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic. Before taking up any work, an agreed phased programme for the diversion of traffic on the highway shall be drawn up in consultation with the Engineer and approved by the concerned authorities.

2. The barricades erected on either side of the carriageway/portion of the carriageway close to traffic, shall be of strong design to resist violation, and painted with alternate black and white stripes. Red lanterns or warning lights of similar type, rope lights, etc., shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise.

3. At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriage way) the channel for traffic shall be clearly marked with the aid of pavement markings, painted drums or a similar device as per the directions of the Engineer. At night, the passage shall be delineated with lanterns or other suitable light source.

4. One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns/lights.

5. On both sides, suitable regulatory/warning signs as approved by the Engineer shall be installed for the guidance of road users. On each approach, at least two signs shall be put

up.

4.1.7.2.3 Maintenance of Diversions and Traffic Control Devices

Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversions shall be maintained in a satisfactory condition till such time they are required as directed by Engineer. The temporary traveled way shall be kept free of dust by frequent applications of water, temporarily paved where ever required as the case may be and as directed by the Engineer.

4.1.7.2.4 No extra payments shall be effected for Traffic Safety and Control described and maintenance of Diversions and Traffic Control Devices.

4.1.8 Methodology and Sequence of Work

Prior to start of the construction activities at site, the Contractor shall, within 30 days after the date of the Letter of Acceptance, submit to the Engineer for approval, the detailed construction methodology including mechanical equipment proposed to be used, sequence of various activities and programme schedule of work from start to end of the project in hard and soft copies and the same shall be got approved.

4.1.9 Approval of Materials

4.1.9.1 Approval of all sources of material/ manufacturing companies for materials used in Works shall be obtained in writing from the Engineer before their use on the project. The contractor shall verify that the entire quantity required for the work could be obtained from the approved locations from where material is to be taken. Any extra lead, in the eventuality of material not being available at the said locations, will not be allowed, should be locations subsequently approved be located at a distance involving more lead.

4.1.9.2 Where the terms crushed gravel/shingle, crushed stone, broken stone or stone aggregate appear in any part of the Tender Documents or Drawings issued for work, they refer to crushed gravel /crushed shingle / crushed stone aggregate obtained from an integrated crushing plant having appropriate primary crusher, secondary crusher and vibratory screen.

4.1.9.3 Raw and processed samples of the mineral aggregates from the approved quarry shall be submitted by the Contractor at no extra cost.

4.1.10 Access to Abutting Properties

4.1.10.1 For the duration of the Works the Contractor shall at all times provide convenient access to paths, steps, bridges or drives for all entrances to property abutting the site and maintain them clear, tidy, and free from mud and objectionable matter.

4.1.10.2 In addition to the above, in order to ensure uninterrupted traffic flow in the cross roads, the Contractor has to provide and maintain suitable crossing arrangement for the existing traffic to move across the construction work for all categories of roads crossing the roads where the work is carried out during the entire period of construction or till such time that alternative arrangement for the traffic is made.

4.1.11 Use of Equipment on works
The following conditions regarding use of equipment's on works shall be followed:
1. The Contractor shall be required to give a trial run of the equipment(s) or establishing their capability to achieve the required Specifications and tolerance to the satisfaction of the Engineer before commencement of the work.
2. All equipment's provided shall be proven efficiency and shall be operated and maintained at all times in a manner acceptable to the Engineer.
3. No equipment or personnel will be removed from site without permission of Engineer.

4.1.12 Quality Control on Works and Materials

4.1.12.1 The Contractor shall be responsible for the quality of the work in the entire construction work within the contract. He shall, therefore, have his own independent and adequate set-up for ensuring the same. The contractor shall submit his Quality control programme to the satisfaction of the Engineer and got approved before commencement of any work.

4.1.12.2 The Engineer shall inspect the work from time to time during and after construction and ascertain the quality of the work tested (by himself, by his Testing and Quality Control Units or by any other agency deemed fit by him). Additional tests may also be conducted where, in the opinion of the Engineer, need for such tests exist.

4.1.12.3 The Contractor shall provide necessary cooperation and assistance in obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This may include provision of labour, attendance, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests. The contractor shall provide all sample-collection equipment, tools, etc., required for the collection of samples

4.1.12.4 The Contractor shall carry out modification in procedure of work, if any, as directed by the Engineer during inspection.

4.1.12.5 Works falling short of quality as per tests indicated in Clause 2.1.12.2 above shall be rectified by the Contractor as directed by the Engineer at his own cost.

4.1.12.6 For testing of samples of soil, soil mix, granular material and mix, aggregates, etc. Samples in the required quantity and form shall be supplied to the Engineer by the Contractor at his own cost.

4.1.12.7 For cement and similar other materials where essential tests are to be carried out
at the manufacturer's plants or at laboratories approved by the Engineer other than the site laboratory, the cost of samples, sampling, testing and furnishing of test certificates shall be borne by the Contractor. He shall also furnish the test certificates to the Engineer.

4.1.12.8 For testing of cement concrete at site during construction, arrangement for supply of samples shall be made by the Contractor as per the frequency and number of tests specified in the relevant IS codes.

4.1.12.9 Where the Engineer considers that in the interest of the control of the quality on materials or workmanship, modifications, if any, are necessary, such modifications shall be carried out by the Contractor at no extra cost.

4.1.12.10 The Contract rate quoted for the work shall be deemed to be inclusive of all costs of the provisions indicated in the above-mentioned clauses.

4.1.13 Completion Drawings

4.1.13.1 The Contractor shall submit to the Engineer within 15 days of actual completion, "Completion" Drawings as specified below for the whole of the works. These Drawings shall be accurate and correct in all respects and shall b shown to and approved by the Engineer.

4.1.13.2 Completion Drawings on two prints, Documentation, photographs, videotapes, etc., shall be supplied by the Contractor in hard and soft copies.

4.1.13.3 Such completion drawings should be As built drawings containing all details of Longitudinal profiles, Ground levels at intervals not more than 50 metres, Location of valves and fittings, cross sections at required locations, structural and mechanical drawings of valve chambers, connecting points, etc., which shall be of accurate actual measurements in confirmation with the final bill submitted.

4.1.14 Standards

Standard and codes listed below are made a part of this specification. All standards, tentative specifications, specifications, code of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. If no standard is indicated, the relevant Indian Standard, if any, shall apply. Indian standards are published by: Bureau of Indian Standards, NEW DELHI**.**

IS: 456 Plain and Reinforced concrete
IS: 3370 Code of Practice for concrete structures for storage of liquids
IS: 2502 Code of practice for bending and fixing of bars for concrete reinforcement
IS: 269,8112,12269 Ordinary Portland cement
IS 1489 Portland pozzolana cement
IS Sulphate resistant Cement
IS: 10262 Recommended guidelines for concrete mix design
IS: 1786 Specification for high strength deformed steel bars and wires for concrete reinforcement
IS:2386 Method of test for (Part I & VIII) aggregate for Concrete
IS:1199 Method of sampling and analysis of concrete
IS: 10790 Methods of sampling of steel for prestressed and reinforced concrete
IS:3025 Method for sampling and test (physical and chemical) for water used in construction.
IS: 516 Method of test for strength of concrete
IS:2750 Specification for steel scaffolding
IS:3558 Code of practice for use of immersion vibrators for consolidating concrete
IS:15622 Pressed ceramic tiles

IS:13630 Ceramic Tiles - Methods of Test, Sampling and acceptance
IS: 1948 Aluminium doors, windows, ventilators
IS: 1949 Aluminium doors for Industrial buildings
IS: 1081 Fixing glass for Aluminium doors and windows
IS: 6248 Metal rolling shutters and grills.
IS: 1904 Design and construction of foundation in soil
IS: 1893 Earth quake resistant design of structures
IS: 2527 Fixing rain water gutters and down pipes
IS:2720 Methods of test for soils (Parts I & XLI)
IS:3696 Safety code of scaffolds (Parts I & II) and ladders
IS:3764 Code of safety for excavation work
IS:3696 Safety code of scaffolds (Parts I & II) and ladders
IS:1536 Centrifugally cast (spun) Iron pressure pipes for water, gas and sewage
IS: 1538 (part 1-24) Cast iron fittings for pressure pipes for water, gas and sewage
IS: 3114 Code of practice for laying of Cast Iron Pipes.
IS:8329 Centrifugally cast (spun) Ductile Iron pressure pipes for water, gas and sewage
IS:9523 Ductile Iron fittings for pressure pipes for Water, Gas & Sewage Specification
IS:12288 Code of practice for use and laying of Ductile Iron Pipes.
IS: 1239 Specification for MS Tubes (GI pipe).
IS:638 Specification for sheet rubber jointing and rubber insertion jointing.
IS:5382 Specification for Rubber sealing rings for gas mains, water mains and sewers.
IS: 4984 HDPE pipes for potable water supplies
IS: 7634 (part 1-3) Code of practice for laying of PE and PVC pipes
IS: 8008 HDPE fittings
IS: 4985 Unplastized PVC pipes for potable water supplies
IS: 7834 PVC fittings
IS: 12235 Test on PVC pipes.
IS: 800 Code of practice for general construction in steel
IS: 3589 Electrically welded steel pipes for water, gas and sewage -MS Pipes
IS: 5822 Code of Practice for laying of welded steel pipes for water supply
IS: 4350 Concrete porous pipe for under drainage.
IS: 1520,IS 6595 Centrifugal pump
IS: 8034 Submersible pump
IS: 9694 Selection, installation, operation and maintenance of centrifugal pump.
IS: 7538 Three phase squirrel cage induction motor
IS: 900 Installation and maintenance of induction motor
IS: 4029 Testing of induction motor
IS: 9283 Motors for submersible pumpsets.
IS: 1180 Outdoor three phase transformer
IS: 10553 (part 1-5) Requirement for chlorination equipment.
IS: 14846 Sluice valves for water works purposes (50 to 1200mm size)
IS:2685 Selection, installation and maintenance of sluice valves.
IS: 3042 Single faced Sluice gates (200 to 1200mm size)
IS: 5312 Non return valve
IS: 4038 Foot valve for water works
IS: 13095 Butterfly valves for general purpose
IS: 2373 Water meter (bulk type)
IS: 1180 Out door type three phase transformer
IS: 1726 Specification for Cast Iron Manhole Covers and Frames.
IS: 2721 Galvanized steel chain link fence
IS: 1700 Drinking water fountains

IS: 5330 Criteria for design of anchor blocks
IS: 3025 Method of sampling and test for water
IS: 2556 Specification for vitreous sanitary appliances
IS: 10005 SI Units and Recommendations for the use of their Multiples and of certain other units
IS:2190 Selection, installation and maintenance of portable first aid appliances
IS: 13983 stainless steel sinks for domestic purpose
IS:15622 Pressed ceramic tiles
IS: 6248 Metal rolling shutters and grills
IS: 2527 Fixing rain water gutters and down pipes
IS: 2470 Installation of septic tank
SP: 7- National Building code
SP: 35 – hand book on water supply and drainage
IRC -15 - Standard specification and code of practice for construction of concrete roads

4.3 SITE CLEARANCE

4.3.1 Scope

This work shall consist of cutting, removing and disposing of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness, rubbish etc., from the area of Works which in the opinion of the engineer are unsuitable for incorporation in the Works, and such other areas as may be specified on the Drawings or by the Engineer. It shall include necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, and disposal of cleared materials. Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these Specifications.

4.3.2 Preservation of Property/Amenities

Trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all facilities within or adjacent to the site which are not to be disturbed shall be protected from injury or damage. The Contractor shall provide and install at his own expense, suitable safeguards approved by the Engineer for this purpose.

4.3.3 Methods, Tools and Equipments

Only such methods, tools and equipments as are approved by the Engineer and which will not affect the property to be preserved shall be adopted for the Work

4.3.4 All excavations below the general ground level arising out of the removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface as these points conform to the surrounding area.

4.3.5 Any boulder or small mound protruding should also be removed either by chiseling, chipping or by heating and by adopting in latest technologies for cresting cracks and fissures etc in the rock as approved by the Engineer.

4.3.6 Disposal of Materials

4.3.6.1 All materials arising from clearing and grubbing operations shall be the property of Employer and shall be disposed of by the Contractor as hereinafter provided or directed by the Engineer.

4.3.6.2 Trunks and stumps of trees shall be cleaned of limbs and roots and stacked. Also boulders, stones and other materials usable in construction shall be neatly stacked as directed by the Engineer. Stacking stumps, boulders, stones etc., shall be done at specified spots with all lifts and up to a lead of 1000 m.

4.3.6.3 All products of clearing and grubbing which, in the opinion of the Engineer, cannot be used or auctioned shall be cleared away from the site in a manner as directed by the Engineer. Care shall be taken to see that unsuitable waste materials are disposed off in such a manner that there is no likelihood of these getting mixed up with the materials meant for construction.

4.3.7 Stacking, Covering and Protection

4.3.7.1 Material shall be stacked in such a manner as to ensure the preservation of their quality and fineness for the work. Different types of materials shall be stacked separately and in such a way that counting and measurements can be done without Tenderer disturbing the stacks. Any material that is liable to be affected by rain or other adverse weather conditions shall be covered and protected against the same.

4.3.7.2 Earth, dismantled materials shall be stacked as directed by the Engineer.

4.3.7.3 Cement bags, steel bars, structural steel sections, bricks and timber and other similar materials shall be stacked in regular tiers and protected from adverse atmospheric conditions.

4.3.7.4 Pipes of DI, BWSC, PVC, GI etc. shall be stacked in rows over wooden supports or other plane protective surfaces.

4.3.7.5. Pipes shall be properly cleaned inside and outside, and at the jointing portions before placing / laying in trenches.

4.4 EARTHWORK, EROSION CONTROL AND DRAINAGE

4.4.1 Scope

This Specification covers the general requirements of earthwork in excavation in different materials necessary for the construction of the Works including structures, and water supply lines in accordance with requirements of these Specifications and the lines, grades and cross- section shown in the Drawings or as indicated by the Engineer. This Specification also includes site grading, filling in areas as shown in Drawing, filling back around foundations, conveyance and disposal of surplus spoils or stacking them properly as shown on the Drawings or as directed by the Engineer and all operations covered within the intent and purpose of this Specification.

4.4.2 General:

4.4.2.1 Contractor shall furnish all tools, plants, instruments, qualified supervisory

personnel, labour, materials, any temporary work, consumable, any and everything necessary, whether or not such items are specifically stated herein for completion of the job in accordance with Specification requirements.

4.4.2.2 Contractor shall carry out the survey of the site before excavation and properly mark all lines and establish levels for various works such as earthwork in excavation for grading, basement, foundations, plinth filling, roads, drains, cable, trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference / grid lines at intervals as determined by Engineer based on ground profile. These shall be checked by Engineer and thereafter properly recorded.

4.4.2.3 The excavation shall be done to correct lines and levels. This shall also include, where required, proper shoring to maintain excavations and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for ensuring safety.

4.4.2.4 The rates quoted shall also include the dumping of excavated materials in regular heaps, bunds, riprap with regular slopes as directed by Engineer, within the lead specified and leveling the same as to provide natural drainage. Rock / soil excavated shall be stacked properly as directed by Engineer. As a rule, all softer material shall be laid along the center of heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

4.4.3Clearing

The area to be excavated / filled shall be cleared as specified.

4.4.4 Timber Shoring

4.4.4.1 Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'Polling Boards'. These shall be of minimum 250 mm x 40 mm sections or as directed by Engineer. The boards shall generally be placed in position, vertically, side by side without any gap, on each side of the excavation and shall be secured by horizontal walli g of strong wood at maximum 1.2 metres spacing, strutted with “Ballies” or as directed by Engineer. The length of the “Ballie” struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical walling,which in turn shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

4.4.4.2 Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by Engineer in-Charge. It shall be the responsibility of Contractor to take all necessary steps to prevent the sides of excavation, trenches, pits, etc., from collapsing.

4.4.4.3 Timber shoring may be required to keep the sides of excavations vertical to ensure

safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only on instructions from Engineer.

4.4.4.4 The withdrawal of the timber shall be done very carefully, to prevent collapse, systematically from one end to the other end. Concrete or masonry shall not be damaged during the removal of the timber. No claim shall be entertained for any timber, which cannot be withdrawn and is lost or buried.

4.4.4.5 In case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 250 mm x 40 mm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 500 mm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of Engineer. In all other respects, Specification for close timbering shall apply to open timbering.

4.4.4.6 In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations /pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. Load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut.

4.4.4.7 Shoring is deemed to have been included in the rates quoted for the contract.

4.4.5 Dewatering

4.4.5.1 If water is met within the excavations due to springs, seepage, rain or other causes, it shall be removed by suitable diversions, pumping or bailing out and the excavation kept dry during any construction/ laying works or whenever so required or as directed by the Engineer. Care shall be taken to discharge the drained water into suitable outlet as not to cause damage to the works, crops or any other properties. Due to any negligence on the part of the Contractor, if any such damage is caused, it shall be the sole responsibility of the Contractor to repair / restore to the original condition at his own cost or compensate for the damage. Sumps made for dewatering must be kept clear of the excavations / trenches required for further work. Method of pumping shall be approved by Engineer; but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction.

4.4.5.2 All excavations shall be kept free of water. Grading in the vicinity of excavations shall be controlled to prevent surface water running into excavated areas.

4.4.5.3 When there is a continuous inflow of water and quantum of water to be handled is considered in the opinion of Engineer, as large, ‘Well Point System’ – single stage or multistage, shall be adopted. Contractor shall submit to Engineer his scheme of well point

system including the stages, the spacing, number and diameter of well points, headers, etc. and the number, capacity and location of pumps for approval.

4.4.5.4 Unless separately provided for in the schedule of quantities, dewatering is deemed to have been included in the rates quoted for the contract.

4.4.6 Rock excavation

4.4.6.1 Rock, when encountered, shall be removed up to the formation / bed level or as otherwise indicated on the Drawings. Where, however, unstable shales or other unsuitable materials are encountered at the formation / bed level, these shall be excavated to the extent of 150 mm below the formation / bed level or as otherwise specified. In all cases; the excavation operations shall be so carried out that at no point on cut formation / bed the rock protrudes above the specified levels.

4.4.6.2 Rocks and large boulders which are likely to cause differential settlement and also local drainage problems should be removed to the extent of 150 mm below the formation / bed level in full formation / bed width including drains and cut through the side drains.

4.4.6.3 Where excavation is done to levels lower than those specified, the excess excavation shall be made good as specifications, to the satisfaction of the Engineer.

4.4.6.4 Slopes in rock cutting shall be finished to uniform lines corresponding to slope lines shown on the Drawings or as directed by the Engineer. Notwithstanding the foregoing, all loose pieces of rock on excavated slope surface which move when pierced by the crowbar shall be removed.

4.4.6.5 Where blasting is to be resorted to, the same shall be carried out as per specifications and all precautions indicated therein observed.

4.5 Construction Operation for Water Supply Lines

4.5.1 T r i a l pits shall be taken along the lines of the trenches in advance of the excavations for the purpose of locating underground obstructions orconditions.

4.5.2 Setting out after the site has been cleared, the limits of excavation shall be set out true to lines, curves and slopes.

4.5.3 Excavation

4.5.3.1 Excavation for permanent work shall be taken out to such widths, lengths, depths and profiles as are shown on the Drawings or such other lines and grades as may be specified by Engineer. Rough excavation shall be carried out to a depth 150 mm above the final level. The balance shall be excavated with special care. Soft pockets shall be removed even below the final level and extra excavation filled up as directed by Engineer.

4.5.3.2 Contractor may, for facility of work or similar other reasons excavate, and also backfill later, if so approved by Engineer, at his own cost, outside the lines shown on the

Drawings or directed by Engineer. Should any excavation be taken below the specified elevations. Contractor shall fill it up, with concrete of the same class as in the foundation resting thereon, up to the required elevation. No extra shall be claimed by Contractor on this account.

4.5.3.3 All excavations shall be done to the minimum dimension as required for safety and working facility. Prior approval of Engineer shall be obtained by Contractor in each individual case, for the method he proposes to adopt for the excavation, including setting out, dimensions, side slopes, dewatering, disposal, etc. This approval, however, shall not in any way relieve Contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand and precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope.

4.5.3.4 Excavation shall be carried out with such tools, tackles and equipment as described hereinbefore. Blasting or other methods may be resorted to in the case of hard rock; however not without the specific permission of Engineer.

4.5.3.5 Stripping loose rock:
All loose boulders, semi detached rocks (along with earthy stuff which might move therewith) not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Engineer, to fall or otherwise endanger the workmen, equipment, or the work, etc., shall be stripped off and removed away from the area of the excavation. The method used shall be such as not to shatter or render unstable or unsafe the portion which was originally sound and safe. Any material not requiring removal as contemplated in the work, but which, in the opinion of Engineer, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed as directed by Engineer.

4.5.3.6. The Contractor has to conduct his own soil investigation by approved agencies and decide the method of excavation approved by the Engineer. Any deviation of soil strata not matching with the general soil strata during investigation or during execution of work shall be decided upon the approval of the Engineer and no extra cost shall be paid in this regard.

4.6.4 Filling
4.6.4.1 General

All fill material will be subject to Engineer's approval. If any material is rejected by Engineer, Contractor shall remove the same forthwith from the site at no extra cost to the Owner. Surplus fill material shall be deposited / disposed off as directed by Engineer after the fill work is completed. No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by Engineer.

4.6.4.2 Material:

1. To the extent available, selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, and organic or other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of moorum or earth to fill up the voids and the mixture used for filling.

2. If any selected fill material is required to be borrowed, Contractor shall make arrangements for bringing such material from outside borrow pits. The material and source shall be subject to prior approval of Engineer. The approved borrow pit area shall be cleared of all bushes, roots of trees, plants, rubbish etc. top soil containing salts / sulphate and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed by Engineer. Contractor shall make necessary access roads to borrow areas and maintain the same, if such access road does not exist, at his cost.

4.4.4.3 Filling in pits and trenches around foundations of structures, walls etc.:

1. As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris, and filled with earth in layers not exceeding 150 mm., each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless Engineer is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to proper profile as directed by Engineer or indicated on the Drawings.

4.4.4.4 Filling in trenches:

1. Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipe and drains have been tested and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.
2. Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the centerline of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 80 mm; backfilling above the level of the centerline of the pipe shall be done with selected earth by hand compaction or other approved means in layers not exceeding 150 mm.
3. In case of excavation of trenches in rock, the filling up to a level 300 mm. above the top of the pipe shall be done with fine materials, such as earth, moorum etc. The filling up of the level of the centerline of the pipe shall be done by hand compaction in layers not exceeding 80 mm, whereas the filling above the centerline of the pipe shall be done by hand compaction or approved means in layers not exceeding 150 mm. The filling from a level 300 mm. above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 150

mm. mixed with fine material as available to fill up the voids.
4. Pumping sand slurry shall be done to ensure the filling up of the voids that may be present in the material used for refilling the pipe line trenches.
5. Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

4.4.5 General site grading:

Site grading shall be carried out as indicated in the Drawings and as directed by Engineer. Excavation shall be carried out as specified in the Specification. Filling and compaction shall be carried out as specified.

4.4.6 Back filling as per Specification on the sides of foundations of columns, footings, structures, walls, tanks, rafts, trenches, etc. with excavated material will not be paid separately.

4.4.7 No payment for fill inside trenches, plinth or similar filling with selected excavated material will be made for compaction as specified / directed.

4.5 MATERIALS FOR STRUCTURES

4.5.1 SCOPE

45.1.1 Materials to be used in the work shall conform to the Specifications mentioned on the Drawings, the requirements laid down in this section and Specifications for relevant items of work covered under these Specifications.

4.5.1.2 If any material, not covered in these specifications, is required to be used in the work, it shall conform to relevant Indian Standards, if there are any, or to the requirements specified by the Engineer.

4.5.2 CEMENT

4.5.2.1 Cement to be used in the works shall be any of the following types with the prior approval of the Engineer:

1. Ordinary Portland cement, 33 Grade, conforming to IS: 269-1989 or latest revision.
2. Rapid Hardening Portland Cement, conforming to IS: 8041-1990 or latest revision.
3. Ordinary Portland cement, 43 Grade, conforming to IS: 8112-1989 or latest revision.
4. Ordinary Portland cement, 53 Grade, conforming to IS: 12269-1987 or latest revision.
5. Sulphate Resistant Portland cement, conforming to IS: 12330-1988 or latest revision.

4.5.2.2 Cement conforming to IS: 269-1989 or latest revision shall be used only after ensuring that the minimum required design strength could be achieved without exceeding the maximum permissible cement content of 450kg/cum. of concrete.

4.5.2.3 Cement conforming to IS: 8112-1989 and IS: 12269-1987 or latest revision may be used provided the minimum cement content mentioned elsewhere from durability considerations is not reduced. From strength considerations, these cements shall be used with a certain caution as high early strengths of cement in the 1 to 28-day range can be achieved by finer grinding and higher constituent ratio of C3S/C2S, where C3S is Tricalcium Silicate and C2S is Dicalcium Silicate. In such cements, the further growth of strength beyond say 4 weeks may be much lower than that traditionally expected. Therefore, further strength tests shall be carried out for 56 and 90 days to fine-tune the mix design from strength considerations.

4.5.2.4 Cement conforming to IS: 12330-1988 or latest revision shall be used when sodium sulphate and magnesium sulphate are present in large enough concentration to be aggressive to concrete. The recommended threshold values as per IS: 456-2000 are sulphate concentration in excess of 0.2 percent in soil substrata or 300 ppm (0.03 percent) in ground water. Tests to confirm actual values of sulphate concentration are essential when the structure is located near the sea coast, chemical factories, and agricultural land using chemical fertilizers and sites where there are effluent discharges or where soluble sulphate bearing ground water level is high. Cement conforming to IS: 12330-1988 or latest revision shall be carefully selected from strength considerations to ensure that the minimum required design strength could be achieved without exceeding the maximum permissible cement content of 450kg/cum. of concrete.

4.5.2.5 Cement conforming to IS: 8041-1990 or latest revision shall be used only for precast concrete products after specific approval of the Engineer.

4.5.2.6 Total chloride content in cement shall in no case exceed 0.05 percent by mass of cement; also, total sulphur content calculated as sulphuric anhydride (SO3) shall in no case exceed 2.5 percent and 3.0 percent when tri-calcium aluminate percent by mass is up to 5 or greater than 5 respectively.

4.5.3 COARSE AGGREGATES

4.5.3.1 For plain and reinforced cement concrete (PCC and RCC) or prestressed concrete (PSC) works, coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone, crushed gravel, natural gravel or a suitable combination thereof or other approved inert material. They shall not consist pieces of disintegrated stones, soft, flaky, elongated particles, salt, alkali, vegetable matter or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the steel reinforcement. Coarse aggregate having positive alkali silica reaction shall not be used. All coarse aggregates shall conform to IS: 383-1970 and tests for conformity shall be carried out as per IS: 2386-1963 Parts I to VIII or latest revision.

4.5.3.2 The Contractor shall submit for the approval of the Engineer, the entire information indicated in Appendix A of IS: 383-1970 or latest revision.

4.5.3.3 The maximum value for flakiness index for coarse aggregate shall not exceed 35 percent.

4.5.4 SAND/FINE AGGREGATES

4.5.4.1 For masonry work, sand shall conform to the requirements of IS: 2116-1980 or latest revision.

4.5.4.2 For plain and reinforced cement concrete (PCC and RCC) or prestressed concrete (PSC) works, fine aggregate shall consist of clean, hard, strong and durable pieces of crushed stone, crushed gravel, or a suitable combination of natural sand, crushed stone or gravel. They shall not contain dust, lumps, soft or flaky, materials, mica or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the embedded steel. Motorised sand washing machines should be used to remove impurities from sand. Fine aggregate having positive alkali-silica reaction shall not be used. All fine aggregate shall conform to IS: 383-1970 and test for conformity shall be carried out as per IS: 2386-1963 (Part I to VIII) or its latest revision. The Contractor shall submit to the Engineer the entire information indicated in Appendix A of IS: 383-1970 or latest revision.. The fineness modules of fine aggregate shall neither be less than 2.0 nor greater than 3.5.

4.5.5 WATER

Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete. Mixing and curing with sea water shall not be permitted. The pH value shall not be less than 6.

4.6 TESTS AND STANDARD OF ACCEPTANCE

4.6.1 All materials, even though stored in an approved manner shall be subjected to an acceptance test prior to their immediate use. Independent testing or cement for every consignment shall be done by the Contractor at site in the laboratory approved by the Engineer before use. Any cement with lower quality than those shown in manufacturer's certificate shall be debarred from use. In case of imported cement, the same series of tests shall be carried out before acceptance.

4.6.2 Testing and Approval of Material

4.6.2.1 The Contractor shall furnish test certificates from the manufacturer/supplier of materials with each batch of material(s) delivered to site.

4.6.2.2 The Contractor shall set up a field laboratory with necessary equipment for testing of all materials, finished products used in the construction as per requirements of conditions of contract and the relevant Specifications. The testing of all the materials shall

be carried out by the Engineer or his representative for whom the Contractor shall make all the necessary arrangements and bear the entire cost.

4.6.2.3 Tests which cannot be carried out in the field laboratory have to be got done at the Contractor's cost at any recognized laboratory/testing establishments approved by the Engineer.

4.6.3 Sampling of Materials

42.6.3.1 Samples provided to the Engineer or his representative for their retention is to be in labeled boxes suitable for storage.
4.6.3.2 Samples required for approval and testing must be supplied well in advance by at least 48 hours or minimum period required for carrying out relevant tests to allow for testing and approval. Delay to works arising from the late submission of samples will not be acceptable as a reason for delay in the completion of the works.
4.6.3.3 If materials are brought from abroad, the cost of sampling/testing whether in India or abroad shall be borne by the Contractor.

4.6.4 Rejection of Materials not conforming to the Specifications
Any stack or batch of material(s) of which sample(s) does not conform to the prescribed tests and quality shall be rejected by the Engineer or his representative and such materials shall be removed from site by the Contractor at his own cost. Such rejected materials shall not be made acceptable by any modifications.

4.6.5 Testing and Approval of Plant and Equipment
All Plants and equipment used for preparing, testing and production of materials for incorporation into the permanent works shall be in accordance with manufacturer's Specifications and shall be got approved by the Engineer before use.

4.7 DI PIPES
4.7.1 Scope
This specification covers the requirements for manufacturing, supplying, laying, jointing and testing of DI pipes used for water supply and sewerage.

4.7.2 Applicable codes

The laying of DI pipes and fittings/specials shall comply with all currently applicable statute, regulations, standard and Codes. In particular the following standards, unless otherwise specified herein shall be referred. In all cases, the latest revision of the standards/Codes shall be referred to. If Requirements of this Specification conflicts with the requirements of the standards/Codes, this Specification shall govern IS: 8329-2000(or its latest revision): Code of practice for Centrifugal Cast (Spun) DI Pipes

4.7.3 Manufacture

The DI pipes and fittings shall be of approved brand conforming to relevant IS standards

for K9 pipes. Factory tests shall be conducted as per specification and test results shall be produced before delivery of materials.

4.7.4 Specials and fittings
DI specials and fittings shall conform to the following IS.
IS: 9523 - 2000(or its latest revision): Specifications for DI fittings for pressure pipes for water, gas and sewage.

4.7.5 D i m e n s i o n s and tolerances
The dimension of pipes and their tolerances shall conform to the sizes specified in relevant clause of IS: 8329-2000 or its latest revision.

4.7.6 Inspection of Pipes
The pipes and fittings shall be inspected before laying for defects, cracks, internal and external coatings, etc., and any pipe or fitting found unsuitable during site inspection shall be rejected.

4.7.7 Laying and jointing of DI pipes and fittings
4.7.7.1 Laying of pipes shall in general be in accordance with Clause 15.7. Specifications given in relevant IS Code (IS 8329-2000, IS 9523-2000) shall also be followed as applicable.

4.7.7.2 Jointing
The DI pipes and fittings shall be joined by the following method:
1. Rubber gaskets confirming to IS 5382 or SBR quality for providing push on joint to centrifugal (Spun) DI pipes
2. Rubber insertion for 900mm pipes, Bolts and nuts of 30mm dia and 130mm long for providing flanged joints to double flanged DI pipes
Jointing shall be done as per the requirement depending on the type of pipes and as per the relevant IS Codes.

4.7.8 Testing
Mechanical tests during the manufacture of pipes, the Hydrostatic tests at works and the Hydraulic test at site (Pressure and leakage test – intermediate and final tests) shall be carried out under the conditions and pressures specified, as per IS: 4985-2000.

4.7.9 Rate
The rate shall include the cost of materials and labour involved in all execution items, testing and the operations.

4.7.10 If any damage is caused to the pipeline during execution of work or while cleaning/testing the pipeline as specified, contractor shall be held responsible for the same and shall replace the damaged pipeline and retest the same at his own cost to the full satisfaction of Engineer.

4.7.11 Water for testing of pipeline shall be arranged by Contractor at his own cost.

4.8 Supply of Pipes, Valves and Fittings

4.8.1 General

All pipes, valves and fittings required for the Works, including all appurtenant connections and accessories, shall be supplied by the Contractor in compliance with the requirements of the latest editions of applicable IS Codes and/or with the additional requirements as specified. The Contractor shall take all responsibility for ordering the correct and sufficient quantities of pipes, valves, fittings, etc., and shall immediately prior to placing any order, ascertain the required quantities thereof. Pipes shall be ordered in the maximum lengths available to minimize the number of joints. A sufficient number of short lengths for closure pieces shall be supplied. When ordering the pipes, the contractor shall obtain the Engineer's approval for the type of standard joint he intends to use in the Works.

4.8.2 Inspection

The manufacture of the pipes, fittings and accessories shall be open to inspection by the Employer or his representative at the manufacturer's works in the course of manufacture. Any pipes, fittings, or accessories found on such inspection not to meet the requirements of the relevant standards, or of this Specification, may be rejected by the Employer.

4.8.3 Testing

Material tests and hydraulic tests on the pipes, fitting and accessories shall be carried out in accordance with the relevant Standards acceptable to the Employer. If required, the Contractor shall forward to the Employer, before dispatch, Manufacturer's Certificates showing that the pipes, fittings and accessories have been tested and comply with the requirements of this Specification.

4.9 Laying of Pipes and Fittings / Specials

4.9.1 Scope

This Specification covers the requirements for laying of pipes and fittings / specials below ground for sewerage.

4.9.2 Applicable Codes

The laying of pipes and fittings / specials shall comply with all currently applicable statutes, regulations, standards and Codes. In particular, the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the standards / Codes shall be referred to. If requirements of this Specification conflict with the requirements of the standards / Codes, this Specification shall govern.

4.9.3 Codes of practice

IS: 311(or its latest revision) : code of Practice For Laying of Cast Iron Pipes.
IS: 376(“) : Safety Code for Excavation Work.
IS: 5822-1994 (“): Code of Practice for Laying of Welded Steel Pipes for Water Supply.
IS: 8329-2000(“): C o d e of practice for Laying DI pipes
IS: 9523-2000 (“): for DI fittings for pressure pipes

4.9.4 Carting and Handling

4.9.4.1 Pipes and fittings / specials shall be transported from the factory to the work sites, at places along the alignment of pipe line as directed by Engineer. The Contractor shall be responsible for the safety of pipes and fittings / specials in transit, loading / unloading. Every care shall be exercised in handling pipes and fittings / specials to avoid damage. While unloading, the pipes and fittings / specials shall not be thrown down from the truck on to hard surfaces. They should be unloaded on timber with steadying ropes or by any other approved means.

4.9.4.2 Padding shall be provided between coated pipes, fittings / specials and timber skids to avoid damage to the coating. Suitable gaps between pipes should be left at intervals in order to permit access from one side to the other. In case of spigot socket pipes while unloading, as far as possible pipes shall be unloaded on one side of the trench only. The pipes shall be checked for any visible damage (such as broken edges, cracking or splaying of pipe) while unloading and shall be sorted out for reclamation. Any pipe which shows sufficient damage to preclude it from being used shall be discarded. Dragging of pipes and fittings / specials along concrete and similar pavement with hard surfaces shall be prohibited.

4.9.4.3 Wherever a section of pipe, or a fitting is to be lifted or moved, it shall be handled carefully with belt slings. The belts shall be constructed so that no metal bears against the pipe and so that the bearing is uniform. The width of the belts shall be adequate to revent any damage to the pipe coating. The pipe section may at no time be dropped but shall be lowered carefully into position and may not be slides along the ground. If it is to be rolled, it may be done only on slides or ground specially prepared so as to prevent any damage to the coating.

4.9.4.4 All State and local laws be observed during transportation. The Contractor shall secure permits and licenses and provide all signals, guards and lights that may be required. Upon delivery the pipe sections and fittings shall be placed on specially prepared ground to protect them from distortion and damage. The ground shall be prepared so that they will rest evenly and will have uniform bearing throughout their lengths. Valve and sluice gates shall be placed on blockings.

4.9.5 Storage

4.9.5.1 Each stack of pipes shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever

possible. Storage shall be done on firm level and clean ground and wedges shall be provided at the bottom layer to keep the stack stable. The stack shall be in pyramid shape or the pipes laid lengthwise and crosswise in alternate layers. The pyramid stack shall be made for smaller diameter pipes for conserving space in storing them. The height of the stack shall not exceed 1.5m.

4.9.5.2 Fittings / specials shall be stacked under cover and separated from pipes. Valves and sluice gates shall be placed on blockings.

4.9.5.3 Rubber rings shall be stored in a clean, cool store away from windows, boiler, electrical equipment and petrol, oils or other chemicals. Particularly in the field where the rubber rings are being used it is desirable that they should not be left out on the ground in the sun or overnight under heavy frost or snow conditions.

4.9.6 Laying

4.9.6.1 Excavation

1. Before excavating the trench the alignment of pipeline shall be approved by Engineer. The excavation of trenches and pits for manholes / chambers shall be carried out in accordance with the Specification and shall be done such that it does not get far ahead of the laying operation as approved by Engineer.

2. To protect persons from injury and to avoid damage to property, adequate barricades, Construction signs, red lanterns and guards as required shall be placed and maintained during the progress of the construction work until it is safe for the traffic to use the roadways. The Contractor shall provide sign boards at salient points in streets and keep men to guide the traffic at his own cost. The relevant Indian Standards and the rules and regulations of local authorities in regard to safety provisions shall be observed.

3. Trial pits may be dug by the Contractor, without being directed to do so, along the lines of the trenches as shown on the drawings in advance of the excavations for the purpose of satisfying himself as to the location of underground obstructions or conditions. The Contractor shall proceed with caution,in any excavation and shall use every means to determine the exact location of underground structures, pipelines, conduits etc., prior to excavation in the immediate vicinity thereof. The Contractor shall be solely responsible for the cost of protection or repair or replacement of any structure, pipeline, conduit etc., above or below ground, which may be broken or otherwise damaged by his operations.

4. Suitable fencing shall be provided along the sides of trenches and pits. The posts of fencing shall be of timber securely fixed in the ground not more than 3 m apart and they shall not be less than 90mm in diameter or less than 1.2 m above the surface of the ground. There shall be two rails, one near the top of the posts and the other about 50mm above the ground and each shall be of 50mm to 70mm in diameter and sufficiently long to run from post to post to which it shall be bound with strong rope. The method of

projecting rails beyond the posts and tying them together where they meet will not be allowed on any account. All along the edges of the excavated trenches a bank of earth about 1.2 m high shall be formed where required by Engineer for further protection.

5. The lighting, barricading, guarding of the trenches and the maintenance of watchman shall be done by the Contractor at his cost. At every 30 meters interval and at every change in the gradient, sight rails shall be provided and fixed by the Contractor at his own cost. The sight rails and boning rods for checking the excavation and inverts of the pipes shall be of the quality approved by the Engineer. In all streets in the City/Town at every 15 meters interval, blank board shall be provided by the Contractor at his own cost, to facilitate crossing of the trench by the public residing on the either side.

6. The road metal and also the rubble packing shall first be stripped off for the whole width of the trench / pit and separately deposited in such place or places as may be determined by Engineer.

7. During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side of the trench leaving adequate clear distance from the edges of the trench and pit or as may be necessary to prevent the sides of the trench / pit to slip or fall or at such a distance and in such a manner so as to avoid covering fire hydrants, sluice values, manhole covers, etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organization or otherwise as Engineer may direct.

8. Contractor shall take into account additional excavation if any as Engineer may require in order locating the position of water pipes, drains, sewers, etc. or any other works which may be met with, in or about the excavation of trenches / pits while quoting the rates for the work. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of s h o r in g , strutting, planking over, padding or otherwise as Engineer may direct, and shall be protected by Contractor from damage during the progress of the work.

9. Wherever extra width of excavation shall be necessary for shoring and strutting, of the trenches on account of the nature of the soil, such extra width required to accommodate the shoring boards shall not be paid for separately and the rates quoted are deemed to be inclusive of all such incidental work.
10. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structures/pipelines of water, gas, sewage etc.

11. If the work for which the excavation has been made is not complete by the expected date of the setting in of monsoon which is First week of June or the setting in of rain whichever is earlier, or before the day fixed by Engineer

for filling in any excavation on account of any festival or special occasion, Contractor shall backfill such excavation and consolidate the filling.

12. Utmost care shall be taken to see that the width of the trench at the top of pipe is not more than [External diameter of pipe in mm + 600mm. In case additional width is required it shall be provided only in the top portion from the ground level up to 300mm above the crown of pipe. If any extra width is provided in the area below this portion, Contractor shall have to provide remedial measures in the form of lime concrete or rubble masonry or otherwise at the discretion and to the satisfaction of Engineer. If rock is met with, it shall be removed to 150 mm below the bottom of pipes and fittings / specials and the space resulting shall be refilled with lean cement concrete of adequate depth, properly consolidated to give the curved seating. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline. Bottom of trenches / pits shall be saturated with water and well rammed wherever Engineer may consider it necessary to do so. For laying of pipes larger than 1200mm in diameter, in earth and moorum, the curvature of the bottom of the trench should match the curvature of the pipe as far as possible, subtending an angle of 120 degrees at the centre of the pipe.

13. Wherever a socket or collar of pipe or fitting / special occurs a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 90mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand; all around the socket in order to make the joint and the grip shall be maintained clear until the joint has been approved by Engineer.

14. When welding is to be carried out with the pipes and specials in the trench, additional Excavation of not more than 600 mm in depth and 900 mm in length shall be made at joints in order to facilitate welding.

15. The excess excavated material shall be carried away from site of works to a place up to a distance as directed by Engineer. This shall be done immediately so as not to cause any inconvenience to the public or traffic. If the instructions from Engineer are not implemented within seven days from the date of instructions to cart the materials and to clear the site, the same shall be carried out by Engineer at Contractor's risk and cost and any claim or dispute shall not be entertained in this respect.

16. Refilling of trenches, where the excavation is in rock shall be with the surplus soft soil from pits located within 200meters from the reach in question. Else the same has to be brought from nearby approved borrow pits.

17. It is to be distinctly understood that no extra payment shall be made for the excavation from borrow pits. No payment shall be made for disposal of soil for excavation, surplus to or unsuitable for filling.

18. Pipe trenches shall be excavated to the lines and levels shown on the approved Drawings or as directed by the Engineer. Strong sight rails shall be fixed and maintained at each change of gradient, and at as many intermediate points as may be necessary. On the rails shall be marked the centre line and the level to which the pipe is to be laid, such rails being not more than 35 m apart. Except as otherwise provided herein, excavation for pipelines shall be in open-cut trenches with vertical sides, carried out only so far in advance of pipe laying in one continuous reach as specified in item 26 below.

19.The trench shall be excavated to the necessary depth to meet the requirements. Any part of the trench excavated below grade shall be backfilled to grade with thoroughly compacted material approved by the Engineer.

20. Ledge rock, boulders, and large stones shall be removed to provide clearance to each side of and below all pipe and accessories as required under the Specification and shown on the Drawings. Excavations in rock or in boulders below sub- grade so required or shown shall be refilled to sub grade with materials approved by the Engineer. Blasting for excavation will be permitted only after the approval of the Engineer has been secured and only when proper precautions have been taken for the protection of persons and property. The hours of blasting shall be fixed by the Engineer. Any damage caused by blasting shall be repaired by the Contractor at his expense. The Contractor's procedures and methods of blasting shall conform to local laws and regulations. The Engineer shall have power to regulate, restrict or prohibit blasting if in his opinion it is necessary to do so for the safety of persons or property, or to safeguard the bottoms or sides of the excavations and the Contractor shall have no claim against the Employer in respect of such regulation or prohibition. The greatest care shall be taken in the use of explosives, the charges being so placed and of such amount as in no way to shake or loosen the permanent bottoms or sides of excavations. Special care shall be taken as the excavation bottom is approached, and a thickness of not less than 750 mm above the excavation bottom shall be completed with small charges in holes not exceeding 600 mm in depth.

21. The Contractor shall provide a special proper store for explosives accordance with local regulations. The Contractor shall provide experienced men for handling explosives to the satisfaction the Engineer and the authorities concerned. The Contractor shall take all necessary precautions to prevent loss, injury or accident to persons or property or work completed or under construction, and shall be entirely liable for any accident or damage that may result from the use of explosives. The contractor has to take permission from concerned authorities as per the prevailing law in the locality for handling and usage of explosives.

22. The use of trench-digging machinery will be permitted except where the operation wil1 cause damage to trees, buildings, existing structures above or

below the ground. At such locations hand methods shall be employed to avoid such damage. Wherever necessary to prevent caving, trench excavations in soils such as gravel, and sandy soil shall be adequately sheeted and braced. Where sheeting and bracing are used, the net trench width after sheeting shall not be less than that specified. As backfill is placed and sheeting is to be withdrawn, it shall be withdrawn in increments of not more than 300 mm, and the void left by the withdrawn sheeting shall be filled and compacted. If, despite such precautions, or by reason of their neglect, any portions of the bottoms, sides or ends shall give way or be excavated without instructions from the Engineer, the Contractor shall excavate and remove all the ground, thereby disturbed and make it good, with well rammed fill or in such class of concrete as may be ordered the Engineer. All excavated material shall be piled in a manner that will not endanger the work or obstruct sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street and other drainage.
23. The materials from excavation shall be deposited on both the sides and only one side of the trench as directed by the Engineer depending on the width of the road. All suitable materials removed in excavation or as much thereof as may be needed, shall be used for backfill. Material removed from trenches shall be placed alongside the trench at a sufficient distance from the trench to prevent it from falling into the trench, or its weight causing the trench sides to cave in. Where necessary, selected material required for backfill and topsoil and/or sod for later replacement shall be stored separately. In restricted urban areas, where no storage space is available for excavated material along the trench, or where the municipal authorities so require, the excavated material shall be removed immediately from the right-of way, and backfill material shall be brought to the site immediately before backfilling of trench. Rock and waste material not suitable or not required for backfill shall be mounded or spread along the trench and/or along the right-of way, except that where such mounding or spreading is prohibited by the authorities or by the owners of property or otherwise undesirable in the Engineer's opinion, such material shall be carted away.

24. Pipe shall be laid directly on a trench bottom, shaped to provide continuous contact with the pipe. The bottom portion of the trench shall be excavated and trimmed so that the pipe will be uniformly bedded on the required grade. Normal bedding according to the typical excavation sections shown on the Drawings, without concrete surround, shall be used unless otherwise called for elsewhere on the Drawings or directed by the Engineer. For said normal bedding the trench bottom shall be given a final trim and shape as shown on the Drawings so that each pipe section when first laid will be continuously in contact with the ground along the length of the pipe section. Any stones or flints likely to damage the pipe or its coating shall be picked out of the pipe bed, and any holes so formed shall be filled in with soft material, and trimmed to the correct level. Wherever said normal bedding is required and, due to over-excavating, inaccurate trimming, or other cause, the bottom of the trench fails to afford uniform supports as herein required, the Contractor shall, at his own cost, refill to

required grade with approved suitable material having optimum water content for compaction, shall compact said material, and ret rim the trench bottom to the required section and grade, or, if so instructed by the Engineer, shall make good the bottom of the trench with such class of concrete as directed by the Engineer.

25. Excess excavation is defined as excavation done by the Contractor beyond the lines shown on the Drawings, determined in the Specification or ordered by the Engineer. The Contractor shall backfill any excess excavation with compacted material approved by the Engineer, or in such class of concrete as may be ordered by the Engineer. No payment will be made for excess excavation or for its backfilling as specified.

26. Unless otherwise directed by the Engineer, and subject to any more stringent requirements imposed by the competent authorities, the following limitations for lengths of open trenches shall rule for a pipeline laid in one continuous reach:

a. Not more than l00m of trench in built-up areas and/or 300 m elsewhere, shall be opened in advance of pipe laying.

b. Not more than 100 m of pipeline left uncovered after pipe laying in built- up areas and not more than 300 m elsewhere. If these lengths of open trench are exceeded or if, in the opinion of the Engineer, there is undue delay in:

(1) Testing the pipelines;
(2) Removing surplus material;
(3) General tidying-up of areas where pipes have been laid; (4)
Partial restoration or maintenance of surfaces;

The Engineer may order that no further trenches shall be opened until the outstanding work has been carried out to his satisfaction, and the Contractor shall have no grounds for a claim against the Employer on this account.

27. Work included in Excavation

Unless otherwise directed on the project Specifications, all of the following items are included in the excavation:

1. Removing all surface obstructions including shrubs, jungle etc.,
2. Making all necessary excavations true to line and grade,
3. Furnishing and installing all shoring and bracing as necessary or as directed,
4. Pumping and bailing out water to keep trenches free of water during pipe laying and jointing and thereafter until joints mature,
5. Providing for uninterrupted surface water flow during work in progress,
6. Providing for disposing off water flows from storm, drains or other sources, suitably,

7. Protecting all pipes, conduits, culverts, railway tracks, utility poles, wire fences, buildings, and other public and private property adjacent to or in the line of work,
8. Removing all shoring and bracing which is not ordered to be left in place or not required by the project plans or Specifications to remain in place,
9. Hauling away and disposing of excavated materials not necessary or else unsuitable for back filling purposes. The extra excavated soil will have to be properly dressed in soil banks along with the trench as directed,
10. Back filling the trenches as directed or as per Specifications,
11. Restoring all property injured or disturbed by these construction activities to the condition as near its original condition as possible.

28. Change of Trench Location

In case the Engineer orders that the location of trench be moved areasonable distance, on account of the presence of an obstruction or due to such other cause or if a changed location is authorized at the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damage.

29. Minimum earth cover

If a profile is not furnished for a pipeline, the main will be constructed with a minimum earth cover of 1000mm from the top of the pipeline, unless otherwise indicated on plans and ordered by the Engineer.

30. Dewatering

1. During the excavation, if subsoil water is met with, Contractor shall provide necessary equipment and labourers for dewatering the trenches / pits by bailing out water or water mixed with clay. If pumping out subsoil water is found to be necessary, Contractor shall provide sufficient number of pumps for the same. In both the above cases the excavation shall be done to the required level and the pipes shall be laid to proper alignment and gradient. Contractor shall also make necessary arrangement for the disposal of drained water to nearby storm water drain or in a pit if allowed by Engineer. In no case the water shall be allowed to spread over the adjoining area. Before discharging this water into public sewer / drain, Contractor shall take necessary permission from the local authorities.
2. The Contractor shall be responsible for the adequate pumping, drainage and bailing out of water from the excavation. Failure to make such provisions which results in unsuitable sub grade conditions and which will require any special foundations as directed by the Engineer, such foundations shall be placed at the entire cost of the Contractor and will not be measured or paid for as separate pay items. If the Contractor selects to under cut the trench and use gravel or tile bailing, drainage of well pointing, the additional work will be considered as incidental work and additional compensation will not be allowed.

31 Wooden shoring

1. Contractor shall suitably design polling boards, walling and struts to meet different soil conditions that might be encountered in excavating trenches / pits. The horizontal and

vertical spacing of struts shall be such that not only the sides of trenches shall be prevented from collapse but also easy lowering of pipe in trenches shall be ensured without creating undue obstructions for the excavation of the work. Any Inconvenience and / or delay that might be caused in lowering pipes in trenches as a result of adopting improper spacing of struts by Contractor shall be his sole responsibility. While taking out shoring planks the hollows of any form must simultaneously be filled in with soft earth well rammed with rammers and with water.

2. Engineer may order portions of shoring to be left in the trenches / pits at such places, where it is found absolutely necessary to do so as to avoid any damage which may be caused to buildings, cables, gasmains, water- mains, sewers, etc. in close proximity of the excavation, by pulling out the shoring from the excavations. Contractor shall not claim, on any reason, whatsoever for the shoring, which may have been left in.

32. Steel plate shoring

Where the subsoil conditions are expected to be of a soft and unstable character in trench / pit excavation the normal method of timbering may prove insufficient to avoid subsidence of the adjoining road surfaces and other services. In such circumstances Contractor will be required to use steel trench sheeting or sheet piling adequately supported by adjustable steel / timber struts, walling, etc., as per the instructions, manner and method directed by Engineer. Contractor shall supply, pitch, drive and subsequently remove trench sheeting or piling in accordance with other items of the Specification.

33. Bedding
The bedding for pipe shall be provided as specified in the Drawings or as per direction of Engineer.

4.9.6.2 Laying of pipes and fittings / specials

1. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure / pipe line of water, gas, sewage, etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Engineer. Pipes and fittings / specials shall be carefully lowered in the trenches.

2. The pipes and specials shall be stacked along the alignment in advance with utmost care during the transit so that they are not damaged. Any damage due to these reasons shall be Contractor's liability. The pipe shall be lowered and laid only after the trenches are finally ready and levels duly checked by the Engineer. It shall be seen that no damaged pipe is lowered in the trench. Every precaution shall be taken to prevent foreign materials from entering the pipe when they are being placed in the line. Normally the socket ends shall face the upstream. When any portion of the excavation shall have been carried down to the necessary depth, the Contractors shall obtain permission from the Engineer before commencing the laying of pipes.

3. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fittings / specials shall be made by Contractor. In no case pipes and fittings / specials shall be dropped. Slings of canvas or equally non abrasive material of suitable width or special attachment to fit the ends of pipes and fittings / specials shall be used to lift and lower the coated pipes and fittings / specials. The pipes and fittings / specials shall be inspected for defects and be rung with a light hammer preferably while suspended to detect crack, wherever applicable. If doubt persists, further confirmation shall be done by pouring a little paraffin on the inside of the pipe at the suspected spot. No sign of paraffin should appear on the outside surface. Pipes and fittings / specials damaged during lowering or aligning shall be rejected by Engineer.

4. All the pipes are to be laid perfectly true both in alignment and to gradient specified. Pipes in a trench shall be laid and fitted previous to the jointing being commenced. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipe line runs uphill in which case the socket ends should face the upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings / specials which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipes and fittings / specials of proper dimensions to ensure such uniform space. Precaution shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that plug is on, the Contractor shall take proper precautions against floatation of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted, the deflection allowed at joints shall not exceed 2½o or such specifications mentioned in the manufacturer's catalog. In the case of pipes, with joint to be made with loose collars, the collars shall be slipped on before the next pipe is laid. The pipes shall be laid such that the marking on pipes appears at the top of the pipes.

5. Properly fitted temporary wooden stoppers shall be provided to close the ends of all incomplete pipe lines. The stoppers are only to be removed when pipes are being laid and jointed. Pipe laying and jointing shall be started and completed only section wise as per the instruction of the Engineer. During the progress of pipe laying the open ends of pipe shall be closed and water tight. After a particular section of the pipe is laid and jointed hydraulic testing shall be done section wise.

6. The item for laying of pipe line also includes labour work for lowering, laying and jointing various pipes including jointing with specials, leveling, etc. The Contractors shall transport pipes and specials from stores, for their various

sections in such quantities as may be required for laying. Ordinarily no surplus stock shall remain on completion of any section. In case however, such pipe etc. become surplus in any sections, the Contractor shall remove the same to the next section for use in the work. It is likely that on completion of the whole work, some pipes and specials etc. may become surplus at the site and the Contractors shall arrange to hand over the same in good condition to the Engineer at the Owner's store as may be directed if required by Owner. The Contractor shall supply a list of stock so returned to the Engineer. No extra payment shall be made to the Contractors for these works. The rates for laying the pipes shall cover the cost of loading, transporting and unloading as may be required. The fortnight report for pipes collected and laid should be sent to the Engineer.

7. The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe cutting machine shall be used.

4.10 Valve Assemblies, Crossings, Connections

4.10.1 General

The following clauses deal with the special requirements for the installation of valves and accessories of all descriptions, crossing of public utilities, river crossings, cutting into existing mains, thrust blocks, valve chamber etc. The following requirements shall be in addition to and shall in no way diminish from or vitiate the applicable requirements of other of the Specification, nor shall they relieve the Contractor of his obligations under the Contract.

4.10.2 Installation of Valves

The details of sluice valves, air valves, scour valves, surface boxes etc., shall be as shown on the drawings. All such valves and accessories shall be as manufactured by approved firms following the related IS Specifications. All valves and accessories shall be installed in the exact positions shown on the Drawings or as directed by the Engineer and shall be set accurately level and plumb. Extension Spindles, head stocks etc. shall be properly positioned. All valves and accessories shall be thoroughly cleaned before installation. Fitting of valves and accessories to the pipes shall be done accurately and true to alignment but without the use of undue force. No attempt shall be made to align valves or accessories by tightening bolts forcibly, by hammer blows or by any other method likely to cause damage or to give rise to internal stresses in the valve body or flanges. Flanged connections and mechanical joints shall be made as specified in the relevant clauses of this Section. To ascertain its proper operation, each gate valve shall be operated through its full range before and after installation. Non-return valves, air valves, etc. shall also be checked for ease of operation before and after installation. Valves and accessories which will be furnished by the manufacturer painted or coated shall have their exposed surfaces accessible from the inside of valvechambers, manholes etc. coated with two additional

coats of an approved bituminous paint, one applied before erection and the other after erection. Before the application of the new paint, all defective spots in the existing paint or coating shall be cleaned and touched up, to make them equal to the existing paint or coating. After installation the valve shall be left clean and ready for operation in all respects. The water tightness of valves shall be checked during filling and testing of the pipeline or installation and where necessary packing-glands shall be repacked and/or tightened.

4.10.3 Valve Chambers, Valve Supports etc.

Valves and accessories shall be housed in valve chambers, all as shown on the relevant drawings. Valve chambers shall be constructed of cast-in- situ reinforced concrete built on concrete foundations with a concrete floor, concrete cover slab with a heavy duty CI MH cover. Valves in valve chambers shall be anchored in concrete chamber walls and/or supported or encased by cast in-place concrete blocks. All concrete work shall be in accordance with relevant Specifications.
Metal parts to be installed in valve chambers, such as step irons, MH covers, etc. Shall be in accordance with relevant Specifications or as shown in the drawings.

4.10.5 Crossing under Public Utilities - General Requirements

Wherever the construction of the pipeline is to be performed under railway tracks, culverts, roads, bridges, storm drains, sewers, electric conduits, and any other public utility improvements, the Contractor shall make all arrangements with the public authorities having jurisdiction over such affected utilities regarding the method of crossing and restoration.

4.10.9 Cutting into Existing Mains

Prior to cutting into an existing main, the latter shall be uncovered for a suitable length and the exact position of the cut determined by the Engineer. The interruption of existing pumping line shall be coordinated with the Employer. The stoppage of pumping must be kept as short as possible and the time table agreed with the Engineer must be strictly adhered to. The section of the main in which the cutting is located shall be fully isolated between the nearest two adjacent valves; the other parts of the main shall remain full of water under pressure. The main has to be emptied in such a manner that the new pipe connection will be installed on dry ground. Where a new pipe is to be connected to the existing main, without an outlet having been provided beforehand, one pipe length shall be disjointed and removed, a section of it cut away and the remaining pipe ends trimmed to accommodate a Tee piece or long collar detachable joint with a branch outlet. Where a Tee is used it shall be connected to the pipes by means of D.I. detachable joints or mechanical joints. It is absolutely essential that the existing main shall be kept clean from impurities of any kind, and precautions shall be taken to prevent the entrance of dirt or other deleterious matter into the main while it is open for making the connection. Where the excavation for uncovering the pipe and making the connection is found wet, it shall be disinfected with liberal quantities of hypochlorite.

4.10.10 The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe cutting machine shall be used.

4.11 Jointing

4.11.1 Pipes shall be laid to the lines and grades given in the plans, with the ends abutting to form an even joint without shoulders or unevenness of any kind along the invert of the pipes. No joint shall be made under water. The ends of the pipes shall be dry and kept clean before and during laying and jointing operations.
4.11.2 All joint work shall be done in an approved manner by skilled workmen so that the completed pipeline shall have a continuous, smooth and uniform interior surface. Extruded joint material shall be removed from the interior of the pipe. In cold weather protective measures must be taken to ensure a satisfactory joint.

4.11.3 Jointing for pipes and fittings / specials shall be done in accordance with the relevant Specifications depending on type of pipes being used.

4.12 Temporary stoppages of work
At times when pipe laying is not in progress, or at the end of the day's work, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that plug is on, the Contractor shall take proper precautions against floatation of the pipe owing to entry of water into the trench.

4.13 Testing and commissioning
Testing and Commissioning of pipes shall be done in accordance with the relevant Specifications.

4.13.1 Water Tightness test

All hydraulic structures, either water supply or drainage etc., such as sewer lines, joints etc., or any other liquid containers shall have to be tested for water tightness. The Contractor shall give all such hydraulic tests by making his own arrangements for water filling and disposal of water after the test and shall repeat this test, if necessary, until the requisite test results are obtained without any claim for extra cost or compensation. The water tightness test shall be conducted as specified in IS: 4127- 1983. The tendered rates for hydraulic structures shall include all costs incurred by the Contractor for water tightness test. If any such hydraulic structure or fixture is found to be unsatisfactory at the time of giving this test the Contractor shall either repair or demolish and reconstruct the same as directed such that the structure is made absolutely water tight and declared as satisfactory by the Engineer. The decision of the Engineer will be taken as final.

4.14 Backfilling

Trenches shall be backfilled with approved selected excavated material only after the

successful testing of the pipe line. The tamping around the pipe shall be done by hand or other hand operated mechanical means. The water content of the soil shall be as near to the optimum moisture content as possible. Filling of the trench shall be carried out simultaneously on both sides of the pipe in such a manner that unequal pressure does not occur. Back filling shall be consolidated by watering, ramming, care being taken to avoid damage to the pipe line. Where timbers are placed under the pipe line to aid alignment, these timbers shall be removed before backfilling. Compaction test shall be for the backfilled area where ever found necessary.

4.15 Clearing of site

All surplus materials, and all tools and temporary structures shall be removed from the site as directed by Engineer and the construction site left clean to the satisfaction of Engineer.

4.16 Notes

4.16.1 Service lines if damaged during excavation shall be made good either by Contractor or by other agency as Engineer may decide and the cost of the same shall be borne by the Contractor wholly in either case.

4.16.2 Contractor shall not be paid any additional compensation for excess excavation over what is specified as well as for any remedial measures that are specified.

4.16.3 The excess excavated material shall be carried away from site of works as specified, failing which in view of public safety and traffic convenience Engineer may carry out the work by any other agency at Contractor's risk and cost.

5. SPECIAL SPECIFICATIONS

5.1 Protection shall be provided for the filled up earth with dry rubble works wherever necessary and asdirected by the Engineer in charge.
5.2 Constructing RCC supports structures over the bridge and culvert portion without obstructing the water flow as per the design approved by the Engineer-in-charge.
5.3 Supporting, protecting and replacing and repairing of damaged public utilities wherever found necessary-including waterlines, sewers, electric/telephone post etc. shall be the responsibility of the contractor.
5.4 Trial pits shall be taken before excavation for trenches in the pipe line alignment for detectin the service utility underneath and then only proceed for the actual excavation.
5.5 The above points will give only general information of the work to be executed under this contract.The tenderers shall meticulously inspect the proposed alignment, survey the required areas, water courses which the pipe line will have to cross, road crossing etc. and assess the items of materials to be supplied and works to be done for the satisfactory completion.
5.6 All the specials supplied shall be of same or higher pressure class of the pipe line having matching sizes of jointing ends.

5.7 For pipes upto 350mm dia, Sluice valves of the same size of the pipe lines are to be provided as control valves as per the directions of the Engineer in charge. The sluice valves shall be of approved make and pressures class PN-1.6. All necessary specials/tail pieces required for fixing the valves shall be supplied by the tenderer without any extra cost. Control Valves shall be fixed in the line at an interval not exceeding 2km. Sluice valves of suitable rating of reputed make are to be supplied. The valves shall conform to the relevant BIS/ISO standards and shall bear ISI/ISO marking/certificate wherever applicable. The scour valves are to be provided with scour Tee and Scour delivery system at every valley or, at places where the water can be drained out conveniently. The valves shall conform to relevant BIS/ISO standards and bear the ISI/ISO marking/certification.
5.8 Supply and fixing of Air valves of size 100mm is required for the project are also included within the scope of the work and contractor shall supply air valves of reputed make. All required specials such as Tees/Saddle pieces etc. shall also be supplied by the contractor without any extra cost. All such specials supplied shall be of best quality, approved make and IS Specifications. Air valves conforming to relevant BIS/ISO standards should be provided with isolation Valves in all crest points along the alignment as per the directions of the Engineer in charge. The size of air valves in no case be less than 1/8 of the pipe diameter.
5.9 The necessary specials such as Bends, Tees for fixing Air valves, Scour Tees for Scour arrangements, Tail pieces for fixing valves, Pipes for scour delivery arrangement, all confirming to BIS/ISO standards are to be supplied and installed by the tenderer for the completion of work. In case of non-standard specials, fabricated specials shall be used with the permission of the Engineer in charge.

5.10 In case if any of the specials are fabricated for special application/purpose the project, all such fabrications shall be done with 8mm M.S. plate or of higher thickness and painted with anticorrosive epoxy paint over a coat of epoxy primer withstanding the designed pressure. The Executive Engineer or the agreement authority shall have the right and authority to direct the tenderer to fabricate any special for which DI specials are not available. Cost of all such fabrications shall deem to have included in the amount quoted by the tenderer. No extra claim will be admissible in all such cases.
5.11 All specials, valves etc. Supplied by the tenderer shall conform with relevant IS Specifications. In case of absence of IS specification, special relevant international specifications such as British Standard shall have to be satisfied by the materials supplied. In all cases of supply of materials, prior approval of the make (manufacturer) by the Executive Engineer in charge is imperative.

5.12 Pre-Delivery Inspection of Pipes and Other Materials

5.12.1 The contractor shall supply all the materials including pipes and specials covered under the contract at his own cost. The pipes, specials etc. should be tested at the factory by one of the third party inspection agencies acceptable to KMC.

5.12.2 The agreement authority will have the option to depute an officer of KMC for witnessing the predelivery testing by the third party inspectors. Inspection Certificate should be produced before the dispatch of materials from the factory and only after written

communication-after the verification and acceptance of the inspection report, the materials shall be dispatched to the site. This third party inspection is mandatory for all pipes, specials and pumping and electromechanical equipments supplied by the contractor. Also ISI marked materials shall alone be accepted, wherever ISI specifications is available for such item. Any disputes between the Contractor and the supplier for inspection agencies or on any subject related to the work shall be a matter of settlement among both of them and KMC Authority shall not be a party to such disputes. The amount quoted shall be inclusive of the cost of all materials and charges of inspection as specified.

5.13 Testing of pipes & specials at site

The pipes and specials laid have to be tested at field to the required test pressure. The joints of all the pipes and specials shall be kept open until the testing arranged by the contractor. Failure of test due to any reason is to be rectified and retested without any extra cost. Contractors shall maintain a record of testing of pipe line which shall got signed by an officer not below the rank of an Assistant Executive Engineer which shall be produced along with his request for release of security deposit and shall be presented to any inspecting officer above the rank of Assistant Executive Engineer.

5.14 Positive results observed during pre-delivery inspection and the acceptance of the inspection report/results by KWA/Agreement authority will not any way relieve the contractor of his responsibility on the quality of materials supplied by him at the work site. If the materials supplied at site are found to be of inferior quality, the Executive Engineer in charge will have all the right to ask the contractor to replace the material supplied at his risk and cost

5.15 Valve Chambers, etc.

Valve Chambers shall be provided for air valves & sluice and scour valves of size 100mm and above, with 0.6 m minimum clear space on all sides of the valves. Earth work shall be done as per specification in all classes of soil with all protection, shoring etc. for the completion of the work. Base course for foundations for valve chambers shall be in Cement Concrete (1:3:6) using 40mm and down size metal, with hard broken granite, trap, and basalt or with any other approved grade as per the specifications. Base course shall be 150mm thick, laid at a level not less than 1 m below the natural ground level. Over the base coarse, foundation for the walls of the valve chamber shall be constructed in M20 as per the specifications. All the valve chambers shall be constructed with RCC M20 side wall of thickness not less than 150 mm with cover slab made in RCC M20, designed for taking Class A-A loading. All the valve chambers shall be provided with CI heavy duty manhole cover of 550 mm or nearest size capable of taking heavy traffic load.

The inside size of the valve chambers shall be minimum 1200x1200mm for valves upto 300 mm and for valves above 300mm, the Chamber size shall be 1500mmx1500mm (inside). The bottom of the valve chambers shall be finished in cement concrete to a

level below the pipe line. All the RCC and other civil structures shall be plastered smooth with cement mortar 1:4 or richer mix. Plastering inside the valve chambers should be with cement mortar 1:3 with a neat flushing coat by adding approved quality waterproofing compound in the cement mortar.

5.16 C.I. Protection Tube

For sluice, scour valves of size upto and including 80mm, CI protection tube of approved quality for covering the valves is to be provided. The protection tube shall be fixed over a bed concrete as directed by the departmental officers and approved drawings.

5.17 All steel materials shall be painted with two coats of anticorrosive epoxy paint over a priming coat, all approved by the Authority.

5.18 The tenderer shall study each of them and inspect the site to his satisfaction before quoting. It should be understood that it shall be the contractor's sole responsibility that the quantities under the detailed scope of work, are verified at site. The foundations, pipe lines and other structures completed as a part of this tender are to be 100% safe, durable and functional. He shall be responsible to conduct the necessary test on part of the items of materials used and as a whole after the completion of work as per the norms stipulated by the Indian Standard codes and satisfy the Engineer in charge/ Agreement authority on the acceptability, quality, performance and adequacy of the system in parts and as a whole.

5.19 Tenderer should furnish the names of suppliers of each item if he is not a manufacturer of the same.The full particulars regarding method of execution of work or any other relevant information shall be furnished to enable the Authority to have a correct evaluation of the technical bid in Cover B.

5.20 Variation in Length of pipe line

If the length on actual execution is found to be at variance with length specified in the scope of work the contract amount shall be considered to have changed proportionately based on rates quoted the price schedule.

5.21 As Laid Maps

Contractor shall submit five copies of the as laid map of the entire facility he had installed for the project as part of this contract with necessary references to the existing permanent structures. The as laid map must be prepared progressively with the progress of work and must be presented along with all the running contract bills. Submission of the as laid map in complete- for the entire work both in hard and soft copies is mandatory for considering the work as completed.

5.22 Man made Structures, Other Utilities- Affecting the work

When the works under this contract are executed, situations may arise that the works are affected by other man made structures either in service or abandoned. It is also likely that other utility services installed by various Government bodies are affected by the works under this contract. It shall be the duty of the contractor to ensure whether adequate sanction has been obtained from the authority concerned for the work with the help of Kozhikode Municipal Corporation / Kozhikode Medical College, before the works of such affected portions are undertaken. Any damage caused to any of the manmade structure or any of the utility services will have to be made good by the contractor at his cost. The contractor has to restore the original position if he has to demolish any structure like culverts, compound walls , roads etc. during the course of work at his own cost.

The contractor shall make arrangement for spraying water during and after excavation to keep dust away (3 times a day) for first 2 weeks and there after once as when required for one month. No extra payment shall be made for the same.

5.23 Vendors List

Two copies of complete list of Vendors/ Manufacturers from whom the valves, specials spares etc. can be procured with the product specification broachers / product identification number etc. shall be submitted by the contractor on completion of the work.

5.24 The DI-K9 pipes shall conform to the relevant specification of either BIS or ISO and shall bear ISI/ISO marking / certification. The pipes shall be provided with internal cement mortar lining and external Zinc coating. The internal lining shall have an epoxy seal coat as specified in the relevant IS/ISO specifications and standards.

5.25 All the spares supplied shall be properly stacked at the Treatment Plant Yard or at any such Stock Yard as directed by the Engineer in charge and compliance to this condition shall be a pre-condition to consider the work as completed.

5.26 The contractor shall engage qualified supervisory staff for the execution of work at site. Supervisory staff details engaged for the work at site including Managers, engineers and Supervisors shall be submitted to the Engineer in charge before commencement of the work. No supervisory staff shall be removed from site until completion of the project after commencement without obtaining permission from the engineer in charge. The contractor shall preferably submit an organogram showing the line of control with contact numbers of his supervisory staff at site.

5.27 Maintenance of the project

It is the sole responsibility of the contractor to protect and maintain the entire project successfully for the maintenance period of 60 months after commissioning. The following measures are to be taken essentially by the contractor Necessary

maintenance crew with supervisory staff shall be deployed. The staff pattern proposed by the contractor for the maintenance of the completed project should be got approved by the Department one month before the issue of completion certificate. The entire strength of maintenance crew with the supervisory personnel should be available from the first day of the maintenance period. The contractor should keep all spares required for replacements at the site for, pumping main, pump sets etc readily available to ensure uninterrupted sewage treatment. All the equipments that go out of order during the course of the maintenance period shall be rectified/replaced immediately to ensure uninterrupted Treatment. If any equipment/machinery is found to be defective either due to manufacture or due to unsatisfactory maintenance, the same should be replaced by the contractor at his cost. If the contractor fails to rectify the defects within 24 hours, the repair will be carried out departmentally and the actual expenditure incurred will be realized from the bill.

The contractor is responsible for the incidence of any theft, malpractice etc within the project area during the maintenance period and the contractor shall keep the Engineer informed about the day to day affair. During the period of maintenance, all costs towards labour, spares, consumables, chemicals, repairs and renewals shall be on to the account of the contractor. However the electrical energy charges payable to KSEB during the maintenance period shall be borne by Kozhikode Medical College. Complete quality service shall be ensured by the contractor during the maintenance period. Necessary log books indicating the quantity of water pumped, and maintenance carried out and repairs attended with details of spares changed shall be maintained by the contractor on a day to day basis and produced to the Engineer in charge whenever called for. Training to staff of Kozhikode Corporation & Medical College shall be given before handing over the scheme.

Schedule of Works

Technical Specifications

a) Civil Works

Sl.No	Works/Equipment	Quantity
	1. COLLECTION TANK	
1	Earthwork in excavation for collection tank	258.156 cum
2	Extra for every additional lift 1.5 m	193.617 cum
3	Providing and laying in position cement concrete of Grade 1:3:6 for collection tank.	10.757 cum
4	Providing and laying in position ready mixed concrete of grade M-30 grade for reinforced cement concrete work,usingSulphate Resistant Cemen.t	63.077 cum
5	Providing and laying in position ready mixed concrete of Grade M-25 grade for reinforced cement concrete work, using cement content as per approved design mix	10.701 cum
6	Epoxy Coated Steel reinforcement for R.C.C work	8550.360 kg
7	Extra for providing and mixing water proofing material in cement concrete work	428.924 kg
8	Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases ofcolumns, etc. for mass concrete	14.941 sqm
9	Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	165.600 sqm

10	Centering and shuttering including strutting, etc. and removal of form for:Lintels, beams, plinth beams,girdersbressumers and cantilevers	5.500 sqm
11	Centering and shuttering including strutting, etc. and removal of form for:Suspended floors, roofs,landings, balconies and access platform	38.500 sqm
12	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation	64.291 cum
13	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment. For vertical surface two coats	78.000 sqm
14	Providing and applying integral crystalline slurry of hydrophilic in nature for water proofing treatment. For horizontal surface one coat. For horizontal surface one coat	40.000 sqm
15	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	157.460 sqm
16	Supplying and fixing 450X600 mm rectangular D.I cover	2.000
17	Providing and fixing uPVC pipes	12.000 m
2. **RECIEVINJG CHAMBER & SCREEN CHANNEL**		
1	Earthwork in excavation	10.261 cum
2	Providing and laying in position cement concrete of grade Grade 1:3:6 for collection tank.	0.671 cum
3	Providing and laying in position ready mixed concrete of grade M-30 grade for reinforced cement concrete work, using Sulphate Resistant Cement	3.494 cum

4	Epoxy Coated Steel reinforcement for R.C.C work	349.401 kg
5	Extra for providing and mixing water proofing material in cement concrete work	23.760 kg
6	Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases ofcolumns, etc. for mass concrete	2.750 sqm
7	Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	19.500 sqm
8	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation	3.912 cum
9	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment. For vertical surface two coats	9.080 sqm
10	Providing and applying integral crystalline slurry of hydrophilic in nature forwaterproofing treatment. For horizontal surface one coat. For horizontal surface one coat	1.101 sqm
11	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	10.181 sqm
3. LANDSCAPING FOR 2MLD & 100KLD SEPTAGE		
1	Trenching in ordinary soil up to a depth of 60 cm including removal and stacking of serviceable materials and then disposing of surplus soil	150.000 cum
2	Screened through sieve of I.S. designation 4.75 mm	75.000 cum

3	Spreading of sludge, dump manure and/or good earth in required thickness	150.000 cum
4	Mixing earth and sludge or manure in the required proportion specified	150.000 cum
5	Providing and fixing Neelgiri/Mexican grass turf with earth 50mm to 60mm thickness of existing ground	250.000 sqm
6	Digging holes in ordinary soil and refilling the same with the excavated earth	80.000 holes.
7	Providing and fixing M.S. flat iron tree guard	10.000 nos
8	Supply and stacking of Lagerstroemia flosreginae plant of height 150-165 cm	10.000 each
9	Supply and stacking of Plumeriaacutifolia plant of height 150-165 cm	10.000 each
10	Supply and stacking of Ficus benjamina (green) plant of height 120-135 cm.	20.000 each
11	Supply and stacking of Delonixregia (Gulmohar) plant of height 150-165 cm.	20.000 each
12	Supply and stacking of Azadirachtaindica (Neem) plant of height 120-130cm	10.000 each
13	Plantation of Trees, Shrubs, and Hedge at site i/c watering and removal of unsaverieable material	80.000 no

4. 2 MLD STP – COLLECTION TANK (CIRCULAR)		
1	Earthwork in excavation for collection tank	1143.300 cum
2	Extra for every additional lift 1.5 m	1431.901 cum
3	Providing and laying in position cement concrete of Grade 1:3:6 for collection tank.	33.300 cum
4	Providing and laying in position ready mixed concrete of M-30 grade for reinforced cement concrete work, using Sulphate Resistant Cement	183.431 cum
5	Providing and laying in position ready mixed concrete of M-25 grade for reinforced cement concrete work, using cement content as per approved design mix	74.575 cum
6	Epoxy Coated Steel reinforcement for R.C.C work	38640.000 kg
7	Extra for providing and mixing water proofing material in cement concrete work	1247.331 kg
8	Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases ofcolumns, etc. for mass concrete	26.000 sqm
9	Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	434.250 sqm
10	Centering and shuttering including strutting, etc. and removal of form for:Lintels, beams, plinth beams,girdersbressumers and cantilevers	45.088 sqm
11	Centering and shuttering including strutting, etc. and removal of form for:Suspended floors, roofs,landings, balconies and access platform	165.720 sqm

12	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation	129.700 cum
13	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment. For vertical surface two coats	211.885 sqm
14	Providing and applying integral crystalline slurry of hydrophilic in nature forwaterproofing treatment. For horizontal surface one coat. For horizontal surface one coat	177.000 sqm
15	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	565.885 sqm
16	Supplying and fixing 450X600 mm rectangular D.I cover	1.000 each
17	Providing and fixing uPVC pipes	12.000 metre
5. RECEIVING CHAMBER & SCREEN CHANNEL		
1	Earthwork in excavation	65.038 cum
2	Extra for every additional lift 1.5 m	29.563 cum
3	Providing and laying in position cement concrete of Grade 1:3:6 for collection tank.	2.365 cum
4	Providing and laying in position ready mixed concrete of M-30 grade for reinforced cement concrete work,usingSulphate Resistant Cement	20.110 cum

5	Epoxy Coated Steel reinforcement for R.C.C work	2011.000 kg
6	Extra for providing and mixing water proofing material in cement concrete work	136.748 kg
7	Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases ofcolumns, etc. for mass concrete	5.925 sqm
8	Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	149.040 sqm
9	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation	19.868 cum
10	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment. For vertical surface two coats	94.800 sqm
11	Providing and applying integral crystalline slurry of hydrophilic in nature for water proofing treatment. For horizontal surface one coat. For horizontal surface one coat	9.400 sqm
12	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	104.20 sqm
6. PLANT FOUNDATION		
1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual.	2663.284 cum
2	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas	1331.642 cum

3	Providing and laying in position cement concrete of specified grade (Grade 1:3:6)	133.165 cum
4	Providing and laying in position ready mixed concrete of M-25 grade for reinforced cement concrete work, using cement content as per approved design mix	349.344 cum
5	Epoxy Coated Steel reinforcement for R.C.C work	42000.000 kg
6	Extra for providing and mixing water proofing material in cement concrete work	2380.000 kg
7	Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases ofcolumns, etc. for mass concrete	54.120 sqm
8	Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	911.880 sqm
9	Providing and applying integral crystalline slurry of hydrophilic in nature for water proofing treatment. For horizontal surface one coat. For horizontal surface one coat	603.000 sqm
10	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	824.761 sqm
11	Providing and fixing hand rail of approved size by welding	1319.502 kg
7. ELECTROLYTIC REACTORS & FILTRATION BAY		

1	Providing and laying in position ready mixed concrete of M-25 grade for reinforced cement concrete work, using cement content as per approved design mix-All work above plinth level up to floor V level	30.042 cum
2	Providing and laying in position ready mixed concrete of M-25 grade for reinforced cement concrete work, using cement content as per approved design mix-All work up to plinth level.	2.754 cum
3	Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position.	3733.200 kg
4	Centering and shuttering including strutting, etc. and removal of form for: Suspended floors, roofs, landings, balconies and access platform	146.424 sqm
5	Centering and shuttering including strutting, etc. and removal of form for:Lintels, beams, plinth beams, girders bressumers and cantilevers	79.889 sqm
6	Centering and shuttering including strutting, etc. and removal of form for:Columns, Pillars, Piers, Abutments, Posts and Struts	60.481 sqm
7	12 mm cement plaster finished with a floating coat of neat cement of mix:1:3 (1 cement : 3 fine sand)	165.360 sqm
8	6 mm cement plaster of mix:1:3 (1 cement : 3 fine sand)	286.794 sqm
9	Finishing with Epoxy paint (two or more coats) at all locations prepared and applied	286.794 sqm
8. INTERNAL ROADS & STORM WATER DRAINS		
1	Filling with Quarry Muck	31.680 cum

2	Providing and laying factory made chamfered edge Cement Concrete paver blocksin footpath, parks,	211.200 sqm
3	Providing, laying and making kerb channel 30 cm wide and 50 mm thick with cement concrete 1:3:6	15.840 sqm
4	Manufacturing, supplying and fixing retro reflective sign boards-Mandatory / Regulatory sign boards of 900 mm diameter with support length of 3750 mm	2.000 each
5	Manufacturing, supplying and fixing retro reflective sign boards-.Cautionary / warning sign boards of equilateral triangular shape having each side of 900 mm with support length of 3650 mm	2.000 each
6	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature jointed with cement mortar 1:3.	3.168 cum
7	Earth work in excavation by mechanical means (Hydraulic excavator) /manual.	12.936 cum
8	Providing and laying in position cement concrete of specified grade (Grade 1:4:8)	1.848 cum
9	Providing and laying in position cement concrete of specified grade (Grade 1:3:6)	2.64cum
10	Extra for providing and mixing water proofing material in cement concrete work	29.634 kg

11	Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	52.800 sqm
9. SITE CLEARANCE & LEVELLING		
1	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth upto 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared	200 sqm
2	Felling trees of the girth (measured at a height of 1 m above ground level) including cutting of trunks andbranches, removing the roots and stacking of serviceable material and disposal of unserviceablematerial. Beyond 60 cm girth up to and including 120 cm girth	2 nos
10. SEWER CONVEYANCE		
1	Excavating trenches of required width for pipes, cables, etc.	1400m
2	Providing and laying Double Flanged (Screwed / Welded) Centrifugally (Spun) Ductile Iron Pipes ofClass K	400m
3	Providing and fixing uPVC complete as per direction of engineer in charge.110 mm dia6Kgf/cm2	500m
4	Providing and fixing uPVC pipes includings jointing of pipes with one step uPVC solvent cement,trenching, refilling,fittings& testing of Joints complete as per direction of engineer in charge.160 mm dia6Kgf/cm2	200m
5	Providing and fixing uPVC pipes includings jointing of pipes with one step uPVC solvent cement,trenching, refilling ,fittings & testing of Joints complete as per direction of engineer in charge.200 mm dia6Kgf/cm2	300m

6	Supplying, filling, spreading &leveling coarse sand of size range 3 mm to 6 mm in trenches, in requiredthickness over gravel layer, for all leads & lifts, all complete as per direction of Engineer-in-charge.	149.252 cum
7	Dismantling of flexible pavement (bituminouscourses) by mechanical means and disposal of dismantledmaterial up to a lead of 1 kilo metre, as per direction of Engineer-in-charge.	4.801 cum
8	Providing , laying spreading and compacting graded stone aggregate (size range 53 mm to 0.075 mm) to wet mix macadam	4.801 cum
9	Primer Coat - Bitumen Emulsion (SS-1) Providing and applying primer coat with bitumen emulsion (SS-1) on prepared surface of granular baseincluding cleaning of road surface and spraying primer at the rate of 0.70-1.0 kg/sqm using mechanicalmeans as per Technical Specification Clause 502(low porosity).	48 sqm
10	Tack Coat - RS Bitumen Emulsion - On W.B.M / W.M.M @ 0.4 kg/ sqmProviding and applying tack coat using bitumen emulsion conforming to IS : 8887, using emulsionpressure distributor including preparing the surface & cleaning with mechanical broom.	48 sqm
11	Mix Seal Surfacing - Manual Means - Type B - Bitumen S-65 Providing, laying and rolling of close-graded premix surfacing material of 20 mm thickness composed of11.2 mm to 0.9 mm (Type-A) or 13.2 mm to 0.9 mm (Type-B) aggregates	48sqm
12	Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand) with R.C.C. topwith 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundationconcrete 1:4:8 mix (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size,)	21 nos
13	Extra for depth for manholesSize 120x90 cmWith Sewer bricks conforming to IS: 4885	16.8m
11. 1 MLD STP - CONVEYANCE		

1	Excavating trenches of required width for pipes, cables, etc	1830m
2	Providing and laying Double Flanged (Screwed / Welded) Centrifugally (Spun) Ductile Iron Pipes ofClass K - 9 conforming to IS: 8329 :200 mm dia Ductile Iron Double Flanged	1000m
3	Providing and fixing uPVC pipes includings jointing of pipes with one step uPVC solvent cement,trenching, refilling ,fittings & testing of Joints complete as per direction of engineer in charge.200 mm dia6Kgf/cm2	430m
4	Providing and fixing uPVC pipes includings jointing of pipes with one step uPVC solvent cement,trenching, refilling,fittings& testing of Joints complete as per direction of engineer in charge.160 mm dia6Kgf/cm2	400m
5	Supplying, filling, spreading &leveling coarse sand of size range 3 mm to 6 mm in trenches, in requiredthickness over gravel layer, for all leads & lifts, all complete as per direction of Engineer-in-charge.	221.560
6	Dismantling of flexible pavement (bituminous courses) by mechanical means and disposal of dismantledmaterial up to a lead of 1 kilo metre, as per direction of Engineer-in-charge.	4.801 cum
7	Providing , laying spreading and compacting graded stone aggregate (size range 53 mm to 0.075 mm) towet mix macadam (WMM)	4.801
8	Providing and applying primer coat with bitumen emulsion (SS-1) on prepared surface of granular baseincluding cleaning of road surface and spraying primer at the rate of 0.70-1.0 kg/sqm using mechanicalmeans as per Technical Specification Clause 502(low porosity).	48 sqm
9	Tack Coat - RS Bitumen Emulsion - On W.B.M / W.M.M @ 0.4 kg/ sqmProviding and applying tack coat using bitumen emulsion conforming to IS : 8887, using emulsionpressure distributor including preparing the surface & cleaning with mechanical broom.	48 sqm

10	Providing, laying and rolling of close-graded premix surfacing material of 20 mm thickness composed of11.2 mm to 0.9 mm (Type-A) or 13.2 mm to 0.9 mm (Type-B) aggregates	48 sqm
11	Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand) with R.C.C. topwith 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundationconcrete 1:4:8 mix (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size,)	22 nos
12	Extra for depth for manholesSize 120x90 cmWith Sewer bricks conforming to IS: 4885	17.6 m
12. COLLECTION TANK		
1	Earthwork in excavation for collection tank	566.500 cum
2	Extra for every additional lift 1.5 m	709.5 cum
3	Providing and laying in position cement concrete of Grade 1:3:6 for collection tank.	16.50 cum
4	Providing and laying in position ready mixed concrete of grade M-30 grade for reinforced cement concrete work, using Sulphate Resistant Cement	83.731 cum
5	Providing and laying in position ready mixed concrete of Grade M-25 grade for reinforced cement concrete work, using cement content as per approved design mix	34.696 cum
6	Epoxy Coated Steel reinforcement for R.C.C work	17201 kg
7	Extra for providing and mixing water proofing material in cement concrete work	569.840kg
8	Centering and shuttering including strutting, etc. and removal of form for: Foundations, footings, bases of columns, etc. for mass concrete	18.10 sqm

9	Centering and shuttering including strutting, etc. and removal of form for: Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	25.381 sqm
10	Centering and shuttering including strutting, etc. and removal of form for: Lintels, beams, plinth beams, girders bressumers and cantilevers	297 sqm
11	Centering and shuttering including strutting, etc. and removal of form for: Suspended floors, roofs, landings, balconies and access platform	75.710 sqm
12	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation	160.2 cum
13	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment. For vertical surface two coats	141.191 sqm
14	Providing and applying integral crystalline slurry of hydrophilic in nature for water proofing treatment. For horizontal surface one coat. For horizontal surface one coat	79 sqm
15	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	299.191 sqm
16	Supplying and fixing 450X600 mm rectangular D.I cover	1 no
17	Providing and fixing uPVC pipes	12 m
13. RECEIVING CHAMBER AND SCREEN CHANNEL		
1	Earthwork in excavation	45.520 cum
2	Extra for every additional lift 1.5 m	16.465 cum

3	Providing and laying in position cement concrete of Grade 1:3:6 for collection tank.	0.902 cum
4	Providing and laying in position ready mixed concrete of M-30 grade for reinforced cement concrete work, using Sulphate Resistant Cement	10.076 cum
5	Epoxy Coated Steel reinforcement for R.C.C work	1007.6 kg kg
6	Extra for providing and mixing water proofing material in cement concrete work	68.517 kg
7	Centering and shuttering including strutting, etc. and removal of form for: Foundations, footings, bases of columns, etc. for mass concrete	4.20 sqm
8	Centering and shuttering including strutting, etc. and removal of form for: Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	92.20 sqm
9	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation	15.668 cum
10	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment. For vertical surface two coats	57.92 sqm
11	Providing and applying integral crystalline slurry of hydrophilic in nature for water proofing treatment. For horizontal surface one coat. For horizontal surface one coat	5.010sqm
12	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	62.930 sqm
14. **PLANT FOUNDATION**		
1	Earth work in excavation by mechanical means (Hydraulic excavator) /manual.	1560.462 cum

2	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas	767.007 cum
3	Providing and laying in position cement concrete of specified grade (Grade 1:3:6)	79.346 cum
4	Providing and laying in position ready mixed concrete of M-25 grade for reinforced cement concrete work, using cement content as per approved design mix	182.451 cum
5	Epoxy Coated Steel reinforcement for R.C.C work	21960 kg
6	Extra for providing and mixing water proofing material in cement concrete work	1244.4 kg
7	Centering and shuttering including strutting, etc. and removal of form for: Foundations, footings, bases of columns, etc. for mass concrete	27 sqm
8	Centering and shuttering including strutting, etc. and removal of form for: Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	545.7 sqm
9	Providing and applying integral crystalline slurry of hydrophilic in nature for water proofing treatment. For horizontal surface one coat. For horizontal surface one coat	331 sqm
10	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	331 sqm
11	Providing and fixing hand rail of approved size by welding	792.706 kg

15. ELECTROLYTIC REACTORS AND FILTRATION BAY		
1	Providing and laying in position ready mixed concrete of M-25 grade for reinforced cement concrete work, using cement content as per approved design mix-All work above plinth level up to floor V level	23.016 cum
2	Providing and laying in position ready mixed concrete of M-25 grade for reinforced cement concrete work, using cement content as per approved design mix-All work up to plinth level.	2.602 cum
3	Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position.	2587.10 kg
4	Centering and shuttering including strutting, etc. and removal of form for: Suspended floors, roofs, landings, balconies and access platform	109.44 sqm
5	Centering and shuttering including strutting, etc. and removal of form for: Lintels, beams, plinth beams, girders bressumers and cantilevers	60.787 sqm
6	Centering and shuttering including strutting, etc. and removal of form for: Columns, Pillars, Piers, Abutments, Posts and Struts	51.001 sqm
7	12 mm cement plaster finished with a floating coat of neat cement of mix:1:3 (1 cement : 3 fine sand)	221.228 sqm
8	6 mm cement plaster of mix:1:3 (1 cement : 3 fine sand)	122.120 sqm
9	Finishing with Epoxy paint (two or more coats) at all locations prepared and applied	221.228 sqm
16. INTERNAL ROADS & STORM WATER DRAIN		
1	Filling with Quarry Muck	20.160 cum

2	Providing and laying factory made chamfered edge Cement Concrete paver blocks in footpath, parks,	134.40 sqm
3	Manufacturing, supplying and fixing retro reflective sign boards made up of 2 mm thick aluminium sheet, face to be fully covered with high intensity encapsulated type heat activated retro reflective sheeting	2 each
4	Manufacturing, supplying and fixing retro reflective sign boards-Mandatory / Regulatory sign boards of 900 mm diameter with support length of 3750 mm	2.000 each
5	Providing, laying and making kerb channel 30 cm wide and 50 mm thick with cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm bed of dry brick ballast 40 mm nominal size	11.52 sqm
6	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature jointed with cement mortar 1:3.	2.304 cum
7	Earth work in excavation by mechanical means (Hydraulic excavator) /manual.	9.408 cum
8	Providing and laying in position cement concrete of specified grade (Grade 1:4:8)	1.344 cum
9	Providing and laying in position cement concrete of specified grade (Grade 1:3:6)	1.920 kg
10	Extra for providing and mixing water proofing material in cement concrete work	21.543 kg
11	Centering and shuttering including strutting, etc. and removal of form for: Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	38.4 sqm

17. SITE LEVELLING AND CLEARING		
1	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared	1720.00 sqm
2	Felling trees of the girth (measured at a height of 1 m above ground level) including cutting of trunks and branches, removing the roots and stacking of serviceable material and disposal of unserviceable material. Beyond 60 cm girth up to and including 120 cm girth	4 nos
18. COLLECTION TANK-II(CIRCULAR)		
1	Earthwork in excavation for collection tank	566.5 cum
2	Extra for every additional lift 1.5 m	709.5 cum
3	Providing and laying in position cement concrete of Grade 1:3:6 for collection tank.	16.5 cum
4	Providing and laying in position ready mixed concrete of grade M-30 grade for reinforced cement concrete work, using Sulphate Resistant Cemen.t	83.731 cum
5	Providing and laying in position ready mixed concrete of Grade M-25 grade for reinforced cement concrete work, using cement content as per approved design mix	34.696 cum
6	Epoxy Coated Steel reinforcement for R.C.C work	17201.0 kg
7	Extra for providing and mixing water proofing material in cement concrete work	569.371 kg
8	Centering and shuttering including strutting, etc. and removal of form for: Foundations, footings, bases of columns, etc. for mass concrete	18.10 sqm
9	Centering and shuttering including strutting, etc. and removal of form for: Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	297 sqm
10	Centering and shuttering including strutting, etc. and removal of form for: Lintels, beams, plinth beams, girders bressumers and cantilevers	25.381 sqm

11	Centering and shuttering including strutting, etc. and removal of form for: Suspended floors, roofs, landings, balconies and access platform	75.710 sqm
12	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation	160.2 cum
13	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment. For vertical surface two coats	141.191 sqm
14	Providing and applying integral crystalline slurry of hydrophilic in nature for water proofing treatment. For horizontal surface one coat. For horizontal surface one coat	79 sqm
15	9 mm cement plaster finished with a floating coat of neat cement of mix:1:3	299.191 sqm
16	Supplying and fixing 450X600 mm rectangular D.I cover	1 No
17	Providing and fixing uPVC pipes	12.000 m
FILTER PRESS BAY-2MLD		
1	2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil	6.384 cum
2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)	1.634 cum

3	60.7.1 DRY RUBBLE MASONRY _ Dry rubble without concrete levelling course masonry with good quality blasted rubble including packing to compactness to lines and levels cost and conveyance of all materials labour charges etc. complete as per direction of Departmental officers at site	4.104 cum
4	7.1.1 Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) up to plinth level with: Cement mortar 1:6 (1 cement : 6 coarse sand)	2.053 cum
5	6.4.1 Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level in all shapes and sizes in: Cement mortar 1:4 (1 cement : 4 coarse sand)	1.884 cum
6	11.3.1 Cement concrete flooring 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate)finished with a floating coat of neat cement, including cement slurry, but excluding the cost of nosing of steps etc. complete.40 mm thick with 20 mm nominal size stone aggregate	9.611 sqm
7	od191229/2018_2019 Structural steel work in single section, fixed with or without connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer and synthetic enamel paint of approved brand and manufacture (two coats) all complete.	101.290 kilogram
8	13.1.1 12 mm cement plaster of mix:1:4 (1 cement : 4 fine sand)	37.581 sqm
9	od191230/2018_2019 Providing and fixing powder coated aluminium zinc trafford profile sheets of approved quality 0.45mm or nearest thickness with protective guard film of 25microns minimum to avoid scratches, supplied in single length upto 12m with necessary fittings as per direction of engineers in charge	18.240 sqm

FILTER PRESS BAY-1MLD		
1	2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.All kinds of soil	6.384 cum
2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)	1.586 cum
3	60.7.1 DRY RUBBLE MASONRY _ Dry rubble without concrete levelling course masonry with good quality blasted rubble including packing to compactness to lines and levels cost and conveyance of all materials labour charges etc. complete as per direction of Departmental officers at site	4.104 cum
4	7.1.1 Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) up to plinth level with: Cement mortar 1:6 (1 cement : 6 coarse sand)	2.053 cum
5	6.4.1 Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level in all shapes and sizes in: Cement mortar 1:4 (1 cement : 4 coarse sand)	1.884 cum
6	od191229/2018_2019 Structural steel work in single section, fixed with or without connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer and synthetic enamel paint of approved brand and manufacture (two coats) all complete.	101.290 kilogram
7	11.3.1 Cement concrete flooring 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate)finished with a floating coat of neat cement, including cement slurry, but	9.611 sqm

	excluding the cost of nosing of steps etc. complete.40 mm thick with 20 mm nominal size stone aggregate	
8	13.1.1 12 mm cement plaster of mix:1:4 (1 cement : 4 fine sand)	37.581 sqm
9	od191230/2018_2019 Providing and fixing powder coated aluminium zinc trafford profile sheets of approved quality 0.45mm or nearest thickness with protective guard film of 25microns minimum to avoid scratches, supplied in single length up to 12m with necessary fittings as per direction of engineers in charge	18.240 sqm

b) Mechanical works

Sl.No.	Equipments and specifications	Quantity
	1 MLD	
1	**Electrolytic Reactor process feed pump** : Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch capacity 50 m3/hr, 15 mwc, 5HP	**2 nos**
2	**Raw sewage transfer pump** : Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch capacity 50 m3/hr, 15 mwc, 5HP	**2 nos**
3	**Electrolytic Reactor:** Design, detailed engineering, manufacture, supply to site, installation and erection, testing, trial run and commissioning of complete reactor in FRP / MS-FRP with reaction zone size 1.30 m L x 0.5m W x 1.0m D and Froth compartment size 0.5m L x 0.5m W x 0.5m D and with product compartment size 0.5m L x 0.5m W x 1.0m D and overall reactor of size 2.30 m L x	**12 nos**

	0.5m W x 1.0m TD.	
4	**DC Rectifier unit:** Manufacture, supply, installation, erection, testing, trial run and commissioning of DC rectifier unit complete with transformer, rectifier, heat sink , axial cooling fans and all accessores as required, in MS powder coated panel with all internal circuit components, designed for incomer of 415v AC 50 Hz 3 phase input and to delivery 200 amps @ 12 v DC as outlet x 3 rectifiers in parallel and totally provide 600 amps at 12 v DC per reactor above	**36 nos (24 for stage I & 12 for Stage II)**
5	**Aluminum electrodes:** Aluminum electrodes, typically 450mm x 700mm size, 5 mm thickness including stake arm for bus bar connectivity, charges including cost of material, machining, labor, freight to site, erection into the reactor system - all complete	**500 nos appox**
6	**Bus Bar:** Procurement, supply to site, erection of Bus bar in aluminum 6mm thick flat with connecting system for each electrode, including main bus bar header from panel - one for anode and one for cathode and one arm for each electrode - totally 40 arms and connecting systems with each electrode - all complete	**12 nos**
7	Structural support for Electrolytic reactors, with chequered plate assembly walkway and rails, approach ladder all included	**1 no**
8	Procurement, supply to site and erection of sub wiring for each rectifier from panel and main header piping from Electrolytic reactor feed pump to Electrolytic reactor and from all reactors to the settling system - LS	**12 nos**
9	**Filter Feed Pumps** : Supply & Installation of horizontal centrifugal, closed impeller , clear water monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch capacity 50 m3/hr, 15 mwc, 7.5HP	**2 nos**

10	**Under flow pumps** : Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch capacity 3 m3/hr, 12 mwc, 1HP	**2 nos**
11	**Sand Filter** : Supply, & installation of Pressure Sand Filter - PE-FRP composite vessel construction. Filter to be of composite FRP construction with multiport valve for operations. Suitable stand / support should be provided along with the filter. Filtration rate should not be greater than 13 m3/hr / sq.mt of the filtration area. 48" dia x 72" HOS model 4872 with multiport valve and distributors	**4 nos**
12	**Carbon Filter** : Supply, & installation of Activated Carbon Filter - PE-FRP composite vessel construction. Filter to be of composite FRP construction with multiport valve for operations. Suitable stand / support should be provided along with the filter. Filtration rate should not be greater than 15 m3/hr / sq.mt of the filtration area. Carbon filter to be fitted with pressure guage at outlet – 0 – 7 bar, 1.5" dial, glycerine filled SS Bourdon guage. Media to consist of graded pebble, coarse, fine sand and activated carbon. 42" dia x 72" HOS model 4272 with multiport valve and distributors	**4 nos**
13	**Filter Backwash Pumps** : Supply & Installation of horizontal centrifugal, closed CIimpeller , clear water monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch capacity 130m3/hr, 25mwc, 15HP	**2 nos**
14	**Alum Dosing System :**Supply& installation and erection of white double layered HDPE dosing tanks of capacity 300 liters for dosing alum. Dosing tanks to be equipped with inlet line provision for	**1 no**

	chemical mixing water and drain provision. Capacity300 liters. Alum dosing pump of 0-20 lph range with 2.5 bar working pressure electronic metering typepump	
15	**Hypo Dosing System:** Supply& installation and erection of HDPE chemical dosing tanks of 300 liters capacity for dosing. The dosing tanks shall be free standing, to be kept on fixed concrete floor.	**2 nos**
16	**Filter Press Aid dosing system** : Supply & installation and erection of HDPE chemical dosing tanks of 100 liters capacity for dosing. The dosing tanks shall be free standing, to be kept on fixed concrete floor. Dosing tanks to be equipped with inlet line provision for chemical mixing water and drain provision. Supply & Installation of electronic metering pumps of 0 – 6lph capacity at 3bar.	**1 no**
17	**Filter Press Feed Pumps** : Supply & installation of filter press feed pumps – screw / reciprocating plunger of 1.5 m3/hr capacity with SS wetted parts and suitable for working at 5 bar operating pressure. Motor should be IP 55, Class F insulated TEFC, SQI motor Pump discharge common header to be fitted with pressure guage 0- 10 bar, 1.5" dial, SS Bourdon type glycerine filled gauge. capacity 1.5m3/hr, 5 bar (50 mwc),1HP	**1 no**
18	**Filter press** : Supply & installation filter press system. Filter Press will be manual, recessed type press with MS fabricated structure pipe button surface and MS flat parallel bar, with PP cloth. 4/5/6 chamber and 5/6/7 plates of size 355mm x 355mm and with active surface area not less than 0.78 m2 is to be provided. FRP drip tray with drain valve is also to be provided. Filter Press will have center inlet and four corner outlet. The Filter Press Unit will be mounted on a platform and all around drain system to be provided to prevent the filtrate water from contaminating the entire surroundings. 1500lph filter press,4Bar	**1 no**

19	**Bar Screen in Collection Tank** : Supply and installation, of manual bar screen, MS – epoxy frame to be fitted in bar screen chamber of width 500mm ,with MS flat bars each of size 50mm with 6mm thickness and 20mm c/c gap between bars.	**1 no**
20	Provide all labour equipment and materials to furnish and install Prefabricated Security Cabin	**1 no**
21	**High Pressure Jet Pump** Supply, installation, testing and commissioning portable type High Pressure jet pump with 2HP Motor, 80bar Pressure, 1450 rpm 220V 50Hz for cleaning the plant and machineries with 20m length flexible hose as per the specifications or as directed by the engineer in charge	**1 no**
22	**Dewatering Pump-** Supply & Installation of 15.0 m3/hr, 30 mwc horizontal centrifugal non clog semi open CI impeller monobloc pump with TEFC, IP 55 CL - F Squirrel Cage Induction Motor	**1 no**
23	**Portable Hoist - 500kg** Monkey type Hoist with capacity up to 500kg, with lifting height of 6m, 5HP Motor, 415V 50Hz as per the specifications or as directed by the engineer in charge	**1 no**
24	**Aluminium Ladder** Supply, Installation of aluminum ladders for Security Cabin, Office Room & Plant Room	**12 m**
25	**Interconnecting Piping:** One lot of all interconnecting piping and valves and fittings as per specifications provided	**LS**
26	**Instrumentation:** Instrumentation items consisting of pressure gauges, level switches, electro magnetic flow meters, normal flow meters, table top pH and turbidity meter	**LS**

27	Diesel Holding SS Tank 500 Litres	**1 no**
2 MLD		
1	**Under flow pumps** : Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply Pump to be fitted with DRY RUN TRIP with level switch. Capacity 3.0m3/hr, 12 mwc, 1HP	**2 nos**
2	**Electrolytic Reactor process feed pump** : Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch. Capacity 100m3/hr, 15 mwc, 10HP	**2 nos**
3	**Electrolytic Reactor:** Design, detailed engineering, manufacture, supply to site, installation and erection, testing, trial run and commissioning of complete reactor in FRP / MS-FRP with reaction zone size 1.30 m L x 0.5m W x 1.0m D and Froth compartment size 0.5m L x 0.5m W x 0.5m D and with product compartment size 0.5m L x 0.5m W x 1.0m D and overall reactor of size 2.30 m L x 0.5m W x 1.0m TD.	**18 nos**
4	**DC Rectifier unit:** Manufacture, supply, installation, erection, testing, trial run and commissioning of DC rectifier unit complete with transformer, rectifier, heat sink , axial cooling fans and all accessories as required, in MS powder coated panel with all internal circuit components	**54 nos (36 for stage I & 18 for StageII)**
5	**Aluminum electrodes:** Aluminum electrodes, typically 450mm x 700mm size, 5 mm thickness including stake arm for bus bar connectivity, charges including cost of material, machining, labor,	**800 nos approx**

	freight to site, erection into the reactor system - all complete	
6	**Bus Bar:** Procurement, supply to site, erection of Bus bar in aluminum 6mm thick flat with connecting system for each electrode, including main bus bar header from panel - one for anode and one for cathode and one arm for each electrode - totally 40 arms and connecting systems with each electrode - all complete	**18 nos**
7	Structural support for Electrolytic reactors, with chequered plate assembly walkway and rails, approach ladder all included	**1 no**
8	Procurement, supply to site and erection of sub wiring for each rectifier from panel and main header piping from Electrolytic reactor feed pump to Electrolytic reactor and from all reactors to the settling system - LS	**18 nos**
9	**Filter Feed Pumps** : Supply & Installation of horizontal centrifugal, closed impeller , clear water monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch.Capacity 100m3/hr, 25mwc, 15HP	**2 nos**
10	**Sand Filter** : Supply, & installation of Pressure Sand Filter - PE-FRP composite vessel construction. Filter to be of composite FRP construction with multiport valve for operations. Suitable stand / support should be provided along with the filter. Filtration rate should not be greater than 13 m3/hr / sq.mt of the filtration area . 48" dia x 72" HOS model 4872 with multiport valve and distributors	**8 nos**
11	**Carbon Filter** : Supply, & installation of Activated Carbon Filter - PE-FRP composite vessel construction. Filter to be of composite FRP construction with multiport valve for operations. Suitable stand / support should be provided along with the filter. Filtration rate should not be greater than 15 m3/hr / sq.mt of the filtration	**8 nos**

	area. Carbon filter to be fitted with pressure guage at outlet – 0 – 7 bar, 1.5" dial, glycerine filled SS Bourdon guage. Media to consist of graded pebble, coarse, fine sand and activated carbon. 42" dia x 72" HOS model 4272 with multiport valve and distributors	
12	**Filter Backwash Pumps** : Supply & Installation of horizontal centrifugal, closed CIimpeller , clear water monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch. Capacity 130m3/hr, 25 mwc, 15HP	**2 nos**
13	**Alum Dosing System :**Supply& installation and erection of white double layered HDPE dosing tanks of capacity 300 liters for dosing alum. Dosing tanks to be equipped with inlet line provision for chemical mixing water and drain provision. Capacity300 liters. Alum dosing pump of 0-20 lph range with 2.5 bar working pressure electronic metering type pump	**1 no**
14	**Hypo Dosing System :**Supply& installation and erection of HDPE chemical dosing tanks of 300 liters capacity for dosing. The dosing tanks shall be free standing, to be kept on fixed concrete floor.	**2 nos**
15	**Filter Press Aid dosing system** : Supply & installation and erection of HDPE chemical dosing tanks of 100 liters capacity for dosing. The dosing tanks shall be free standing, to be kept on fixed concrete floor. Dosing tanks to be equipped with inlet line provision for chemical mixing water and drain provision. Supply & Installation of electronic metering pumps of 0 – 6lph capacity at 3bar.	**1 no**

16	**Filter Press Feed Pumps** : Supply & installation of filter press feed pumps – screw / reciprocating plunger of 1.5 m3/hr capacity with SS wetted parts and suitable for working at 5 bar operating pressure. Pump discharge common header to be fitted with pressure guage 0- 10 bar, 1.5" dial, SS Bourdon type glycerine filled gauge. capacity2m3/hr, 5 bar (50 mwc), 1HP	**1 no**
17	**Filter press** : Supply & installation filter press system. Filter Press will be manual, recessed type press with MS fabricated structure pipe button surface and MS flat parallel bar, with PP cloth.	**2 nos**
18	**Septage transfer pump** : Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch. Capacity 5m3/hr, 15 mwc,	**2 nos**
19	**Raw sewage transfer pump** from collection tank to existing above ground tanks: Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch. Capacity 100m3/hr, 15 mwc, 10HP	**2 nos**
20	**Raw sewage transfer pump** from ICD to 2 MLD collection tank: Supply & Installation of horizontal centrifugal, non - clog, semi open CI impeller monobloc pumps fitted with TEFC, IP 55, Class F insulated SQI motor, suitable for 3 phase, 50 Hz, 415v AC power supply. Pump to be fitted with DRY RUN TRIP with level switch. Capacity 10m3/hr, 15 mwc,	**2 nos**
21	**Bar Screen in Collection Tank** : Supply and installation, of manual bar screen, MS – epoxy frame to be fitted in bar	**1 no**

	screen chamber of width 500mm, with MS flat bars each of size 50 mm with 6mm thickness and 20mm c/c gap between bars.	
22	**High Pressure Jet Pump** Supply, installation, testing and commissioning portable type High Pressure jet pump with 2HP Motor, 80bar Pressure, 1450 rpm 220V 50Hz for cleaning the plant and machineries with 20m length flexible hose as per the specifications or as directed by the engineer incharge	**1 no**
23	**Dewatering Pump-** Supply & Installation of 15.0 m3/hr., 30 mwc horizontal centrifugal non clog semi open CI impeller monobloc pump with TEFC, IP 55 CL - F Squirrel Cage Induction Motor	**1 no**
24	**Portable Hoist - 500kg** Monkey type Hoist with capacity up to 500kg, with lifting height of 6m, 5HP Motor, 415V 50Hz as per the specifications or as directed by the engineer incharge	**1 no**
25	**Aluminium Ladder** Supply, Installation of aluminum ladders for Security Cabin, Office Room & Plant Room	**12 m**
26	**Interconnecting Piping:** One lot of all interconnecting piping and valves and fittings as per specifications provided	**LS**
27	**Instrumentation:** Instrumentation items consisting of pressure gauges, level switches, electro magnetic flow meters, normal flow meters, table top pH and turbidity meter	**LS**
28	Diesel Holding SS Tank 500 Litres	**1 no**

c) GLS Tanks

Sl.No.	Equipments and specifications	Quantity
	1 MLD	
1	**Filter Feed Tank** : Supply & Installation of process tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground level and walkway bridge on the top. Each tank is to be provided with rungs from the top to access the inner bottom of the tank. 7m diax3.65m	**1 no**
2	**Treated Water Tank**: Supply & Installation of process tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground level and walkway bridge on the top. Each tank is to be provided with rungs from the top to access the inner bottom of the tank. 8m dia x 3.65m	**1 no**
3	**Solid Holding Tank** : Supply & Installation of process tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground level and walkway bridge on the top. Each tank is to be provided with rungs from the top to access the inner bottom of the tank. 2.5m dia x 3.65m	**1 no**
4	**Settler tank 1** : Supply & Installation of process tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground level and walkway bridge on the top. Each tank is to be provided with rungs from the top to access the inner bottom of the tank. 6.6m dia x 3.65m	**1 no**

5	**Settler tank 2**: Supply & Installation of settling tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground level and walkway bridge on the top. Each tank is to be provided with rungs from the top to access the inner bottom of the tank. 5m dia x 3.65m	**1 no**
	2 MLD	
1	**Filter Feed Tank** : Supply & Installation of process tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground levelandwalkwaybridgeonthetop.Eachtankistobeprovidedwithrungsfromth etoptoaccessthe inner bottom of the tank. 10m dia x 3.65m	**1 no**
2	**Treated Water Tank** : Supply & Installation of process tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground levelandwalkwaybridgeonthetop.Eachtankistobeprovidedwithrungsfromth etoptoaccessthe inner bottom of the tank 11.4m dia x 3.65m	**1 no**
3	**Solid Holding Tank** : Supply & Installation of process tanks in GLS / GRP / FRP. Each tank to be provided with inlet, outlet and drain connection. Each tank is to be provided with access from ground levelandwalkwaybridgeonthetop.Eachtankistobeprovidedwithrungsfromth etoptoaccessthe inner bottom of the tank. 3.4m dia x 3.65m	**1 no**

4	**Settlertank1**:Supply&InstallationofsettlingtanksinGLS/GRP/FRP.Eachtankto beprovided with inlet, outlet and drain connection. Each tank is to be provided with access from ground level and walkway bridge on the top. 9.4m dia x 3.65m	**1 no**
5	**Settlertank2**:Supply&InstallationofsettlingtanksinGLS/GRP/FRP.Eachtankto beprovided with inlet, outlet and drain connection. Each tank is to be provided with access from ground level and walkway bridge on the top 6.8m dia x 3.65m	**1 no**

d) Electrical works

a. 1MLD

Sl. No.	Specification	Quantity	
	Medium point rates		
1	Supply and wiring points according to IS 732-1989 using rigid PVC ivory conduit of minimum size 20 mm conforming to IS 9537 part III 1983 and with suitable size specials conforming to IS 3419-1988, fixing the conduit using metal saddles spacing not exceeding 50 cm or concealed suitably and with 1.00 sq mm PVC insulated stranded single core FR copper conductor cable 650V grade, including providing switch board main ,and continuous earthing with 1.5sqmm green coloured FR wire , required qty of copper earth socket, brass bolt and nut crimping etc complete with suitable size modular type metal switch boxes, modular type front plates (white) etc. up to and including 6 A modular type ROHS compliant SP switches and making good the surface of wall, colour washing etc. complete. All the terminations in the switch boards and DB's shall be tinned and the wires shall be drawn and fixed along the periphery of the box using suitable ties, tie mounts etc as required.		
1-a	Single control light point with 6A, 3 plate ceiling rose	18	Nos
1-b	Single control light point without ceiling rose	6	Nos
1-c	Single control ceiling fan point with 6 A, 3 plate ceiling rose & with socket size stepped electronic regulator.	3	Nos
1-d	Combined plug point with 6 A, 5 pin plug socket controlled by 6 A switch in the same switch board as that of light points.	3	Nos

1-e	Independent plug	4	Nos
2	Supply and providing 14 W CFL types and power rated *lamps* in the existing fittings as required	2	Nos
3	Supply and fixing angle / straight brass lined skirt type, *bakelite batten holder* with shade and giving connection etc as required	2	Nos
4	Supply and installation of suitable size *MS rod type fan clamp* as per IS 732 as required.	3	Nos
5	*Supply*, conveyance, installation, testing and commissioning of ceiling fans of 1200mm sizes using standard accessories *excluding resistance type regulator*, wiring the down rod with 16/0.20mm PVC insulated and PVC sheathed 650/1100V grade 3 core round copper conductor flex wire or with extended original wiring etc. as required.	3	Nos
6	*Charges for cutting holes* suitable for accommodating exhaust fans of sizes up to 305 mm sweep including plastering, colour washing etc. as required.	2	Nos
7	*Supply, conveyance, installation, testing and commissioning of 305 mm sizes of exhaust fans in the existing opening, fixing necessary bolt and nuts, making good the damages etc. as required including giving connections with required length of 24/0.20mm PVC insulated and PVC sheathed 3 core round copper conductor flex wire conforming to relevant ISS.*	2	Nos
8	Supply, conveyance, installation, testing and commissioning of pre-wired 18 W LED box light fittings and lamps . including supplying and fixing *ball and socket arrangements* on PVC round block, *suspension down rod of 19mm dia MS conduit up to 2x30cm* length including painting and wiring the down rod with 16/0.20mm 3 core round copper conductor flex wire conforming to relevant ISS or extending the original wiring and giving connections etc. a required.	12	Nos
9	Supply, Conveyance, installation, testing and commissioning of surface mounting 70 W LED down light fittings (IP 65) of all types directly on roof slab/ on wall including giving connections with required length of 16/0.20 mm 3 core round copper conductor flex wire conforming to relevant ISS or with the extended original wiring etc as required(Crompton-)	2	Nos
9-a	Supply, conveyance, installation, testing and commissioning of single piece integral luminaire suitable for **GATE** way installation with die-cast aluminium housing with top opening in powder coated finish with POT optics reflector, toughened glass cover (IP 65 protection) control gear and lamp holder suitable for 45 W CFL lamps pre-wired up to the terminal block including supply and providing suitable lamps in the existing GI pipe and giving connections with the extended original wiring and giving connection etc. as required	2	Nos
10	Supply and installation of sheet steel, phosphatised and painted, dust and vermin proof enclosure of MCB DB including copper /brass bus bar, neutral link, earth bus and DIN rail suitable for fixing MCB/ isolator etc. fixed on wall using suitable anchor bolts or fixed in recess including cutting hole on		

	the wall , making good the damages, colour washing etc. as required		
10-a	8 way single phase double cover (IP 42/43) (Out side Light)	1	No
10-b	6 way (8+18) - three phase double cover (IP 42/43) (Plant Light)	1	No
10-c	6 way (8+18) - double cover TPN vertical DB with provision for fixing 4P MCB / Isolator/ RCCB/ RCBO as incomer and SP/ TP MCB as outgoing (IP 42/43)	1	Nos
11	Supply and installation of the following *accessories* suitable for 50 Hz , AC supply conforming to IS 8828-1995/ IEC 60898 of the following current ratings in the existing enclosure and giving connections as required		
11-a	40 A double pole mini break isolator	1	Nos
11-b	40 A four pole mini break isolator	1	Nos
11-c	40 A, 2 pole, 100 mA RCCB	1	No
11-d	40 A, 4 pole, 100 mA RCCB	1	N0s
11-e	40 A, 10 kA, TP MCB (C curve) ((V DB)	4	Nos
11-f	6 A to 32 A, 10 kA, SP MCB (Ccurve) (6 Nos for Street Light)	8	Nos
11-g	6 A to 32 A, 10 kA, SP MCB (D curve)	32	Nos
11-g	Dammi plate	8	Nos
12	Supply & Fixing the following types/ sizes of boxes suitable for modular accessories in surface/ recess including making good the damages, colour washing etc as required		
12-a	3 module metal box in recess (PP)	2	Nos
12-b	9 module metal box in recess (3+ 3 set of plug)	1	Nos
13	Supply & Fixing the following types/ sizes of front plates on the existing modular boxes.		
13-a	3 module white/ off-white	2	Nos
13-b	1 module white/ off-white	1	Nos
14	Supply and Fixing the following modular switches & accessories in the existing front plates and giving necessary connections as required		
14-a	6 A SP 1 way switch	3	Nos
14-b	6 A Universal socket	3	Nos
14-c	16 A SP 1 way switch	3	Nos
14-d	6 A/16 A Universal socket (pp)	2	Nos
14-c	20A motor starter switch (Drinking water)	1	Nos
15	Supply and fixing the following sizes of *PVC Conduit* conforming to IS 9537 / 1983 part III along with all required accessories *on surface* including making good the damages etc as required.		
15-a	20 mm dia medium gauge	136	M
15-b	25 mm dia medium gauge	220	M
15-c	32 mm dia medium gauge	40	M

16	Supplying and clamping the following sizes of *corrugated PVC flexible conduit* with necessary compression gland with locking ring and check nut at termination pointed using suitable size GI / painted MS saddles spacing not exceeding 60 cms on surface including making good the damages, colour washing etc. as required.	340	M
17	Supply and drawing 650/1100 V grade *PVC insulated stranded single core copper conductor cables* conforming to IS 694 part I 1990 in the existing surface / recess conduit as required including giving necessary connections of the following sizes.		
17-a	2.50 sq mm 3 run (PP & Small Motors)	182	M
17-b	4.00 sq mm 2 run + 2.5 sq.mm 1 run (1 ph Motors)	240	M
17-c	4.00 sq mm 3 run (3 Phase Motors)	320	M
17-d	6.00 sq mm 3 run	88	M
17-e	10.00 sq mm 4 run	32	M
18	Supply, laying and clamping of 1 no. PVC insulated and PVC sheathed armoured aluminium power cable, 1.1 KV grade of the following sizes using clamps noted along with the cables, spacing of clamps not exceeding 60cms, making good the damages , colour washing etc. as required.		
18-a	3.5 core 150 sq mm with factory made clamp (MSB)	4	M
18-b	3.5 core 120 sq mm with factory made clamp (Gr)	32	M
18-c	4 core 25 sq mm with factory made clamp (Sub Panel 1 , 2 & 3)	114	M
18-d	3 core 10 sq mm with factory made clamp (7.5 & 15 HP motor)	150	M
18-e	3 core 6 sq mm with factory made clamp	82	M
18-f	3 core 4 sq mm with factory made clamp	48	M
19	Supply & laying of one number PVC insulated and PVC sheathed armoured aluminium power cable of 1.1KV grade of the following sizes in ground including excavation of trench of size 35 x 75 cm, refilling the trench etc. as required but excluding sand cushioning and protective covering (in ordinary soil).		
19-a	3 core 4 sq mm (Out Door Light)	144	M
19-b	3 core 6 sq mm (Out door Light)	482	M
20	Supplying siemens / tropodur type nickel plated *compression brass cable gland* for PVC insulated and PVC sheathed armoured aluminium/ copper conductor cable 1.1 KV grade, and making end termination suitable for 2/ 3/ 3½/ 4 core cable of the following sizes as required.		
20-a	150 sq mm	8	Nos
20-b	125 sq mm	6	Nos
20-c	25 sq mm	8	Nos
20-d	10 sq mm	24	Nos
20-e	6 sq mm	4	Nos
20-f	4 sq mm	4	Nos
20-g	4sqmm-16 sq mm with 12 mm wide x 1 mm thick clip	32	Nos

20-h	25 sq - 95sq mm with 20 mm wide x 1.20 mm thick clip	14	Nos
20-i	150 sq mm aluminium socket	24	Nos
20-j	70 sq mm	8	Nos
20-k	120 sq mm	18	Nos
20-l	50 sq mm	6	Nos
20-k	25 sq mm	32	Nos
20-l	10 sq mm	72	Nos
20-m	6 sq mm	12	Nos
20-n	4 sq mm	12	Nos
21	Supply and providing *plate earthing* as per IS 3043 *with 600x600x6.30 mm GI/CI earth plate*, 20 mm GI watering pipe fixed to the earth plate with 20 x 3 mm GI clamps, GI funnel with weld mesh, filling required quantity of charcoal including construction of inspection chamber with a bed concrete of 1:4:8 PCC using 40 mm broken stone (10 cm thick), brick work in cement mortar 1:6, plastering the surface of brick masonry and the exposed surface of PCC bed with cement mortar 1:4, 12 mm thick, (the finished inside dimension shall be 300 x 300 x 300 mm) but excluding test joint, earth continuity conductor to the plate, and covering at the top. *(in ordinary soil)*	5	Nos
22	Supply and providing 300x300x6 mm sizes of *cast iron gully trap with covering* at the top of the inspection chamber of earth pit as required	5	Nos
23	Supply and drawing bare *earthing conductors* of the following sizes *along with wiring/ cables* and giving connection as required.		
23-a	2.00 mm copper conductor (14 SWG)	48	M
23-b	2.65 mm copper conductor (12 SWG)	110	M
23-c	3.15 mm copper conductor (10 SWG)	290	M
24	Supply and laying bare *earthing conductors* of No. 10 swg sizes *laid 0.6 m below ground level including excavating trench* of suitable size and refilling etc. as required *(in ordinary soil).*	22	M
24-a	25 x 3 mm copper strip tinned at the points of contacts (Gr. Earthing)	120	M
24-b	4.00 mm GI conductor (8 SWG)	520	M
25	supply of superior quality *copper earth socket* for the following sizes of earth conductor including crimping etc. as required.		
25-a	2.00 mm (14 SWG)	18	Nos
25-b	2.65 mm (12 SWG)	24	Nos
25-c	3.15 mm (10 SWG)	38	Nos
26	Supply and providing the following sizes of *bolt and nut* with washers on the existing MS box / earth bus etc. as required including drilling necessary holes as required		
26-a	25 x 3mm brass bolt & nut	38	Nos
26-b	25 x 6 mm brass bolt & nut	32	Nos
26-c	2 x 25 x 3 mm tinned copper strip	8	M

27	Supplying , threading , laying and jointing of 25 mm sizes of 'B' class *GI pipe* with all required accessories *in ground in the existing trench* as protective covering to earth leads.	24	M
	MAIN PANEL BOARD		
28	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	16.48	m2
29	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	0.8	m2
30	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	42	Mts
31	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6.4	Mts
32	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	32	Kg
33	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	488	cm2
	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC		

	supply in the existing panel assembly as required		
34	160A, 35 kA (Ics=100%Icu), 4 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos
35	63 A, 25 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL (1 out for Light, 3 out for small motors SB- 1, SB-2 & SB -3 , 4 Nos for 7.5 HP & 15 HP Motors)	9	Nos
36	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 200 A	10	Nos
37	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	10	Nos
38	Three phase multifunction meters to read V, A and F, accuracy class 1 & **160/ 5A CT- 3 Nos**	1	Nos
39	LED indicators for all voltage ranges - Blue Colour	2	Nos
40	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
41	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
42	20 A fuse holder for BS type blade fuses.	3	Nos
43	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
44	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
45	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
46	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
47	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
47-a	1.50 sq mm single run with required sockets.	62	Mts
	Sub Panel - 1 (3 HP motors - 12 Nos)		

48	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	14.72	m2
49	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	1.12	m2
50	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	38	Mts
51	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6	Mts
52	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	14	KG
53	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	352	cm2
54	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
54-a	63 A, 25/35 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos

54-b	3 phase, 415 Volts, DOL starter with all connected accessories and single phase preventer	13	Nos
54-c	6 A to 40 A, 10 kA, TP MCB (D curve)	13	Nos
54-d	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 160 A	1	Nos
54-e	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	1	Nos
54-f	Three phase multifunction meters to read V, A and F, accuracy class 1 & 150/ 5A CT- 3 Nos	1	Nos
54-g	LED indicators for all voltage ranges - Blue Colour	2	Nos
54-h	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
54-i	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
54-j	20 A fuse holder for BS type blade fuses.	3	Nos
54-k	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
54-l	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
54-m	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
54-n	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
55	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
55-a	1.50 sq mm single run with required sockets.	58	Mts
	Sub Panel - 2 (0.25 HP motors 12 Nos)		
56	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the	14.72	m2

	fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring		
57	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	1.12	m2
58	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	38	Mts
59	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6	Mts
60	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	14	KG
61	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	352	cm2
62	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
62-a	63 A, 25/35 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos
62-b	Single / 3 phase, 415 Volts, DOL starter with all connected accessories and single phase preventer	13	Nos
62-c	6 A to 40 A, 10 kA, TP MCB (D curve)	13	Nos
62-d	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 160 A	1	Nos
62-e	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	1	Nos

62-f	Three phase multifunction meters to read V, A and F, accuracy class 1 & 150/ 5A CT- 3 Nos	1	Nos
62-g	LED indicators for all voltage ranges - Blue Colour	2	Nos
62-h	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
62-i	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
62-j	20 A fuse holder for BS type blade fuses.	3	Nos
62-k	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
62-l	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
62-m	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
62-n	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
63	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
63-a	1.50 sq mm single run with required sockets.	58	Mts
	Sub Panel - 3 (other motors)		
64	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	14.72	m2
65	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	1.12	m2

66	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	38	Mts
67	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6	Mts
68	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	14	KG
69	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	352	cm2
70	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
70-a	63 A, 25/35 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos
70-b	Single / 3 phase, 415 Volts, DOL starter with all connected accessories and single phase preventer	13	Nos
70-c	6 A to 40 A, 10 kA, TP MCB (D curve)	13	Nos
70-d	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 160 A	1	Nos
70-e	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	1	Nos
70-f	Three phase multifunction meters to read V, A and F, accuracy class 1 & 150/ 5A CT- 3 Nos	1	Nos
70-g	LED indicators for all voltage ranges - Blue Colour	2	Nos
70-h	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
70-i	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
70-j	20 A fuse holder for BS type blade fuses.	3	Nos

70-k	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
70-l	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
70-m	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
70-n	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
71	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
71-a	1.50 sq mm single run with required sockets.	58	Mts
72	Supply, Installation , Testing and commissioning of 3 phase, 415 V oil immersed starter suitable for 7.5 /15 HP motor fixed on wall and giving connection (	4	Nos
73	Supply, Installation , Testing and commissioning of 5 / 7.5 kVAR capacitorsuitable for 10/ 12 HP motor fixed on wall and giving connection	4	Nos
74	Supply, Installation , Testing and commissioning of 2. 2.5 kVAR capacitorsuitable for 10/ 12 HP motor fixed on wall and giving connection	12	Nos
75	Fabrication, supply & installation of dust and vermin proof, wall mounting, Sintex make meter box of 600x600x 214 mm size suitable for fixing KSEB meter,fuse units, CT etc, hinged door construction for the front side with compartments if necessary, providing vision panel for the meter compartment, knock out for cable entry and exit.	1	No
76	200 A, 415 V, DIN type fuse base.	3	Nos
77	200 A, 415 V, 2 way neutral link mounted on DMC/ SMC base.	3	Nos
78	150 A,415 V, DIN type fuse	6	Nos
79	S & F switch disconnector fuse unit complete with handle assembly, door inter lock and padlocking arrangement of 200 A, 4 pole SDF (Near Meter Box)	1	Nos
80	1.61 mm CRCA sheet for mounting SDF	0.5	m2
81	Supply, conveyance, installation, testing and commissioning of Hot dipped Galvanised (internally and externally) seamless,Octagonal pole of overall height 8 Mts with double arm breaket of 1.5mts length 48mm dia x 3.25mm thick with standard arm cap. The top dia 70 mm, bottom dia 155mm having sheet thickness 3mm. The pole shall be with base plate of 225x225x16 mm and 4 nos required size of foundation bolt. The pole shall be mounted on suitable size oundation (design to be got approved) with 4A SP 'c' curve MCB, loop in loop out terminals block, required dia GI/ PVC	6	Nos

	pipe shall be provided in the foundation for taking cable in & out from the pole, 3 Core 1.5 sqmm unarmoured PVC insulated round copper cable from loop in loop out to light fixture etc with all required accessories. The cost of the civil foundation is not considered in this item.		
82	Supply, conveyance, installation, testing and commissioning of 120 **Watts single piece LED** Flood light fittings suitable for roadway installation with pressure die-cast aluminium housing with corrosion resistance powder coating using Nano technology, natural cooling system,, Poly Carbonated UV treated diffuser for higher impact strength and optimum light trasmision, High efficient driver with short circuit, over voltage, over courent and thermal protection, Surge ptotection up to 5 KV, PF 0.95, *IP 65 protection, Horizontal Pole Mounting type fittings with all connected accessories fixing on the existing arm*and giving connections with 1.5 sq. mm 3 core PVC insulated and PVC sheathed copper conductor fles wire etc. as required The LED fittings shall be guaranted for **5 year**s from the date of commissioning from any defects in manufactring. Any of the spares / components which are found to be defective during this period shall be replaced immediately at free of cost. (Make: Philips/ Crompton/ LT)	12	Nos
83	Earth work excavation in *hard soil* and depositing with a lead up to 50 m and lift up to 1.50 m including neat banking	3.24	m3
84	*Plain cement concrete* 1:4:8 using 40mm (Normal size) broken stone. (m^3)	2.8	m3
85	*Cement concrete 1:2:4* using 20mm (nominal size) broken stone *for reinforced concrete work (also for earth cover)*	3.6	m2
86	*Reinforcement for R.C.C works*, bend tied and placed in position (plain grill requiring bend cold) using *tor steel (also for earth cover)*	60	kg
87	*Supply and clamping* the following sizes of *PVC pipe* on wall with all required accessories including cutting and making good the walls, colour washing etc. as required as protective covering to cables.		
87-a	63 mm dia PVC pipe (8 Kgf / cm^2)	8	Nos
88	Fabrication, supply & installation of dust and vermin proof, wall mounting, Sintex make Code No GSJB4030 Piller box suitable for fixing KSEB meter,fuse units, hinged door construction for the front side with compartments if necessary, providing vision panel for the meter compartment, knock out for cable entry and exit. (piller Box)	6	Nos
89	Supplying and installation including all manner of supports/ suspenders, anchor bolts etc for metering cubicle made out of suitable size , slotted angles, flats, MS plates etc as required including painting with 2 coats of synthetic enamel paint over a coat of zinc chromate primer, making good the damages, colour washing etc as required.	188	kg
90	Single dial timer unit digitail type (street Light)	1	Nos
91	2 pole 32 A contactor	1	Nos

92	Control Relay	1	Nos
93	Supply, Installation, testing and commissioning of silent type Desel Generating set alongwith having prime power rating of 100 KVA, 415 V at 1500 RPM , 0.8 PF at 415 V suitable for 50Hz, 3 Phase system and consisting the followings: (1) Diesel Engine : Diesel engine 4 stroke water cooled, electric start, of suitable BHP at 1500 RPM suitable for above out put of the alternator at 40 degree C. 50% BH & at 1000 meter MSL and conforming to BS 5514 BS 649 , IS 10000, capable for taking 10 % over load for one hour after 12 hours of continous operation. (ii) Alternator: Synchronous alternator rated 50KVA , 415 V at 1500 RPM. The alternator having SPDP enclosure, brushless, continuous duty, self- excited and self - regulated through AVR conforming to IS 4722/ BS 2613 suitable for tropical conditions and with class- F/H insulation. (iii) Starting system: 12 V/ 24 V DC starting system comprising of stater motors: voltage regulator and arrengement for initial excitation complete with suitable Nos. of batteries (25 Plates, 180 Amp, hour capacity.) **<u>Control Panel :-</u>** Consistinf Voltmeter, Ammeter, Hz Meter, KWH Meter, Indication Lamp with set ON and load ON, Suitable rating MCCB etc as required.	1	Nos
94	200 A, 415 V, 50 Hz, AC 23 A duty, 4 pole on-load change over switch	1	Nos
95	*Cement concrete 1:2:4* using 20mm (nominal size) broken stone *for reinforced concrete work.*	3.24	Mts
96	*Plastering* with cement mortar 1:4, 12mm thick one coat.	2.8	M2
97	Supply and providing 2.5*mm thick* Elastomeric fire retardent insulating mat as per IS 15652/2006 to withstand 11 KV dielectric strength.	4	m2
98	Supply and providing *5 Kg. Dry Chemical Powder type Fire Extinguisher* with hose and clamps including fixing it to wall as required.	3	Nos
99	Supply and providing *9 Litre capacity GI Fire Bucket* painted in post office red with primer coat of red oxide and written with white paint 'FIRE' mounted on MS angle frame work/ wall bracket filled with fine sand, painting the bracket/ floor stand including making good the damages, colour washing etc. as required.	1	No
100	*Painting letters or figures* of the following sizes with enamel paint as identification mark to SB, DB, panel board etc as required	180	Nos
101	Obtain test certificates for all proective devices, prepration of schematic drawings and obtain approval from respective statutory authoroties and obtain energisation certificate excluding stautory fee remitted to different statutory authorities.	1	job

ii) 2MLD

Sl.No	Specification	Quantity	
	Medium point rates		
1	Supply and wiring points according to IS 732-1989 using rigid PVC ivory conduit of minimum size 20 mm conforming to IS 9537 part III 1983 and with suitable size specials conforming to IS 3419-1988, fixing the conduit using metal saddles spacing not exceeding 50 cm or concealed suitably and with 1.00 sq mm PVC insulated stranded single core FR copper conductor cable 650V grade,including providing switch board main ,and continuous earthing with 1.5sqmm green coloured FR wire , required qty of copper earth socket, brass bolt and nut crimping etc complete with suitable size modular type metal switch boxes, modular type front plates (white) etc. up to and including 6 A modular typeROHS compliant SP switches and making good the surface of wall, colour washing etc. complete. All the terminations in the switch boards and DB's shall be tinned and the wires shall be drawn and fixed along the periphery of the box using suitable ties, tie mounts etc as required.		
1-a	Single control light point with 6A, 3 plate ceiling rose	18	Nos
1-b	Single control light point without ceiling rose	6	Nos
1-c	Single control ceiling fan point with 6 A, 3 plate ceiling rose & with socket size stepped electronic regulator.	3	Nos
1-d	Combined plug point with 6 A, 5 pin plug socket controlled by 6 A switch in the same switch board as that of light points.	3	Nos
1-e	Independent plug	4	Nos
2	Supply and providing 14 W CFL types and power rated *lamps* in the existing fittings as required	2	Nos
3	Supply and fixing angle / straight brass lined skirt type, *bakelite batten holder* with shade and giving connection etc as required	2	Nos
4	Supply and installation of suitable size *MS rod type fan clamp* as per IS 732 as required.	3	Nos
5	*Supply*, conveyance, installation, testing and commissioning of ceiling fans of 1200mm sizes using standard accessories *excluding resistance type regulator*, wiring the down rod with 16/0.20mm PVC insulated and PVC sheathed 650/1100V grade 3 core round copper conductor flex wire or with extended original wiring etc. as required.	3	Nos
6	*Charges for cutting holes* suitable for accommodating exhaust fans of sizes up to 305 mm sweep including plastering, colour washing etc. as required.	2	Nos
7	*Supply, conveyance, installation, testing and commissioning of 305 mm sizes of exhaust fans in the existing opening, fixing necessary bolt and nuts, making good the damages etc. as required including giving connections with required length of 24/0.20mm PVC insulated and PVC sheathed 3 core round copper conductor flex wire conforming to relevant*	2	Nos

	ISS.		
8	Supply, conveyance, installation, testing and commissioning of pre-wired 18 W LED box light fittings and lamps . including supplying and fixing *ball and socket arrangements* on PVC round block, *suspension down rod of 19mm dia MS conduit up to 2x30cm* length including painting and wiring the down rod with 16/0.20mm 3 core round copper conductor flex wire conforming to relevant ISS or extending the original wiring and giving connections etc. a required.	12	Nos
9	Supply, Conveyance, installation, testing and commissioning of surface mounting 70 W LED down light fittings (IP 65) of all types directly on roof slab/ on wall including giving connections with required length of 16/0.20 mm 3 core round copper conductor flex wire conforming to relevant ISS or with the extended original wiring etc as required(Crompton-)	2	Nos
9-a	Supply, conveyance, installation, testing and commissioning of single piece integral luminaire suitable for **GATE** way installation with die-cast aluminium housing with top opening in powder coated finish with POT optics reflector, toughened glass cover (IP 65 protection) control gear and lamp holder suitable for 45 W CFL lamps pre-wired up to the terminal block including supply and providing suitable lamps in the existing GI pipe and giving connections with the extended original wiring and giving connection etc. as required	2	Nos
10	Supply and installation of sheet steel, phosphatised and painted, dust and vermin proof enclosure of MCB DB including copper /brass bus bar, neutral link, earth bus and DIN rail suitable for fixing MCB/ isolator etc. fixed on wall using suitable anchor bolts or fixed in recess including cutting hole on the wall , making good the damages, colour washing etc. as required		
10-a	8 way single phase double cover (IP 42/43) (Out side Light)	1	No
10-b	6 way (8+18) - three phase double cover (IP 42/43) (Plant Light)	1	No
10-c	6 way (8+18) - double cover TPN vertical DB with provision for fixing 4P MCB / Isolator/ RCCB/ RCBO as incomer and SP/ TP MCB as outgoing (IP 42/43)	1	Nos
11	Supply and installation of the following *accessories* suitable for 50 Hz , AC supply conforming to IS 8828-1995/ IEC 60898 of the following current ratings in the existing enclosure and giving connections as required		
11-a	40 A double pole mini break isolator	1	Nos
11-b	40 A four pole mini break isolator	1	Nos
11-c	40 A, 2 pole, 100 mA RCCB	1	No
11-d	40 A, 4 pole, 100 mA RCCB	1	N0s
11-e	40 A, 10 kA, TP MCB (C curve) ((V DB)	4	Nos
11-f	6 A to 32 A, 10 kA, SP MCB (Ccurve) (6 Nos for Street Light)	8	Nos
11-g	6 A to 32 A, 10 kA, SP MCB (D curve)	32	Nos

11-g	Dammi plate	8	Nos
12	Supply & Fixing the following types/ sizes of boxes suitable for modular accessories in surface/ recess including making good the damages, colour washing etc as required		
12-a	3 module metal box in recess (PP)	2	Nos
12-b	9 module metal box in recess (3+ 3 set of plug)	1	Nos
13	Supply & Fixing the following types/ sizes of front plates on the existing modular boxes.		
13-a	3 module white/ off-white	2	Nos
13-b	1 module white/ off-white	1	Nos
14	Supply and Fixing the following modular switches & accessories in the existing front plates and giving necessary connections as required		
14-a	6 A SP 1 way switch	3	Nos
14-b	6 A Universal socket	3	Nos
14-c	16 A SP 1 way switch	3	Nos
14-d	6 A/16 A Universal socket (pp)	2	Nos
14-c	20A motor starter switch (Drinking water)	1	Nos
15	Supply and fixing the following sizes of *PVC Conduit* conforming to IS 9537 / 1983 part III along with all required accessories *on surface* including making good the damages etc as required.		
15-a	20 mm dia medium gauge	240	M
15-b	25 mm dia medium gauge	262	M
15-c	32 mm dia medium gauge	64	M
16	Supplying and clamping the following sizes of *corrugated PVC flexible conduit* with necessary compression gland with locking ring and check nut at termination pointed using suitable size GI / painted MS saddles spacing not exceeding 60 cms on surface including making good the damages, colour washing etc. as required.	380	M
17	Supply and drawing 650/1100 V grade *PVC insulated stranded single core copper conductor cables* conforming to IS 694 part I 1990 in the existing surface / recess conduit as required including giving necessary connections of the following sizes.		
17-a	2.50 sq mm 3 run (PP & Small Motors)	224	M
17-b	4.00 sq mm 2 run + 2.5 sq.mm 1 run (1 ph Motors)	282	M
17-c	4.00 sq mm 3 run (3 Phase Motors)	450	M
17-d	6.00 sq mm 3 run	120	M
17-e	10.00 sq mm 4 run	44	M
18	Supply, laying and clamping of 1 no. PVC insulated and PVC sheathed armoured aluminium power cable, 1.1 KV grade of the following sizes using clamps noted along with the cables, spacing of clamps not exceeding 60cms, making good the damages , colour washing etc. as required.		
18-a	3.5 core 240 sq mm with factory made clamp (MSB)	48	M

	3.5c 185sqmm (Gr)	58	M
18-b	3.5 core 120 sq mm with factory made clamp (, SSB-1, SSB-2, & SSB-3)	152	M
18-c	4 core 25 sq mm with factory made clamp (Sub Panel 1 , 2 , 3 & 4)	140	M
18-d	3 core 10 sq mm with factory made clamp (10 & 15 HP motor)	178	M
18-e	3 core 6 sq mm with factory made clamp	82	M
18-f	3 core 4 sq mm with factory made clamp	48	M
19	Supply & laying of one number PVC insulated and PVC sheathed armoured aluminium power cable of 1.1KV grade of the following sizes in ground including excavation of trench of size 35 x 75 cm, refilling the trench etc. as required but excluding sand cushioning and protective covering (in ordinary soil).		
19-a	3 core 4 sq mm (Out Door Light)	198	M
19-b	3 core 6 sq mm (Out door Light)	560	M
20	Supplying siemens / tropodur type nickel plated *compression brass cable gland* for PVC insulated and PVC sheathed armoured aluminium/ copper conductor cable 1.1 KV grade, and making end termination suitable for 2/ 3/ 3½/ 4 core cable of the following sizes as required.		
20-a	240 sq mm	8	Nos
	185 sq mm	4	Nos
20-b	125 sq mm	12	Nos
20-c	25 sq mm	32	Nos
20-d	10 sq mm	24	Nos
20-e	6 sq mm	8	Nos
20-f	4 sq mm	8	Nos
20-g	4sqmm-16 sq mm with 12 mm wide x 1 mm thick clip	40	Nos
20-h	20 x 3 mm for earthing glands of size 120 sq mm to 185 sq mm	48	Nos
	25 x 3 mm for earthing glands of size 240 sq mm to 300 sq mm	8	Nos
20-i	240 sq mm aluminium socket	24	Nos
	185 sq mm	12	Nos
20-j	70 sq mm	12	Nos
20-k	120 sq mm	36	Nos
20-l	50 sq mm	10	Nos
20-k	25 sq mm	32	Nos
20-l	10 sq mm	72	Nos
20-m	6 sq mm	14	Nos
20-n	4 sq mm	16	Nos
21	Supply and providing *plate earthing* as per IS 3043 *with 600x600x6.30 mm GI/CI earth plate*, 20 mm GI watering pipe fixed to the earth plate with 20 x 3 mm GI clamps, GI funnel with weld mesh, filling required quantity of charcoal including construction of inspection chamber with a bed concrete of 1:4:8 PCC using 40 mm broken stone (10 cm thick), brick work in cement mortar 1:6, plastering the surface of brick masonry and the	5	Nos

	exposed surface of PCC bed with cement mortar 1:4, 12 mm thick, (the finished inside dimension shall be 300 x 300 x 300 mm) but excluding test joint, earth continuity conductor to the plate, and covering at the top. *(in ordinary soil)*		
22	Supply and providing 300x300x6 mm sizes of *cast iron gully trap with covering* at the top of the inspection chamber of earth pit as required	5	Nos
23	Supply and drawing bare *earthing conductors* of the following sizes *along with wiring/ cables* and giving connection as required.		
23-a	2.00 mm copper conductor (14 SWG)	48	M
23-b	2.65 mm copper conductor (12 SWG)	110	M
23-c	3.15 mm copper conductor (10 SWG)	290	M
24	Supply and laying bare *earthing conductors* of No. 10 swg sizes *laid 0.6 m below ground level including excavating trench* of suitable size and refilling etc. as required *(in ordinary soil).*	22	M
24-a	25 x 3 mm copper strip tinned at the points of contacts (Gr. Earthing)	240	M
24-b	4.00 mm GI conductor (8 SWG)	640	M
25	supply of superior quality *copper earth socket* for the following sizes of earth conductor including crimping etc. as required.		
25-a	2.00 mm (14 SWG)	34	Nos
25-b	2.65 mm (12 SWG)	32	Nos
25-c	3.15 mm (10 SWG)	38	Nos
26	Supply and providing the following sizes of *bolt and nut* with washers on the existing MS box / earth bus etc. as required including drilling necessary holes as required		
26-a	25 x 3mm brass bolt & nut	38	Nos
26-b	25 x 6 mm brass bolt & nut	32	Nos
26-c	2 x 25 x 3 mm tinned copper strip	8	M
27	Supplying , threading , laying and jointing of 25 mm sizes of 'B' class *GI pipe* with all required accessories *in ground in the existing trench* as protective covering to earth leads.	24	M
27-a	*Supplying, laying and jointing* of th50/ 38 mm sizes of double wall corrugated *(DWC) pipes* made out of HDPE conforming to IS 14930 Part II for mechanical protection to underground power cables with all required accessories in ground *in the existing trench*	40	M
	MAIN PANEL BOARD		

28	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	15.82	m2
29	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	0.8	m2
30	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	42	Mts
31	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6.4	Mts
32	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	32	Kg
33	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	488	cm2
	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
34	250 A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC (MSB)	1	Nos

	160 A , 35 kA (Ics=100%Icu), 4 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL (SSB-3, SSB-2 & SSB3)	3	Nos
35	63 A, 25 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL (V - BD & 2Nos spare)	3	Nos
36	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 200 A	7	Nos
37	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	7	Nos
38	Three phase multifunction meters to read V, A and F, accuracy class 1 & **200 / 5A CT- 3 Nos**	1	Nos
39	LED indicators for all voltage ranges - Blue Colour	2	Nos
40	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
41	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
42	20 A fuse holder for BS type blade fuses.	3	Nos
43	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
44	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
45	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
46	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
47	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
47-a	1.50 sq mm single run with required sockets.	110	Mts
48	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after	12.64	m2

	subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring		
49	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	0.6	m2
50	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	36	Mts
51	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	4.6	Mts
52	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	28	Kg
53	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	316	cm2
54	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
55	160 A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC (MSB)	1	Nos
56	63 A, 25 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL (V - Small motor panel 1,2,3 &4)	5	Nos
57	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 200 A	6	Nos
58	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of	6	Nos

	rating up to 160 A (8 Pcs)		
59	Three phase multifunction meters to read V, A and F, accuracy class 1 & **150 / 5A CT- 3 Nos**	1	Nos
60	LED indicators for all voltage ranges - Blue Colour	2	Nos
61	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
62	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
63	20 A fuse holder for BS type blade fuses.	3	Nos
64	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
65	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
66	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
67	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
68	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
68-a	1.50 sq mm single run with required sockets.	88	Mts
	SSB -2 (2 Nos 10 HP & 2 Nos 15 HP motor panel)		
69	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	12.64	m2
70	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	0.6	m2

71	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	36	Mts
72	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	4.6	Mts
73	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	28	Kg
74	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	316	cm2
75	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
76	160 A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC (MSB)	1	Nos
77	63 A, 25 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL .	5	Nos
78	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 200 A	6	Nos
79	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	6	Nos
80	Three phase multifunction meters to read V, A and F, accuracy class 1 & **150 / 5A CT- 3 Nos**	1	Nos
81	LED indicators for all voltage ranges - Blue Colour	2	Nos
82	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
83	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
84	20 A fuse holder for BS type blade fuses.	3	Nos

85	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
86	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
87	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
88	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
89	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
89-a	1.50 sq mm single run with required sockets.	88	Mts
	SSB -3 (2 Nos 10 HP & 2 Nos 15 HP motor panel)		
90	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	12.64	m2
91	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	0.6	m2
92	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	36	Mts
92	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	4.6	Mts

94	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	28	Kg
95	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	316	cm2
96	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
97	160 A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC (MSB)	1	Nos
98	63 A, 25 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL (.	5	Nos
99	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 200 A	6	Nos
100	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	6	Nos
101	Three phase multifunction meters to read V, A and F, accuracy class 1 & **150 / 5A CT- 3 Nos**	1	Nos
102	LED indicators for all voltage ranges - Blue Colour	2	Nos
103	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
104	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
105	20 A fuse holder for BS type blade fuses.	3	Nos
106	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
107	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
108	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
109	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos

110	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
110a	1.50 sq mm single run with required sockets.	88	Mts
	Sub Panel - 1 (0.25 HP to 3 HP motors - 10 Nos)		
111	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	14.72	m2
112	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	1.12	m2
113	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	38	Mts
114	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6	Mts
115	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round	14	KG

	conductors, etc., as required.		
116	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	352	cm2
117	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
117-a	63 A, 25/35 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos
117-b	3 phase, 415 Volts, DOL starter with all connected accessories and single phase preventer	10	Nos
117-c	6 A to 40 A, 10 kA, TP MCB (D curve)	10	Nos
117-d	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 160 A	1	Nos
117-e	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	1	Nos
117-f	Three phase multifunction meters to read V, A and F, accuracy class 1 & 150/ 5A CT- 3 Nos	1	Nos
117-g	LED indicators for all voltage ranges - Blue Colour	2	Nos
117-h	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
117-i	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
117-j	20 A fuse holder for BS type blade fuses.	3	Nos
117-k	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
117-l	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
117-m	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
117-n	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
118	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing		

	suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
118-a	1.50 sq mm single run with required sockets.	58	Mts
	Sub Panel - 2 (0.25 HP to 3 HP motors - 10 Nos)		
119	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	14.72	m2
120	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	1.12	m2
120	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	38	Mts
122	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6	Mts
123	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	14	KG
124	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	352	cm2

125	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
125-a	63 A, 25/35 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos
125-b	Single / 3 phase, 415 Volts, DOL starter with all connected accessories and single phase preventer	10	Nos
125-c	6 A to 40 A, 10 kA, TP MCB (D curve)	10	Nos
125-d	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 160 A	1	Nos
125-e	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	1	Nos
125-f	Three phase multifunction meters to read V, A and F, accuracy class 1 & 150/ 5A CT- 3 Nos	1	Nos
125-g	LED indicators for all voltage ranges - Blue Colour	2	Nos
125-h	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
125-i	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
125-j	20 A fuse holder for BS type blade fuses.	3	Nos
125-k	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
125-l	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
125-m	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
125-n	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
126-	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
126-a	1.50 sq mm single run with required sockets.	58	Mts
	Sub Panel - 3 (0.25 HP to 3 HP motors - 10 Nos)		

127	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring	14.72	m2
128	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	1.12	m2
129	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	38	Mts
130	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6	Mts
131	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	14	KG
132	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	352	cm2
133	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
133-a	63 A, 25/35 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos

133-b	3 phase, 415 Volts, DOL starter with all connected accessories and single phase preventer	10	Nos
133-c	6 A to 40 A, 10 kA, TP MCB (D curve)	10	Nos
133-d	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 160 A	1	Nos
133-e	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of rating up to 160 A (8 Pcs)	1	Nos
133-f	Three phase multifunction meters to read V, A and F, accuracy class 1 & 150/ 5A CT- 3 Nos	1	Nos
133-g	LED indicators for all voltage ranges - Blue Colour	2	Nos
133-h	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
133-i	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
133-j	20 A fuse holder for BS type blade fuses.	3	Nos
133-k	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
133-l	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
133-m	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
133-n	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
134	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
134-a	1.50 sq mm single run with required sockets.	58	Mts
	Sub Panel - 4 (0.25 HP to 3 HP motors - 10 Nos)		
135	Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using 1.60 mm CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for	14.72	m2

	the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments should be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. including control wiring		
136	Supply and providing 3mm thick size of *SMC sheets* in the panel as barriers & shrouding using required bolts and nuts including cutting to shape etc., as required.	1.12	m2
137	Supply and fixing ' A " section types of *beeding* along the periphery of doors/ other detachable compartments to make the panel assembly dust & vermin proof including sticking with glue	38	Mts
138	Fabrication, supply, conveyance and installation of base frame for floor mounting type panel board using channel of class designation ISMC 75 including cutting, welding, drilling holes, painting with two coats of synthetic enamel paint over a coat of zinc chromate primer, bolting the frame to the panel and to the finished floor using required bolt and nuts, making good the damages etc. as required.	6	Mts
139	Fabrication, supply & fixing main bus bar system and interconnections with electrolytic grade Aluminium strips/ rigid conductors conforming to IS 1867 (with latest amendments) for bus bar arrangement with single strip per phase supported on finger type bus bar supports of adequate size, spacing between supports not exceeding 50 cm & overhang not exceeding 5 cm including bending to shape, drilling holes, tinning the points of contacts, fixing heat shrinkable PVC sleeves, plated bolts and nuts with plate washers and spring washers, copper sockets for round conductors, etc., as required.	14	KG
140	Fabrication, supply & fixing ***earth bus*** system with ***coppe***r strip/ conductor and connecting all accessories as per rule including g tinning the points of contacts etc as required	352	cm2
141	Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required		
141-a	63 A, 25/35 kA (Ics=100%Icu), 3 pole, current limiting type MCCB having thermal setting range of 80 - 100% with thermal magnetic release having adjustable OL	1	Nos
141-b	Single / 3 phase, 415 Volts, DOL starter with all connected accessories and single phase preventer	10	Nos
141-c	6 A to 40 A, 10 kA, TP MCB (D curve)	10	Nos
141-d	Rotary drive kit (including BUC handle with door inter lock defeat & pad lock facility for MCCB of rating up to 160 A	1	Nos
141-e	Spreader/ terminal adapter kit Extended terminal for 4 pole MCCB of	1	Nos

	rating up to 160 A (8 Pcs)		
141-f	Three phase multifunction meters to read V, A and F, accuracy class 1 & 150/ 5A CT- 3 Nos	1	Nos
141-g	LED indicators for all voltage ranges - Blue Colour	2	Nos
141-h	LED indicators for all voltage ranges - Red, Green, Black, Yellow or Orange Colour	1	Nos
141-i	Aluminium anodised Danger Notice Board of size 150 x 100 mm. with inscriptions (both in English and Malayalam) and conventional Skull and Bone in Red colour.	1	Nos
141-j	20 A fuse holder for BS type blade fuses.	3	Nos
141-k	2 A-16A clip-on offset tag fuse link of size f1	3	Nos
141-l	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of BUS BAR CHAMBER .	1	Nos
141-m	Aluminium anodised legend plate of size 100 x 40 mm. with inscription of CABLE ALLEY.	2	Nos
141-n	Aluminium anodised legend plate of size 40 x 20 mm. with inscription of EARTH.	2	Nos
142	Carrying out control wiring for panel with normal meters and indication lamps alone with 650/1100 V grade PVC insulated stranded single core copper conductor cables conforming to IS 694 part I 1990 for interconnecting the control devices/ equipments including providing suitable size insulated sockets at the termination points or soldered properly, providing numbering ferrules for the proper identification of the wiring, keeping the wiring firm by suitable tie/ tie mounts/ PVC duct etc as required.		
142-a	1.50 sq mm single run with required sockets.	58	Mts
143	Supply, Installation , Testing and commissioning of 3 phase, 415 V oil immersed starter suitable for 10 /15 HP motor fixed on wall and giving connection (	8	Nos
144	Supply, Installation , Testing and commissioning of 5 / 7.5 kVAR capacitorsuitable for 10/ 12 HP motor fixed on wall and giving connection	8	Nos
145	Supply, Installation , Testing and commissioning of 2. 5 kVAR capacitorsuitable for 3 HP motor fixed on wall and giving connection	18	Nos
146	Fabrication, supply & installation of dust and vermin proof, wall mounting, Sintex make meter box of 600x600x 214 mm size suitable for fixing KSEB meter,fuse units, CT etc, hinged door construction for the front side with compartments if necessary, providing vision panel for the meter compartment, knock out for cable entry and exit.	1	No
147	250 A, 415 V, DIN type fuse base.	3	Nos
148	250 A, 415 V, 2 way neutral link mounted on DMC/ SMC base.	3	Nos
149	150 A,415 V, DIN type fuse	6	Nos
150	S & F switch disconnector fuse unit complete with handle assembly, door inter lock and padlocking arrangement of 250 A, 4 pole SDF (Near Meter	1	Nos

	Box)		
151	1.61 mm CRCA sheet for mounting SDF	0.5	m2
152	Supply, conveyance, installation, testing and commissioning of Hot dipped Galvanised (internally and externally) seamless,Octagonal pole of overall height 8 Mts with double arm breaket of 1.5mts length 48mm dia x 3.25mm thick with standard arm cap. The top dia 70 mm, bottom dia 155mm having sheet thickness 3mm. The pole shall be with base plate of 225x225x16 mm and 4 nos required size of foundation bolt. The pole shall be mounted on suitable size oundation (design to be got approved) with 4A SP 'c' curve MCB, loop in loop out terminals block, required dia GI/ PVC pipe shall be provided in the foundation for taking cable in & out from the pole, 3 Core 1.5 sqmm unarmoured PVC insulated round copper cable from loop in loop out to light fixture etc with all required accessories. The cost of the civil foundation is not considered in this item.	8	Nos
153	Supply, conveyance, installation, testing and commissioning of 120 **Watts single piece LED** Flood light fittings suitable for roadway installation with pressure die-cast aluminium housing with corrosion resistance powder coating using Nano technology, natural cooling system,, Poly Carbonated UV treated diffuser for higher impact strength and optimum light trasmision, High efficient driver with short circuit, over voltage, over courent and thermal protection, Surge ptotection up to 5 KV, PF 0.95, *IP 65 protection, Horizontal Pole Mounting type fittings with all connected accessories fixing on the existing arm*and giving connections with 1.5 sq. mm 3 core PVC insulated and PVC sheathed copper conductor fles wire etc. as required The LED fittings shall be guaranted for **5 year**s from the date of commissioning from any defects in manufactring. Any of the spares / components which are found to be defective during this period shall be replaced immediately at free of cost. (Make: Philips/ Crompton/ LT)	16	Nos
154	Earth work excavation in *hard soil* and depositing with a lead up to 50 m and lift up to 1.50 m including neat banking	4.42	m3
155	*Plain cement concrete* 1:4:8 using 40mm (Normal size) broken stone. (m^3)	3.6	m3
156	*Cement concrete 1:2:4* using 20mm (nominal size) broken stone *for reinforced concrete work (also for earth cover)*	4.8	m2
157	*Reinforcement for R.C.C works*, bend tied and placed in position (plain grill requiring bend cold) using *tor steel (also for earth cover)*	80	kg
158	*Supply and clamping* the following sizes of *PVC pipe* on wall with all required accessories including cutting and making good the walls, colour washing etc. as required as protective covering to cables.		
158-a	63 mm dia PVC pipe (8 Kgf / cm^2)	8	Nos

159	Fabrication, supply & installation of dust and vermin proof, wall mounting, Sintex make Code No GSJB4030 Piller box suitable for fixing KSEB meter,fuse units, hinged door construction for the front side with compartments if necessary, providing vision panel for the meter compartment, knock out for cable entry and exit. (piller Box)	8	Nos
160	Supplying and installation including all manner of supports/ suspenders, anchor bolts etc for metering cubicle made out of suitable size , slotted angles, flats, MS plates etc as required including painting with 2 coats of synthetic enamel paint over a coat of zinc chromate primer, making good the damages, colour washing etc as required.	280	kg
161	Single dial timer unit digitail type (street Light)	1	Nos
162	2 pole 32 A contactor	1	Nos
163	Control Relay	1	Nos
164	Supply, Installation, testing and commissioning of silent type Desel Generating set alongwith having prime power rating of 160 KVA, 415 V at 1500 RPM , 0.8 PF at 415 V suitable for 50Hz, 3 Phase system and consisting the followings: (1) Diesel Engine : Diesel engine 4 stroke water cooled, electric start, of suitable BHP at 1500 RPM suitable for above out put of the alternator at 40 degree C. 50% BH & at 1000 meter MSL and conforming to BS 5514 BS 649 , IS 10000, capable for taking 10 % over load for one hour after 12 hours of continous operation. (ii) Alternator: Synchronous alternator rated 160 KVA , 415 V at 1500 RPM. The alternator having SPDP enclosure, brushless, continuous duty, self- excited and self - regulated through AVR conforming to IS 4722/ BS 2613 suitable for tropical conditions and with class- F/H insulation. (iii) Starting system: 12 V/ 24 V DC starting system comprising of stater motors: voltage regulator and arrengement for initial excitation complete with suitable Nos. of batteries (25 Plates, 180 Amp, hour capacity.) **Control Panel :-** Consistinf Voltmeter, Ammeter, Hz Meter, KWH Meter, Indication Lamp with set ON and load ON, Suitable rating MCCB etc as required.	1	Nos
165	250 A, 415 V, 50 Hz, AC 23 A duty, 4 pole on-load change over switch	1	Nos
166	*Cement concrete 1:2:4* using 20mm (nominal size) broken stone *for reinforced concrete work.*	4.24	Mts
167	*Plastering* with cement mortar 1:4, 12mm thick one coat.	38	M2
168	Supply and providing 2.5*mm thick* Elastomeric fire retardent insulating mat as per IS 15652/2006 to withstand 11 KV dielectric strength.	6	m2
169	Supply and providing *5 Kg. Dry Chemical Powder type Fire Extinguisher* with hose and clamps including fixing it to wall as required.	4	Nos
170	Supply and providing *9 Litre capacity GI Fire Bucket* painted in post office red with primer coat of red oxide and written with white paint 'FIRE' mounted on MS angle frame work/ wall bracket filled with fine sand, painting the bracket/ floor stand including making good the damages,	1	No

	colour washing etc. as required.		
171	*Painting letters or figures* of the following sizes with enamel paint as identification mark to SB, DB, panel board etc as required	200	Nos
172	Obtain test certificates for all protective devices, prepration of schematic drawings and obtain approval from respective statutory authorities and obtain energisation certificate excluding statutory fee remitted to different statutory authorities.	1	job

Suggested Brands of Equipment

The following manufacturers are recommended to be used for the proposed work. The Bidders may substitute alternative equivalent brand names with prior approval of Engineer in charge.

Sl. No.	Equipment	Suggested Vendors
1	VT and Centrifugal Pump	Kirloskar / Mather+Platt / WPIL/ Darling /Aqua
2	Pump motor	KEC/Kirloskar/ Crompton / ABB / Alstom / Siemens
3	Flow & Pressure regulating Valve	Darling Muesco / VAG / Keystone
4	Electro-magnetic Flow meters – Battery operated	Emerson / Krohne Marshall / Yokogawa
5	D.I. pipe Specials & Fittings	Electrosteel / KISWOK / Jindal / Kejariwal
6	Electro-fusion & Compression fittings	Glynwed / Georg Fisher/Astore/Magnum
7	Power Transformers	ABB / Crompton / Emco / Siemens / Alstom
8	HT Switch Gear	Alstom / Jyoti / Crompton / Siemens
9	Vacuum Circuit Breaker (VCB)	Siemens / Schneider M.G. / Jyoti / L & T
10	Air Circuit Breaker (ACB)	Siemens / Schneider M.G. / Jyoti / L & T
11	Moulded Case Circuit Breaker MCCB	Siemens / Schneider M.G. / Jyoti / L & T
12	Soft starters	Siemens / Alstom / Jyoti / ABB
13	Relay and Contactors	Siemens / Alstom / Jyoti / ABB / L&T
14	Cables	Tropodur / Finolex / Asian / Gloster / Incab / Universal / Polycab
15	Panel Enclosures and Consoles	Rittal / President / Cutler Hammer
16	Ultrasonic Type Level Measurement Device	Endress+Hauser / Krohne Marshall / Hycontrol UK.
17	Float & Board Type Level Measuring system	Nivo (Toshniwal), Endress + Hauser, Pune Techtrol
18	Switch fuse Disconnector	L & T, FN Type, Siemens, GEPC

19	Multi-Function Energy Meters	Enercon, L & T, SOCOMEC
20	Capacitor bank	Crompton Greaves, Khatau Junker, Malde, L &T
21	Cable Termination kit	Raychem, Denson, M-Seal
22	Battery	HBL NIFE, Exide, Amco
23	Battery Charger	Chaabi Electrical, Masstech
24	Tacho Meter on line	Kana Electric, Proton, Jay Shree Electronics
25	Pressure switch	Indfoss, Switzer,Tag Process Instruments
26	Flow switch	Switzer, General Instrument,Forbes Marshall
27	Pressure gauge	WAREE, WIKA, AN Instruments, Baumer ,Guru, Hitek
28	Pressure Transmitter	Emerson, Foxbro, Druck, Endress – Hauser, ABB, Honeywell Automation
29	Transformer	NGEF, Crompton, Alstom, Kirloskar,Voltemp, btcl, TESLA
30	VCB	CROMPTON, ALSTHOM, ABB, JYOTI, SIEMENS, BHEL, NIEPE-BANGLORE
31	Air circuit breaker	L & T, SIEMENS, ABB, JYOTI, CROMPTON, C & S
32	Lighting arrester	IGE, OBLUM ALPRO, CROMPTON
33	Relays	L & T, SIEMENS, ABB, JYOTI, C&S
34	Air breaks switches	SIL, WSL, KIRON TEXTILE
35	Post and dis insulators	SIL, WSI, KIRON TEXTILE, ATLAS JAIPURIA, JYOTI
36	Aluminum busbar	AS PER IE RULE AND AS PER RELATIVE STANDARD
37	Cables	FINOLEX UNIVERSAL HAVELLS NICCO CCI
38	Drop out fuses	SIL, WSI, KRON TEXTILE, ATLAS, JAIPURIA
39	Earthing material	AS PER IE RULES AND AS PER RELATIVE

		STANDARD
40	Safety device	AS PER IE RULE AND AS PER RELATIVE STANDARD
42	Meters	AE, MECO, Secure meters,Genius
42	Electrolytic feed pump	Kirloskar/Johnson
43	Underflow pump	Kirloskar / Johnson
44	Filter press feed pump	Hydroprokav / Roto pumps / Rotomac
45	Filter feed pump	Kirloskar / Johnson
46	Alum dosing system	Dosing Pump : Milton roy/Edose/ Equivalent Tank : Sintex/Kaveri/Equivalent
47	Hypo dosing system	Dosing Pump : Milton roy/Edose/ Equivalent Tank : Sintex/Kaveri/Equivalent
48	Filter press aid dosing system	Dosing Pump : Milton roy/Edose/ Equivalent Tank : Sintex/Kaveri/Equivalent
49	Filter backwash pump	Kirloskar/Johnson/Equivalent
50	Filter press	Hydropress / Royal Precision/BKS Engineers/ Equivalent
51	Alarm Annunciator	Minilec, Peacon, ICA, APLAB
52	Uninterruptible Power Supply	HI-Real, Pulse, Tata Libert, APC, APLAB
53	Instruments & Control Cables	Delton, Asian, Servel, TCL, Thermopad
54	Receiver Indicator/Digital panel meter	Masibus, Yokogawa, Lectrotek, NISHKO, SaiTech, MTL INSTS
55	Dewatering pump	Kirloskar/Johnson/Equivalent
56	Electromagnetic flow meter	E & H/Siemens/ABB/Equivalent

CHECK LIST

(The bidder should ensure that all the documents listed below is uploaded before submitting the bid)

1	Certificate of Empanelment for Liquid Waste Management in Kerala	Yes/No
2	Self attested Copy of the Bidder's valid registration certificate	Yes/No
3	Certificate of Registration for Service Tax/GST and acknowledgement of up to date filed return	Yes/No
4	Copy of latest Income tax return attached	Yes/No
5	Affidavit as per Eligibility criteria (Page 6)	Yes/No
6	Information Regarding Eligibility Letter of Transmittal(Form A)	Yes/No
7	Certificate of Financial Turnover from CA (Form B)	Yes/No
8	Bank Solvency Certificate (Form C)	Yes/No
9	The list of works of similar nature completed by the bidder for the immediate past 3 years clearly specifying the date of completion and actual date of completion with certificate from the agreement authority attached. Only Government/ PSU& state or central work will be considered as experience.(Form D)	Yes/No
10	Projects Under Execution Or Awarded (Form E)	Yes/No
11	Performance Report of Works Referred to in Forms "C" & "D"(Form F)	Yes/No
12	Preliminary designs, relevant details, lay out and preliminary general drawings of the proposed civil, electrical and mechanical works in case there is variation from the proposed design in this tender [Ref 2. General Conditions 2.4 above]	Yes/No
13	Details of structure and organization (Form G)	Yes/No
14	Details of Key personal & work force (Form H)	Yes/No
a	Copy of certificate of qualification attached.	Yes/No
b	Resume of concerned persons attached	Yes/No
c	Consent letter of concerned persons attached for this particular work.	Yes/No
15	Preliminary Agreement duly signed attached	Yes/No
16	Form of earnest money deposit	Yes/No

Signature of Bidder

FORM FIN-2

FINANCIAL PROPOSAL SUBMISSION FORM

[Location, Date]

To:

The Superintending Engineer
Corporation Office
Kozhikode
673032

Dear Sirs:

We, the undersigned, offer to provide the consulting Assignment/job for [Insert title of Assignment/job] in accordance with your Tender No……. dated [Insert Date] and our Technical Proposal. Our Financial Proposal is for

Financial Proposal for the original proposal as per the specifications uploaded in this Tender:
Table 1

Srl No	Scope	Cost in Rs (inclusive of all taxes)	Cost in Rs (inclusive of all taxes) in words
1	**Project Implementation Cost**		
1.1	Construction, Supply, Installation, Testing, Successful Commissioning & Operation and Maintenance during the Defect Liability Period Of Sewage Treatment Plant For Kozhikode Medical College With Septage Treatment Facilities For Surrounding Areas With Electrolytic Technology		
1.2	Procurement, Supply, installation/replacement of Electrodes complete as required to ensure confirmation with effluent output standards of Kerala Pollution Control Board for FIVE years.		
1	**Project Implementation Cost* TOTAL (1.1 +1.2)**		
2	Operation & Maintenance charges for Four Years for the treatment plant after the first year of successful commissioning (ie, after the Defect Liability Period) inclusive of chemicals, enzymes for remediation, spare parts, lubricants, skilled & unskilled operators, complete in all respects required for the successful O&M including labour charges		
2.1	2nd year		

2.2	3rd year		
2.3	4th year		
2.4	5th year		
	FINAL TOTAL (1+2.1+2.2+2.3+2.4)		
FINAL Total Amount in words :			

***** The PAC mentioned is this Tender is for the Project Implementation Cost (i.e. 1.1 + 1.2) only.

Table 2 :

The bidder shall input the split-up of rates quoted in Table 1 for section 1.1 "Construction, Supply, Installation, Testing, Successful Commissioning & Operation and Maintenance during the Defect Liability Period Of Sewage Treatment Plant For Kozhikode Medical College With Septage Treatment Facilities For Surrounding Areas With Electrolytic Technology". The rates described below shall be used to check 'front loading' & as a reference while making payments under each head,

Srl No	**Scope**	**Cost in Rs (inclusive of all taxes)**	**Cost in Rs (inclusive of all taxes) in words**
1	**Project Implementation Cost**		
1.1	Construction, Supply, Installation, Testing, Sucessful Commissioning & Operation and Maintenance during the Defect Liability Period Of Sewage Treatment Plant For Kozhikode Medical College With Septage Treatment Facilities For Surrounding Areas With Electrolytic Technology		
1.1 a	Civil Works: Construction Cost		
1.1 b	Supply & installation of Tanks		
1.1 c	Mechanical Works: supply & installation		
1.1 d	Electrical Works : supply & installation		

The quoted cost shall be inclusive of all taxes. We hereby confirm that the financial proposal is unconditional and we acknowledge that any condition attached to financial proposal shall result in rejection of our financial proposal.

Our Financial Proposal shall be binding upon us subject to the modifications resulting from Contract negotiations, up to expiration of the validity period of the Proposal.

We understand you are not bound to accept any Proposal you receive.

Yours sincerely,

Authorized Signature [In full and initials]:
Name and Title of Signatory:
Name of Firm:

6 PROJECT PLANNING AND IMPLEMENTATION

6.1 Project zoning:

For aiding the proper planning and execution of action plans, the entire Medical College was divided into two clusters, based on the expediency in putting decentralized plants .Cluster classification is done based on the convenience for sewage flow through closed conduits under gravity.The proposed cluster classification is as follows:

Table 6-1Buildings Contained In Each Clusters

Cluster	Buildings Contained
Cluster 1	• NMCH, • IMCH, • Super specialty block, • Medical College Campus, • Men Hostel 5, • Old PG Hostel, • PG Hostel, • Dental college ladies hostel, • ladies hostel 6, • women hostel, • men hostel 6, • men hostel 2, • men hostel 1, • Pharmacy college,

	• Canteen , • Ladies Hostel 3 • Future Buildings • ICD • Tertiary Cancer Care Institute
Cluster 2	• Dental College, • Nursing College, • Nurses hostel, • Gents hostel for nursing under construction, • lecture cum theatre complex, • SamrakshanaKendram

Figure 6-1 Cluster classification

Description about each cluster and the required actions for the clusters are listed below:

6.1.1 Cluster 1

This is the most congested and developed cluster in the medical college campus. Main buildings included in cluster 1 are;

1. New Medical College Hospital (NMCH)
2. Institute of Maternal And Child Health (IMCH)
3. Super specialty block
4. Medical College Campus
5. Men Hostel 5
6. Old PG Hostel
7. PG Hostel
8. Dental college ladies hostel
9. ladies hostel 6
10. women hostel -
11. men hostel 6
12. men hostel 2
13. men hostel 1
14. Pharmacy college
15. Canteen
16. Ladies Hostel 3
17. Future Buildings

Figure 6-2 Cluster 1

18. ICD

19. Tertiary Cancer Care Institute

Based on the complexity in the existing wastewater management system followed, cluster 1 is sub divided into six as:

a) Zone 1 including IMCH, NMCH, Medical College,
b) Zone 2 including Super specialty block
c) Zone 3 including Canteen and auxiliary buildings
d) Zone 4 including Hostels
e) Zone 5 including buildings in future expansion stage
f) Zone 6 ICD and tertiary cancer care

6.1.1.1 Zone 1

Zone 1 includes;

a) NMCH excluding the KHRWS pay wards,Kitchen and laundry and OT complexes
b) IMCH and the auxiliary Thanal building
c) Medical College Campus and auxiliary buildings

Figure 6.3 Medical College

Figure 6.4 IMCH

At present there are separate drainage &Waste Water lines for this zone. The overflows of individual manholes are connected to drains, which are found to be open at some locations. Eventually water flowing through these drains becomes a mix of Storm, black and Grey water and ended up in a collection well. Sewage lines from the buildings in this zone are directed to the oxidation tank in Mayanad area. But these oxidation tanks are under capacity so as to receive and treat the present flow. Thus the sewage pond overflows all the way through the residential and agricultural areas of Mayanad. For the past 20 years this has become a nuisance to the Mayanad residents. As a solution for their unending miseries, a project is sanctioned by the District Administration under Zero Waste Medical College Project. For this project an amount of 1.5 crores is funded from the MLA funds. 95 lakhs is sanctioned for the construction of new collection well. Under Zero Waste Kozhikode DPR is submitted for 1.5 crores out of which 95 lakhs is sanctioned and work has been started.

During site investigation of zone 1, it was noticed that most of the sewer lines were in poor condition due to breakage. At major portions of NMCH around 85%-95% roof top rain water was allowed to flow through sullage lines and then combined flow of sewage occur through open drains which was not planned to be happen. This was also noticed in some areas of IMCH.

In case of IMCH zone observations during initial survey were

1. Around 70% storm water and sullage are flowing through a single line
2. 75KLD roof top rain water is harvested in a storage sump for fire demand.
3. 75KLD was reserved in the sump.
4. The sullage lines were rotated into the open drain and the sewage was released down to Mayanad region.
5. The down pipes were of 4” diameter (sullage lines),6” diameter(sewage).
6. The main sewers were of 1 foot diameter pipes.

7. The sewage lines of Mayanad region was interlinked to the sullage line passing to the STP

6.1.1.2 Zone 2

Zone 2 includes the Super specialty block. The sanitation facilities of zone 2 are extremely pathetic. The septic tanks are overflowing. They are not properly and timely being desludged. Stagnant wastewater creates a sewage pool within the compound of the Super specialty block.

Figure 6-3 Super Specialty Block

6.1.1.3 Zone 3

Zone 3 includes;

a) The Indian Coffee House
b) Pharmacy Colleges
c) Ladies hostel 3
d) GNM hostel

This is the developing zone in the campus which consists of two Hostel buildings, Canteens, open spaces, Pharmacy colleges, individual buildings etc. At present all the individual buildings have individual conventional septic tanks to which the sewer lines of each building is connected. There are channel drains to collect the storm water. Storm drains from canteen is flowing down to Mayanad region. Due to improper maintenance the existing drains from the hostels are now clogged.

Figure 6-4 Indian Coffee House 1

Figure 6-6 Institute of Pharmaceutical science

Figure 6.9 GNM Hostel

Figure 6-7 Ladiess hostel 3

6.1.1.4 Zone 4

Zone 4 includes the hostels;

a) Men’s Hostel 1
b) Men’s Hostel 2
c) Men’s Hostel 3
d) Men’s hostel 4
e) Men’s hostel 5
f) Old PG hostel
g) New PG hostel
h) Ladies hostel 4
i) Dental Hostel
j) Ladies hostel new block
k) Men’s Hostel new block

6-11

Figure 6-9 Men's Hostel I

Figure 6-8 Men's hostel II

Figure 6. Men's Hostel V

Figure 6-10 Men's Hostel VI

Figure 6.16 Old PG Hostel

Figure 6.15 New PG Hostel

Figure 6-15 Dental Hostel

Figure 6-14 Ladies Hostel 4

Figure 6-16 Ladies Hostel New block

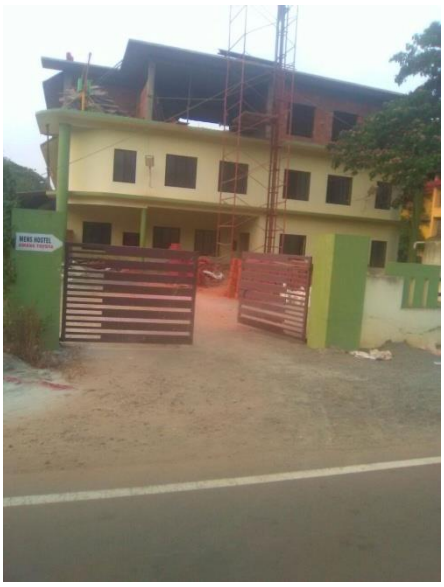


Figure 6-17 Men's Hostel New block

6.1.1.5 Zone 5

Zone 5 includes:

a) PG residents hostel
b) Paramedical Hostel
c) NGO/GO Quarters

This zone addresses the future expansion within the project area. The three buildings mentioned above are under construction. These buildings are situated near to the existing STP compound. Proximity to the existing treatment plant aids the easy conveyance of sewage to this compound.

6.1.1.6 Zone 6 ICD & tertiary cancer care

This zone covers the area for Institute of chest disease and Tertiary Cancer Care Institute. These buildings are located on the other side of the Medical college – Karanthoor road. Presently this area has a septic tank whose overflow is connected a biogas plant nearby. It is proposed to collect the entire sewage of this zone into a collection point and then pump it into the new STP in cluster 1.

Figure 6-19 Institute of chest Diseases

Figure 6-18 Tertiary Cancer Care

6.1.2 Cluster 2

Figure 6-20 Cluster 2

Cluster 2 includes:

a) Nursing College

b) Dental college

c) Nurses hostel A& B

d) Men's Hostel for nursing students (New)

e) Lecture cum theatre complex
f) SamrakshanaKendram
g) PWD building (under construction)
h) OT's, Main Kitchen and laundry, KHRWS Paywards, geriatric wards of NMCH

This is another critical zone in this area which needs some practical solutions. At present the sewer lines from the buildings in this cluster are connected to a conventional single septic tank which is under a miserable condition. The storm water drain in this zone is connected to a soak pit which is also under poor condition. The practical difficulty in this zone is the steep slope terrain which will make difficulties in constructing sewer lines to the existing STP.

Cluster 2 is one of the valley points of the project area. Around 2 acres of vacant land is available at the end point of this cluster. At present the entire sewage through the slope is flowing down to this vacant land. This creates sewage ponds within the cluster 2.Eventhough there is land availability at the lowest point, the soil condition doesn’t favors for the construction of 1 MLD plant. Thus the STP is proposed in the open area at the backyard of nurse’s hostel.

Figure 6-21 Govt. Dental College

Figure 6-22 Govt. College Of Nursing

Figure 6-24 PWD building under construction

Figure 6-23 Nurses Hostel

PLANT CAPACITY DESIGN SHEET

- 2 MLD STP with septage treatment facility
- 1 MLD STP

AMRUT KOZHIKODE MEDICAL COLLEGE

Sewage Treatment Plant capacity design sheet

Cluster 1					
Sl No	**buildings included**	**Description**	**Number of Users**	**Water Supply Requirements (lpcd)**	**Total water Supply Requirements (litres/day)**
1	**Medical college campus (MCH) & New Medical College Hospital (NMCH)**				
		Bed Strength	2205	450	992250
		Outpatients	3700	20	74000
		Staffs	2912	45	131040
		Hostel inmates	229	135	30915
		Students	2481	45	111645
2	**Institute Of Maternal And Child Health (IMCH)**				
		Bed Strength	1159	450	521550
		Outpatients	1050	20	21000
		Staffs	1873	45	84285
		Hostel inmates	90	135	12150
3	**Super Speciality Block**				
		Bed Strength	500	450	225000
		Outpatients	700	20	14000
		Staffs	50	45	2250
		Patient overloading	25	450	475
4	**PMR**				
		Bed Strength	60	450	27000
		Outpatients	125	20	2500
		Staffs	75	45	3375
5	**Hostels**				
	Mens Hostel 1		209	135	28215
	Mens Hostel 2		207	135	27945
	Mens Hostel 3		170	135	22950
	mens hostel 4		200	135	27000
	mens hostel 5		71	135	9585
	Old PG hostel		66	135	8910
	New PG hostel		168	135	22680
	Ladies hostel 4		302	135	40770
	Dental Hostel		297	135	40095
	Ladies hostel new block		250	135	33750
	Mens Hostel new block		250	135	33750
6	**PG residents hostel**				
	Inmates (60 flats with 4 user/flat)		240	135	32400
7	**Paramedical Hostel**				
		Inmates	100	135	13500
8	**NGO/GO Quarters**				
		Inmates	630	135	85050
9	canteen 150 seated				
			3500	15	52500

10	ladies hostel 3				
		Inmates	214	135	28890
11	GNM hostel				
		Inmates	106	135	14310
12	Pharmacy college (new& Old)				
		Staffs/students	249	45	11205
13	Institute Of Chest Disease				
		Bed Strength	110	450	49500
		Outpatients	180	20	3600
		Staffs and students	170	45	7650
					60750
14	Tertiary Cancer care institute				80000
A	**Net water demand in cluster 1**				2988440
B	**Sewage generation (90% of A)**				2689596
C	**Rain water intrusion (after completion of roof top harvesting) and considering practicality in isolation of rainwater from sewage**				1000000
D	**Total waste water(B+C)**				3689596
	Infiltration (5% of D)				184480
E	**Waste water comdribution ,Considering future expansions (1% of D)**				36896
F	**Net waste water produced (D +E)**				3910972
G	**Present treatment plant capacity**				2000000
H	**Additional capacity requirement (F- G)**				1910972
I	**Design Capacity of plant**				2000000
					2 MLD

Cluster 2					
Sl No	**buildings included**	**Description**	**Number of Users**	**Water Supply Requirements (lpcd)**	**Total water Supply Requirements (litres/day)**
1	Nursing College				
		Staffs/students	485	45	21825
2	Dental college				
		Staffs/students	490	45	22050
		Outpatients	385	20	7700
3	Nurses hostel A& B				
		Inmates	200	135	27000
4	Mens Hostel for nursing students New				
		Inmates	200	135	27000
5	Lecture cum theatre complex		1530	45	68850
6	Samrakshana Kendram				
		Bed Strength	80	135	10800
7	additional building 3 floors				15000
8	Dental College Additional Block				
		Bed strength	160	450	72000
9	Condribution from OT's, Main Kitchen and laundry, KHRWS Paywards,geriatric wards)				700000
	Water demand				972225
	Sewage generation				875002.5
	Infiltration				43750
	Expansion				70000
	Net wastewater generation				918753
	Design Capacity				1000000
					1 MLD

NOVEL GEOSERVICES

PAYLIPARAMBIL, PERUMPILLY, MULANTHURUTHY- 682314

SUMMARY OF LABORATORY TEST RESULTS

Project: **Sewage Treatment Plant, Medical College, Kozhikode**	**LOGIC SOILSURVEY**	Date of boring: 21/03/2018 to 30/03/2018
Borehole Nos **BH/1 , BH/2 and BH/3**		Ground water table :
Type of Boring: Rotary drilling		Depth in Meter :

							Aterbergs Limit				Shrinkage			Grainsize Analysis					
Sample Depth m	Sample Type	Visual Identification of Soil	SPT "N"	Classification	Natural Moisture content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Differential Free Swell Index %	Shrinkage Limit	Specific Gravity	Gravel %	Coarse Sand %	Medium Sand %	Fine Sand %	Silt %	Clay %
Depth (1)	Type (2)	Description (3)	(4)	CLASS (5)	NMC (6)	LL (7)	PL (8)	PI (9)	LI (10)	DFSI (11)	SL (12)	SG (13)	G (14)	CS (15)	MS (16)	FS (17)	Silt (18)	Clay (19)
		BOREHOLE BH/1																
1.50	SPT	Brownish grey clayey sandy gravel	32	GC-SP	20.9								33.1	22.5	18.2	10.1	16.1	
3.00	SPT	Brownish grey medium to coarse sand with clay	>47	GC-SP	17.3								3.0	38.1	42.4	5.0	11.5	
4.50	SPT	Brownish grey medium to coarse sand with clay	>52	GC-SP	20.2								8.4	22.8	40.9	6.5	21.4	
6.00	SPT	Yellow sandy silty clay	39	SC	25.8								8.3	4.3	14.7	23.9	48.8	
7.50	SPT	Yellow sandy silty clay	23	SC	37.1									8.4	28.1	14.8	48.7	
9.00	SPT	Yellow sandy silty clay	26	SC	41.7									6.5	20.4	16.3	56.8	
10.50	SPT	Yellow clayey silty fine to medium sand with stones	39	GC-SP									12.4	7.4	28.4	22.4	29.4	
12.30-13.80		Greyish jointed granite																
		BOREHOLE BH/2																
1.50	SPT	Reddish brown clayey fine to coarse sand with gravel	38	GC-SP	11.5								11.9	32.9	33.3	11.5	10.4	
3.00	SPT	Reddish brown clayey fine to coarse sand with gravel	48	SC-SP	22.1								7.7	14.6	56.2	9.3	12.2	
4.50	SPT	Reddish brown sandy silty clay with gravel	39	GC-SC	28.3								15.0	8.0	14.8	19.7	42.5	
6.00	SPT	Reddish brown sandy silty clay with gravel	45		26.2													
8.70-9.30		Light grey jointed granite																
9.30-10.55		Greyish jointed granite																

NOVEL GEOSERVICES
Pailiparambil, Perumpilly P.O.
Mulanthuruthy, Cochin - 682 314

TABLE 1

Project: **Sewage Treatment Plant, Medical College, Kozhikode** **SHEET 2 OF 2**

Depth (1)	Type (2)	Description (3)	"N" (4)	CLASS (5)	NMC (6)	LL (7)	PL (8)	PI (9)	LI (10)	DFSI (11)	SL (12)	SG (13)	G (14)	CS (15)	MS (16)	FS (17)	Silt (18)	Clay (19)
		BOREHOLE BH/3																
1.50	SPT	Reddish brown clayey fine to coarse sand with gravel	9	GC-SP	19.5								37.5	36.5	13.8	1.9	10.3	
3.00	SPT	Reddish brown clayey fine to coarse sand with gravel	13	GC-SP	19.7								19.4	39.3	26.0	3.6	11.7	
4.50	SPT	Reddish brown and grey sandy silty clay with stones	34	GC-SC	34.2								18.9	8.3	17.4	19.5	35.9	
6.00	SPT	Reddish brown and grey clayey silty fine to medium sand with stones	50	GC-SP	16.1								29.3	17.1	15.9	15.0	22.7	
10.50	SPT	Reddish brown and yellow sandy silty clay	38	SC-CI	22.7	43.6	17.5	26.1	0.199									
13.20-14.00		Greenish grey jointed granite																

LAB IN CHARGE: Shereena Reji Das
Geotechnical Laboratory Technician

CHECKED BY Anirudhan I.V.
BSc Engg, MTech. Geotech

Note: All the laboratory tests are conducted based on the procedure found in relevant IS codes (IS2720, different parts), Limit tests are conducted on natural sample without pre-drying

NOVEL GEOSERVICES
Pailiparambil, Perumpilly P.O.
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APPENDIX - A1

FIELD AND CORRECTED N VALUES, ANGLE OF FRICTION AND UNDRAINED SHEAR STRENGTH

BOREHOLE NO: BH/1

Project: Sewage Treatment Plant, Medical College, Kozhikode

Ground water table m

Test Depth	Soil	Density	Field N	p0' t/m^2	Overburden correction	N''	angle of friction OR Cohesion cu
0.00		1.93					
1.50	Brownish grey clayey sandy gravel	1.93	32	1.67	1.60	51	phi=42.8°
3.00	Brownish grey medium to coarse sand with clay	1.97	47	3.07	1.00	47	phi=41.9°
4.50	Brownish grey medium to coarse sand with clay	1.99	52	4.52	1.00	52	phi=41.6°
6.00	Yellow sandy silty clay	1.95	39	6.01	1.00	39	cu=19.5 t/m2
7.50	Yellow sandy silty clay	1.89	23	7.43	1.00	23	cu=11.5 t/m2
9.00	Yellow sandy silty clay	1.90	26	8.77	1.00	26	cu=13.0 t/m2
10.50	Yellow clayey silty fine to medium sand with stones	1.95	39	10.12	1.00	39	phi=35.2°

Note: Undrained cohesion of clay / sandy clay = N x 0.5 t/m2 for residual soil, Stroud, M.J. Tomlinson, Foundation Design and Construction, Fifth Edition, Fig 1.11, For N<5, based on LI., Angle of friction using T.William Lambe & R.V.Whitman, 'Soil Mechanics SI Version', Figure 11.14 & Table 11.3, pp. 148-149

NOVEL GEOSERVICES
Pailiparambil, Perumpilly P.O.
Mulanthuruthy, Cochin - 682 314

APPENDIX - A2

FIELD AND CORRECTED N VALUES, ANGLE OF FRICTION AND UNDRAINED SHEAR STRENGTH
BOREHOLE NO: BH/2

Project: Sewage Treatment Plant, Medical College, Kozhikode

Ground water table m

Test Depth	Soil	Density	Field N	p0' t/m^2	Overburden correction	N"	angle of friction OR Cohesion cu
0.00		1.95					
1.50	Reddish brown clayey fine to coarse sand with gravel	1.95	38	1.71	1.59	61	phi=44.5°
3.00	Reddish brown clayey fine to coarse sand with gravel	1.98	48	3.14	1.39	67	phi=45.4°
4.50	Reddish brown sandy silty clay with gravel	1.95	39	4.61	1.00	39	cu=19.5 t/m2
6.00	Reddish brown sandy silty clay with gravel	1.97	45	6.03	1.00	45	cu=22.5 t/m2

Note: Undrained cohesion of clay / sandy clay = N x 0.5 t/m2 for residual soil, Stroud, M.J. Tomlinson, Foundation Design and Construction, Fifth Edition, Fig 1.11, For N<5, based on LI., Angle of friction using T.William Lambe & R.V.Whitman, 'Soil Mechanics SI Version', Figure 11.14 & Table 11.3, pp. 148-149

NOVEL GEOSERVICES
Pailiparambil, Perumpilly P.O.
Mulanthuruthy, Cochin - 682 314

APPENDIX - A3

FIELD AND CORRECTED N VALUES, ANGLE OF FRICTION AND UNDRAINED SHEAR STRENGTH
BOREHOLE NO: BH/3

Project: Sewage Treatment Plant, Medical College, Kozhikode

Ground water table m

Test Depth	Soil	Density	Field N	p0' t/m^2	Overburden correction	N''	angle of friction OR Cohesion cu
0.00		1.78					
1.50	Reddish brown clayey fine to coarse sand with gravel	1.78	9	1.40	1.66	15	phi=33.0°
3.00	Reddish brown clayey fine to coarse sand with gravel	1.82	13	2.57	1.46	19	phi=34.3°
4.50	Reddish brown and grey sandy silty clay with stones	1.93	34	3.80	1.00	34	cu=17.0 t/m2
6.00	Reddish brown and grey clayey silty fine to medium sand with stones	1.98	50	5.20	1.22	61	phi=39.2°

Note: Undrained cohesion of clay / sandy clay = N x 0.5 t/m2 for residual soil, Stroud, M.J. Tomlinson, Foundation Design and Construction, Fifth Edition, Fig 1.11, For N<5, based on LI., Angle of friction using T.William Lambe & R.V.Whitman, 'Soil Mechanics SI Version', Figure 11.14 & Table 11.3, pp. 148-149

NOVEL GEOSERVICES
Pailiparambil, Perumpilly P.O.
Mulanthuruthy, Cochin - 682 314

LOGIC SOIL SURVEY

Project : Sewage Treatment Plant
Site : Medical College, Kozhikode
Bore Hole No: **BH/1**
Type of Boring Rotary drilling

Date of Commence : 21-03-2018
Date of Completion : 21-03-2018
Ground Water Level :

BORE LOG

Depth (m) beow GL	Profile	Visual Description of Soil	Thicknessof layers	Standard Penetration Test Data					RD / Consistency
				Depth (m)	15	30	45	N	
		Laterite	0.60						
1.0									
2.0		Brownish grey clayey sandy gravel	1.70	1.50	10	11	21	**32**	Dense
3.0									
				3.00	53	47		**>47**	
4.0		Brownish grey medium to coarse sand with clay	3.00						Dense
5.0				4.50	48	52		**>52**	
6.0									
				6.00	11	16	23	**39**	
7.0									
8.0		Yellow sandy silty clay	4.70	7.50	2	8	15	**23**	Stiff
9.0									
				9.00	7	12	14	**26**	
10.0									
11.0				10.50	9	15	24	**39**	
12.0		Yellow clayey silty fine to medium sand with stones	2.30						Dense
				12.30	Rebound			**RB**	
13.0		Greyish jointed granite	12.30-13.80	Rock drilling Recovery 38%, RQD 30%					Hard
14.0									
15.0									
16.0									
17.0									
18.0									
19.0									
20.0									
		Borehole terminated at 13.80m							

LOGIC SOIL SURVEY

Project : Sewage Treatment Plant
Site : Medical College, Kozhikode
Bore Hole No: **BH/2**
Type of Boring Rotary drilling

Date of Commence : 23-03-2018
Date of Completion : 24-03-2018
Ground Water Level :

BORE LOG

Depth (m) beow GL	Profile	Visual Description of Soil	Thicknessof layers	Standard Penetration Test Data					RD / Consistency
				Depth (m)	15	30	45	N	
1.0		Reddish brown clayey fine to coarse sand with gravel	4.00	1.50	8	17	21	**38**	Dense
2.0									
3.0				3.00	13	21	27	**48**	
4.0									
5.0		Reddish brown sandy silty clay with gravel	3.40	4.50	17	19	20	**39**	Very Stiff
6.0									
7.0				6.00	18	21	24	**45**	
				7.40	Rebound			**RB**	
8.0		Weathered rock	1.30						Weak
9.0				8.70	Rebound			**RB**	
		Light grey jointed granite	8.70-9.20	Rock drilling, recovery 80%					Moderate
10.0		Greyish jointed granite	9.20-10.60	Rock drilling, recovery 50%					Moderate
11.0									
12.0									
13.0									
14.0									
15.0									
16.0									
17.0									
18.0									
19.0									
20.0									
		Borehole terminated at 33.30m							

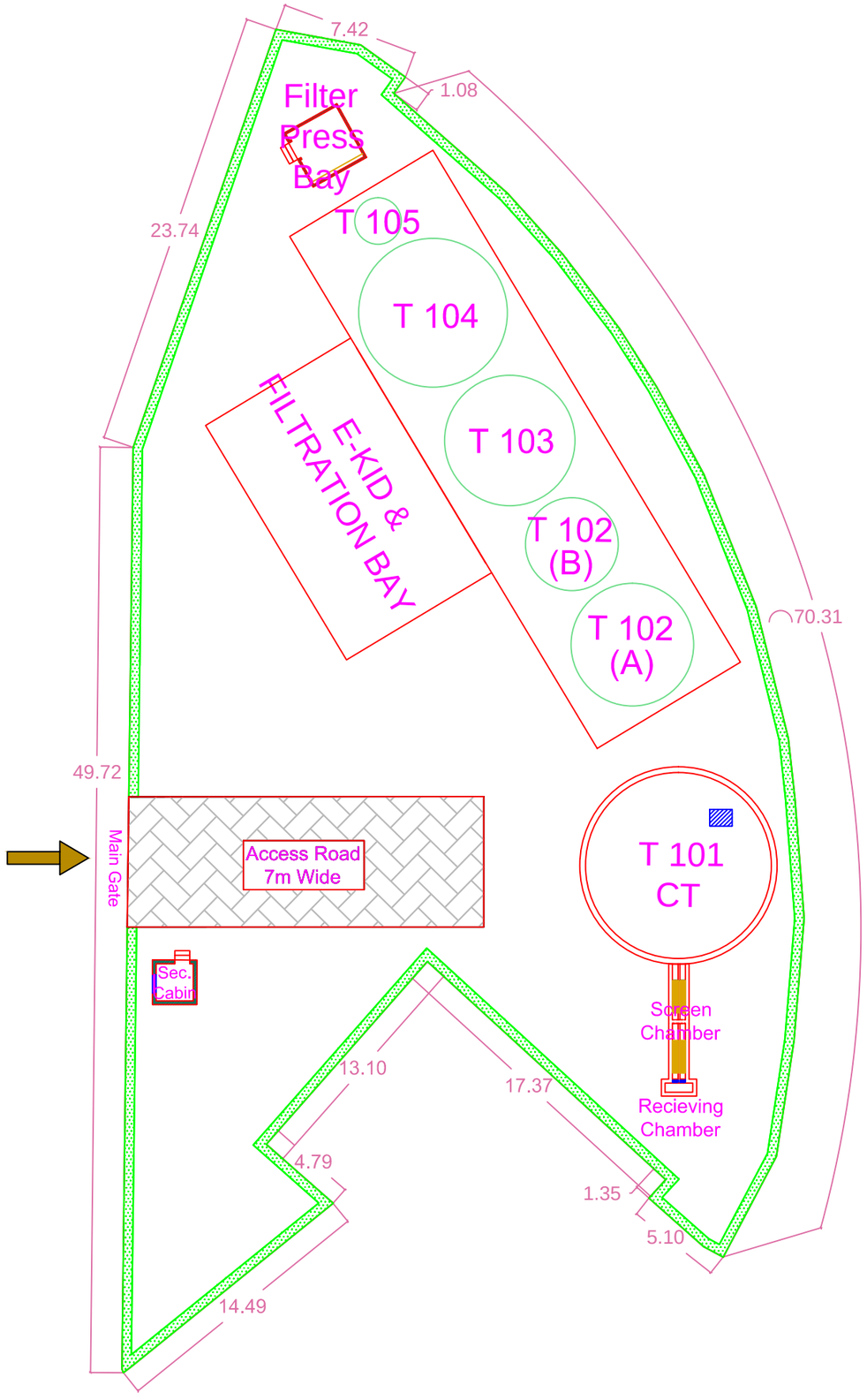
LOGIC SOIL SURVEY

Project : Sewage Treatment Plant
Site : Medical College, Kozhikode
Bore Hole No: **BH/3**
Type of Boring Rotary drilling

Date of Commence : 28-03-2018
Date of Completion : 30-03-2018
Ground Water Level :

BORE LOG

Depth (m) beow GL	Profile	Visual Description of Soil	Thicknessof layers	Standard Penetration Test Data					RD / Consistency
				Depth (m)	15	30	45	N	
1.0		Laterite (filling)	1.50						Fill
2.0		Reddish brown clayey fine to coarse sand with gravel	2.80	1.50	4	4	5	**9**	Loose to Medium Dense
3.0				3.00	4	6	7	**13**	
4.0									
5.0		Reddish brown and grey sandy silty clay with stones	1.90	4.50	13	17	17	**34**	Stiff
6.0									
7.0		Reddish brown and grey clayey silty fine to medium sand with stones	1.20	6.00	9	50/14cm		**>100**	Very Dense
				7.40	Rebound			**RB**	
8.0		Reddish brown weathered laterite	2.00						Weak
9.0				9.40	Rebound			**RB**	
10.0		Reddish brown and yellow sandy silty clay	2.40	10.50	13	17	21	**38**	Stiff
11.0									
12.0				11.80	Rebound			**RB**	
13.0		Weathered rock	1.40	13.20	Rebound			**RB**	Weak
14.0		Greenish grey jointed granite	13.20-14.00	Rock drilling, Recovery 70%, RQD 60%					Hard
15.0									
16.0									
17.0									
18.0									
19.0									
20.0									
		Borehole terminated at 14.00m							



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S

NOTES

01. ALL DIMENSIONS ARE IN METERS UNTIL UNLESS IT IS SPECIALLY MENTIONED
02. ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED
03. THICKENESS OF PCC SHALL BE TAKEN AS 10CM IF NOT MENTIONED SEPERATE

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

01. Area of Development = 1712.30 sqm (42 Cent)
02. Area of Green Belt = 99.78 sqm
03. Area of Road = 133.90 sqm
04. Area of Plant Foundation = 288.90 sqm
05. Area for E-KID & Filtration Bay = 142.59 sqm

CLIENT

CMMU, AMRUT MISSION KOZHIKODE

CONSULTANT

RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
ROAD	
GLS TANK	
SCREEN	
WINDOW / VENTILATOR	
GRASS	
SHRUBS / HERBS	
VERTICAL SCREEN	
DIMENSION LINE	
CONCRETE STRUCTURE	
GLS STRUCTURE	
LANDSCAPE STRUCTURE	

DRAWING TITLE

OVERALL LAYOUT OF SEWAGE TREATMENT PLANT

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-01	00
Approved By	

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
01/13	A3	NTS

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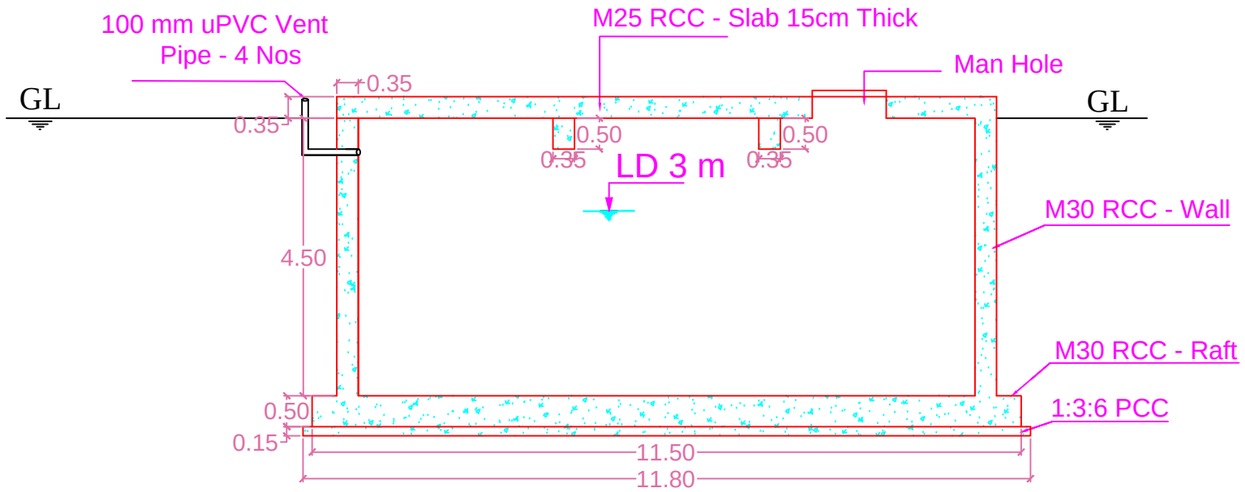

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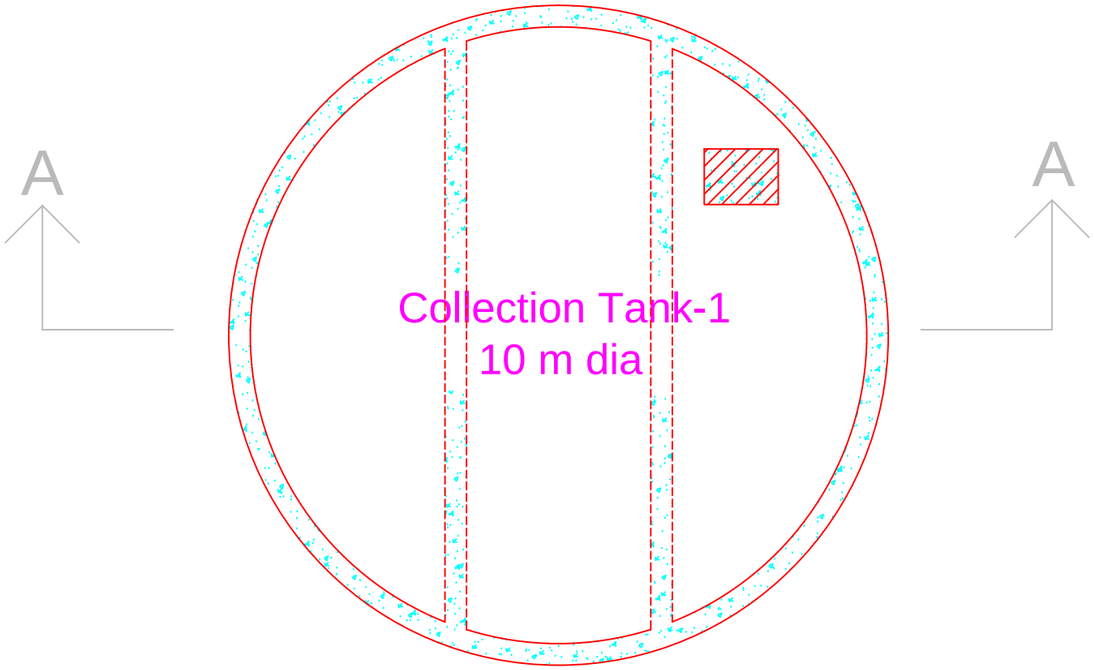

PLAN

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

COLLECTION WELL-
PLAN & SECTION

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-02	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
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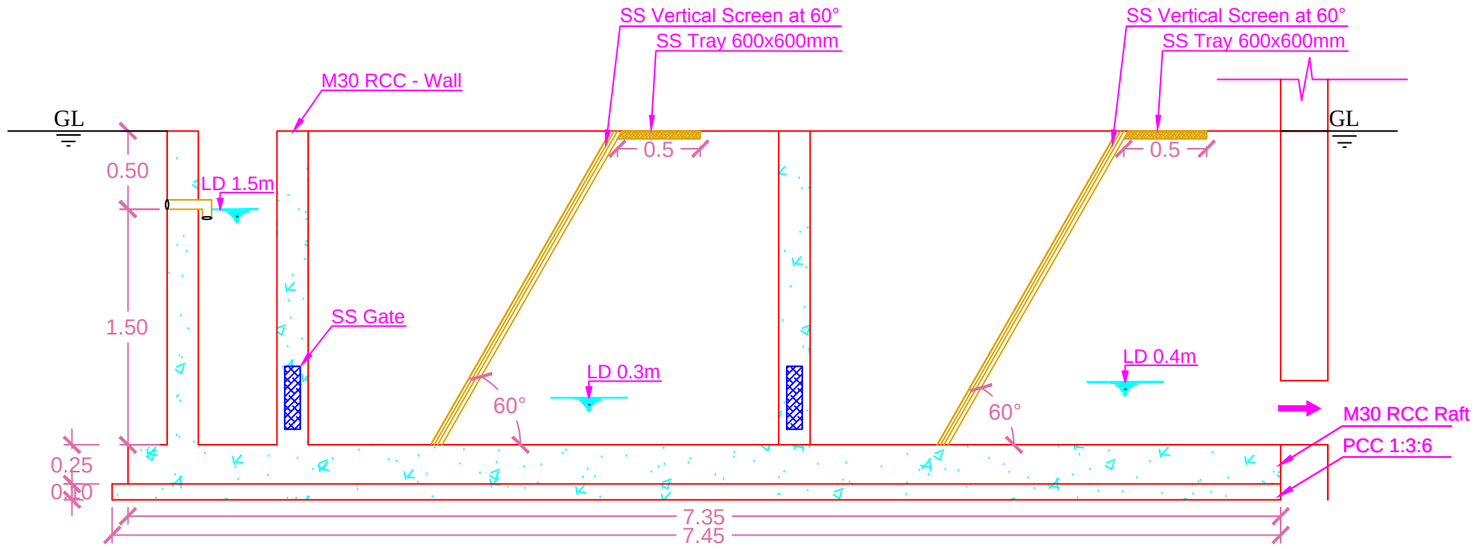

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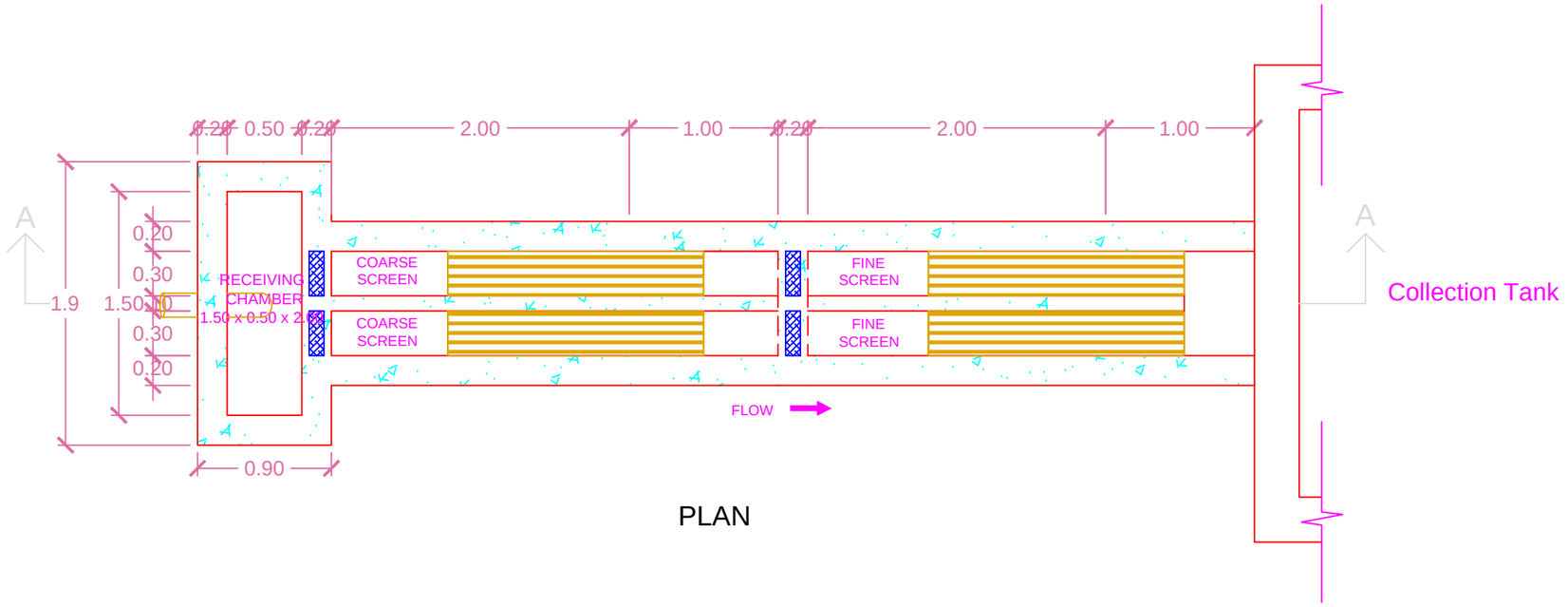

PLAN

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

GENERAL ARRANGEMENTS OF RECEIVING CHAMBER & SCREEN CHANNEL

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-03	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
03/13	A3	NTS

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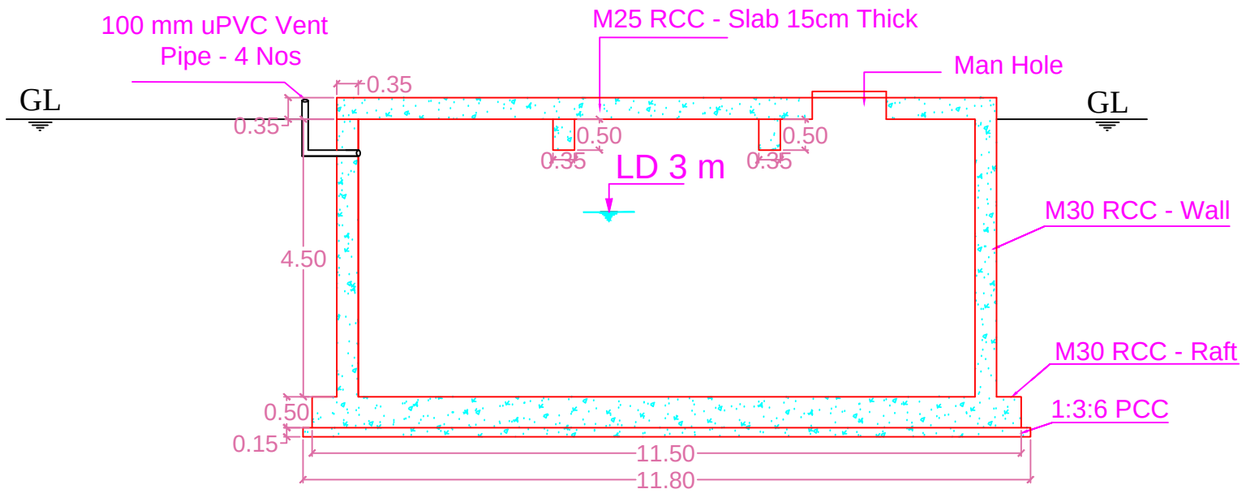

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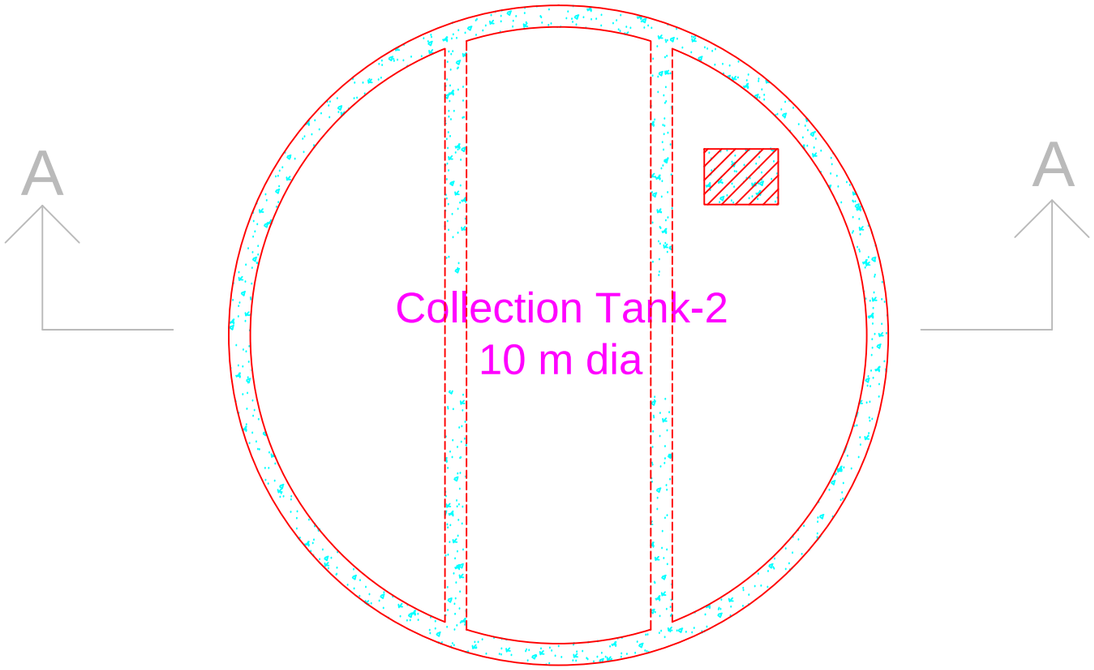

PLAN

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

COLLECTION WELL-
PLAN & SECTION

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-04	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
04/13	A3	NTS

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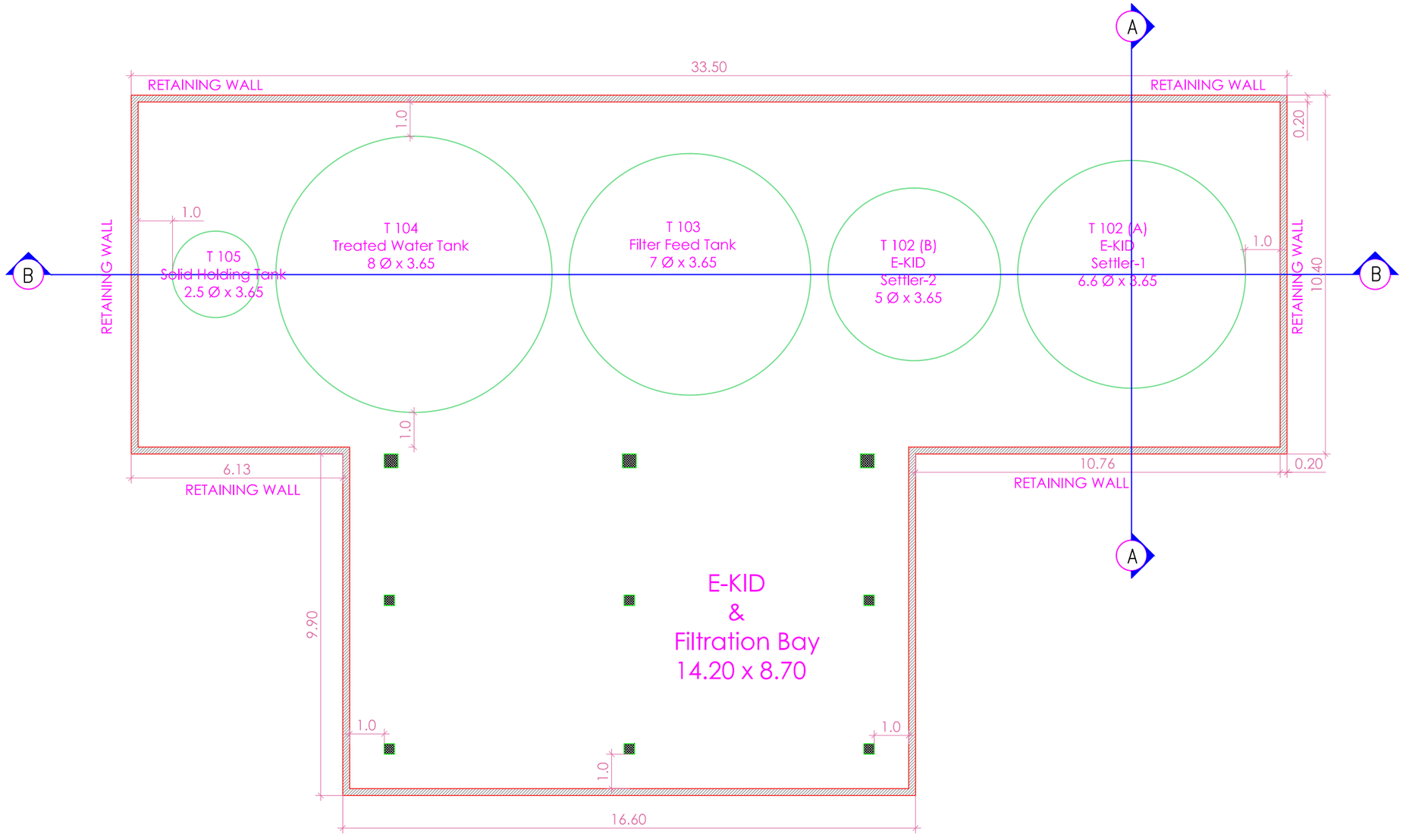

PLAN

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

अमृत
Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

PLANT LAYOUT

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-05	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
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05/13	A3	NTS

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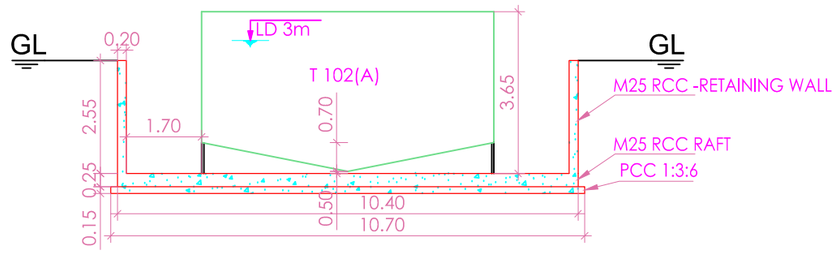

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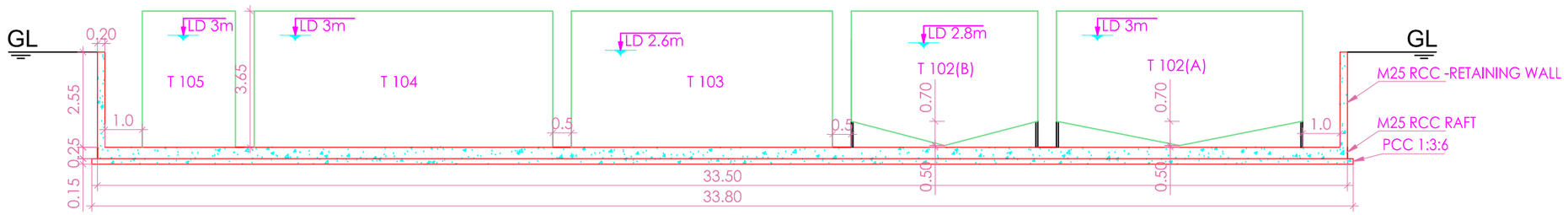

SECTION B-B

All Tanks are made of GLS (Glass Lined Steel)

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

PLANT FOUNDATION SECTIONS

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-06	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
06/13	A3	NTS

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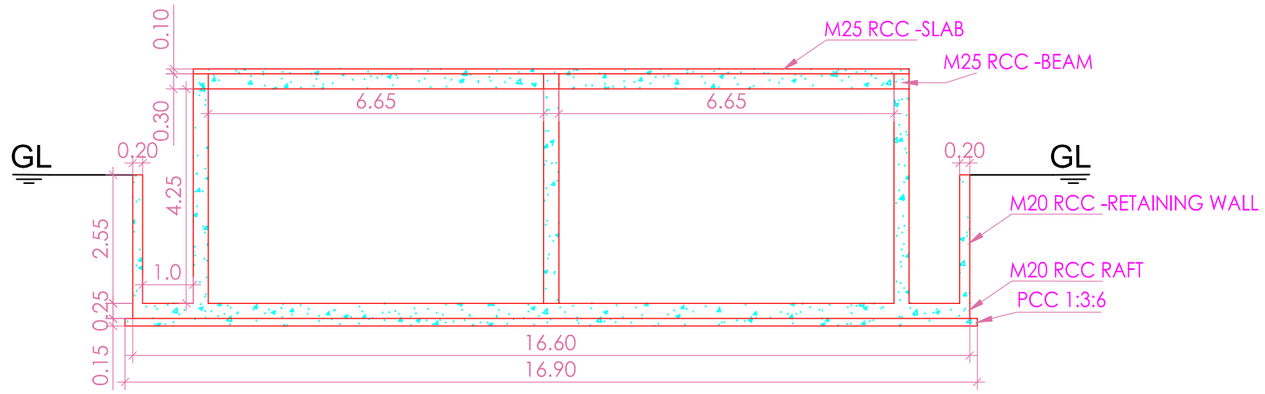

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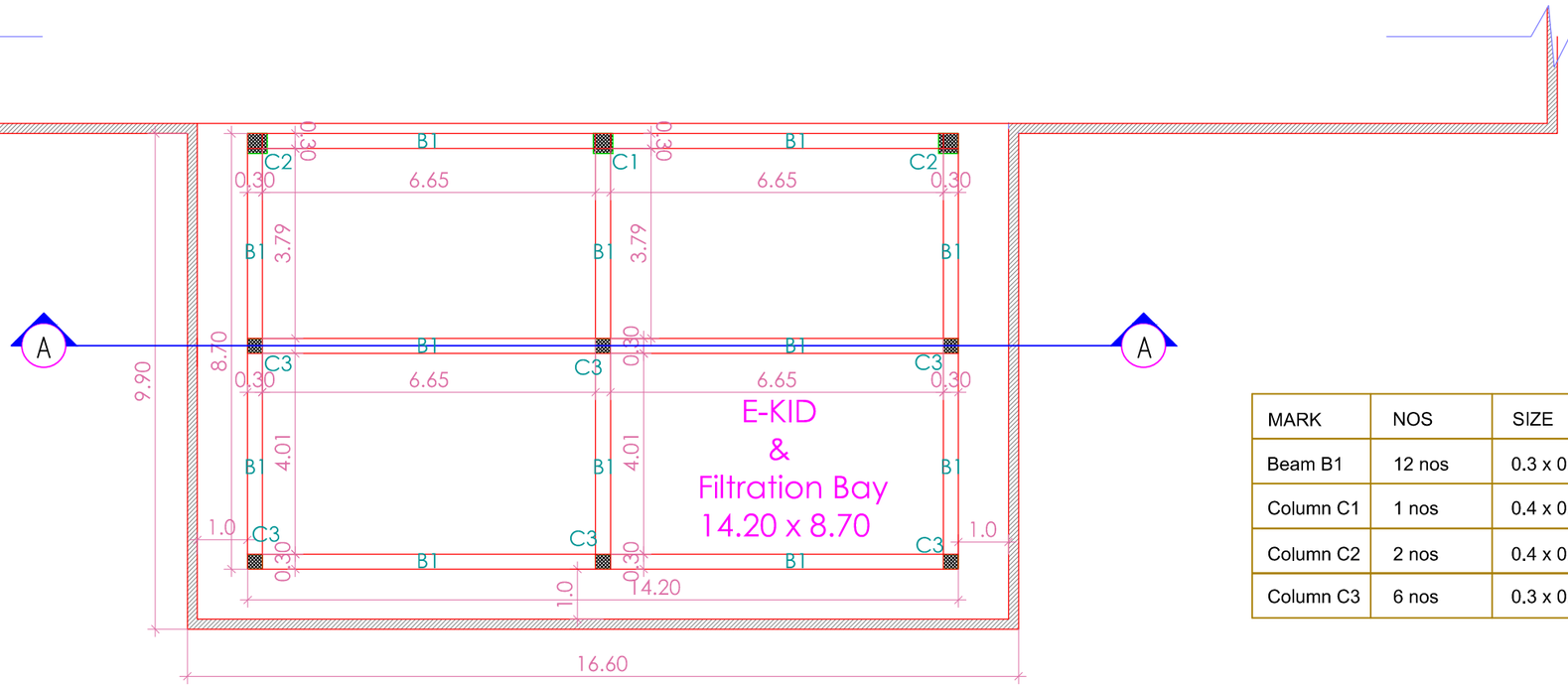

PLAN

MARK	NOS	SIZE
Beam B1	12 nos	0.3 x 0.3
Column C1	1 nos	0.4 x 0.4
Column C2	2 nos	0.4 x 0.4
Column C3	6 nos	0.3 x 0.3

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

E-KID FILTRATION BAY-
PLAN & SECTION

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-07	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
07/13	A3	NTS

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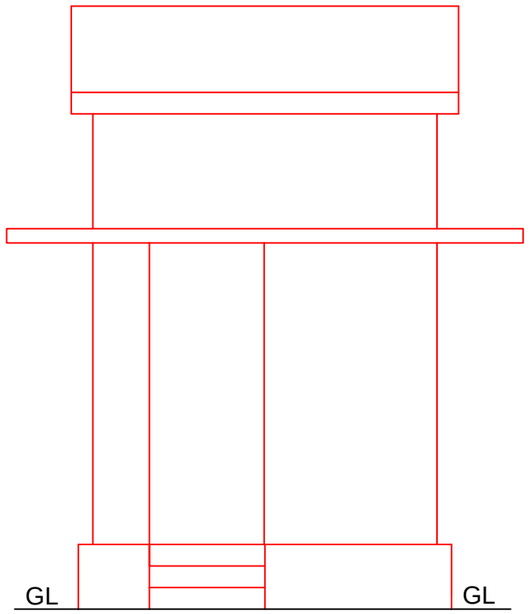

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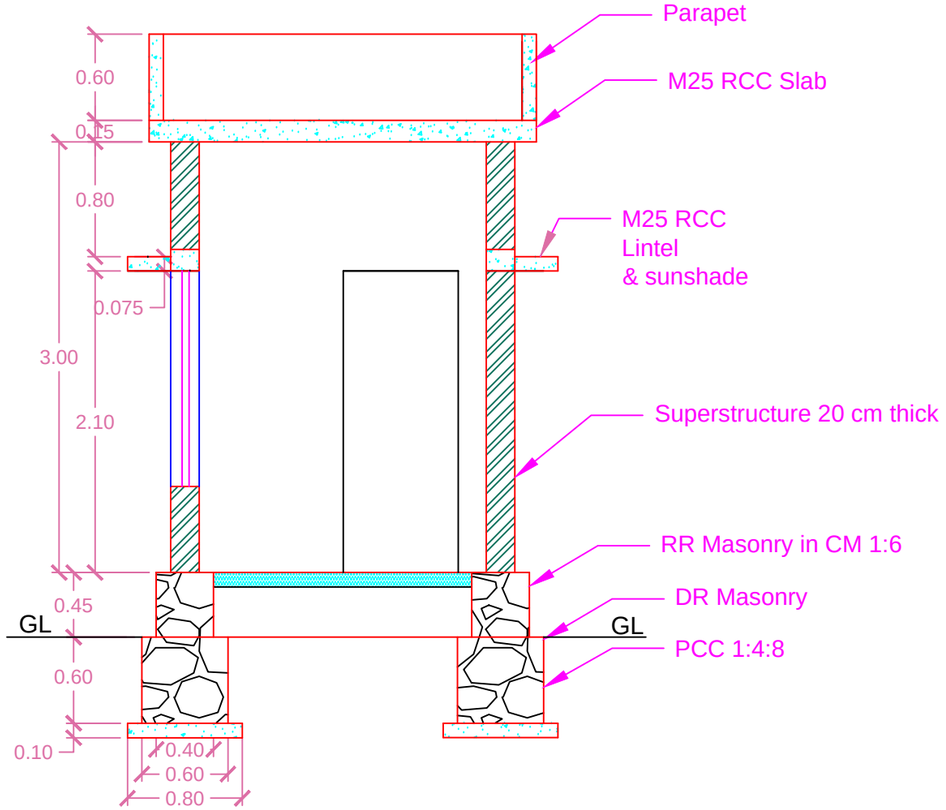

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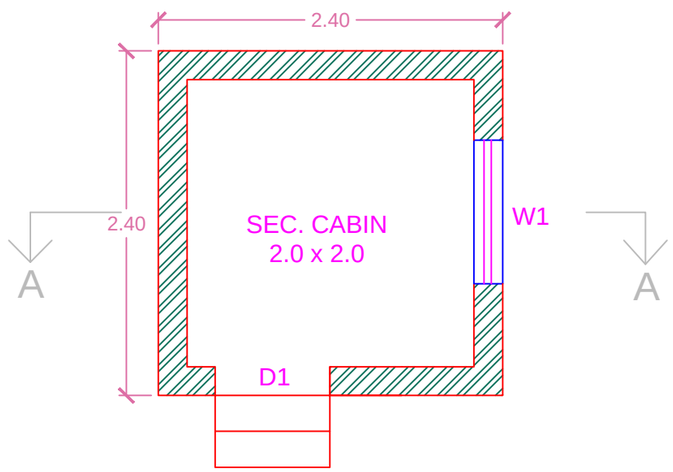

PLAN

MARK	NOS	SIZE
Door D1	1 nos	1.0 x 2.1
Window W1	1 nos	1.5 x 1.5

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

SECURITY CABIN -
PLAN, ELEVATION & SECTION

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-08	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
08/13	A3	NTS

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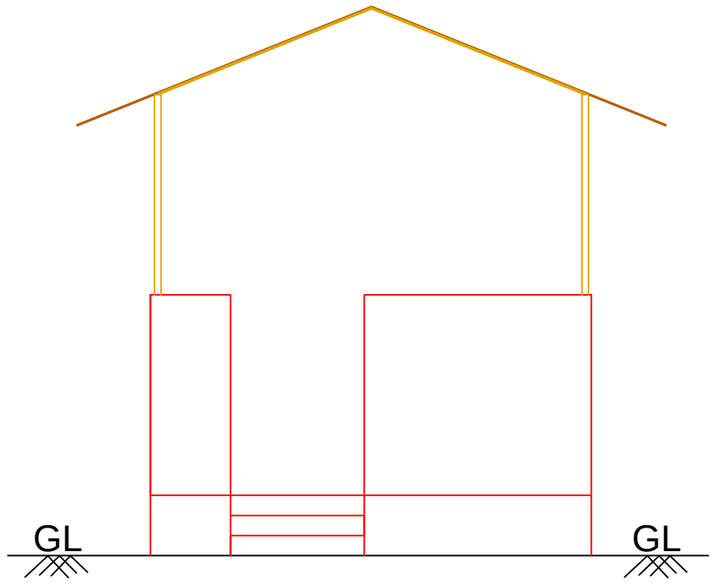

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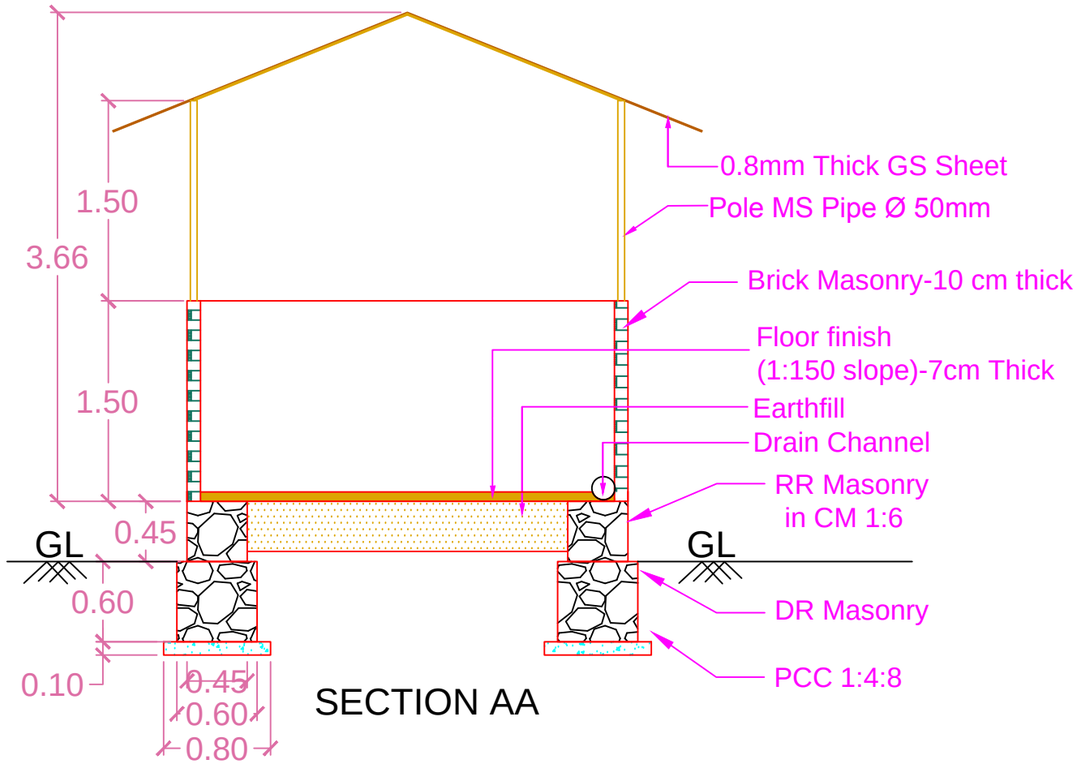

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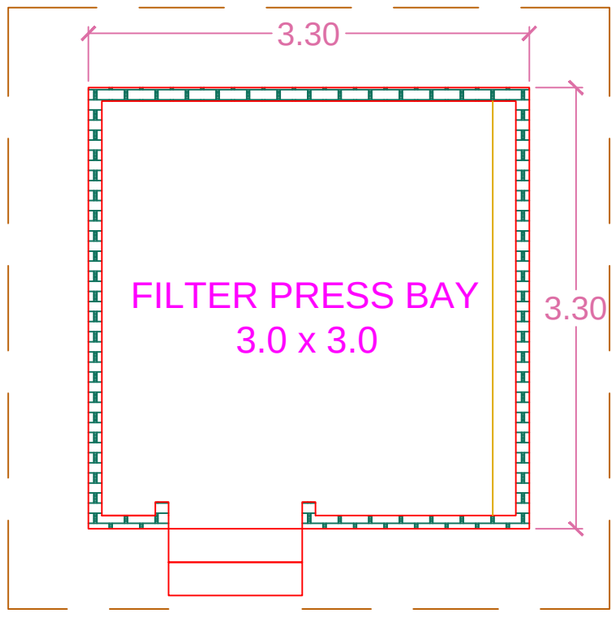

PLAN

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

FILTER PRESS BAY-
PLAN, ELEVATION & SECTION

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-09	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
09/13	A3	NTS

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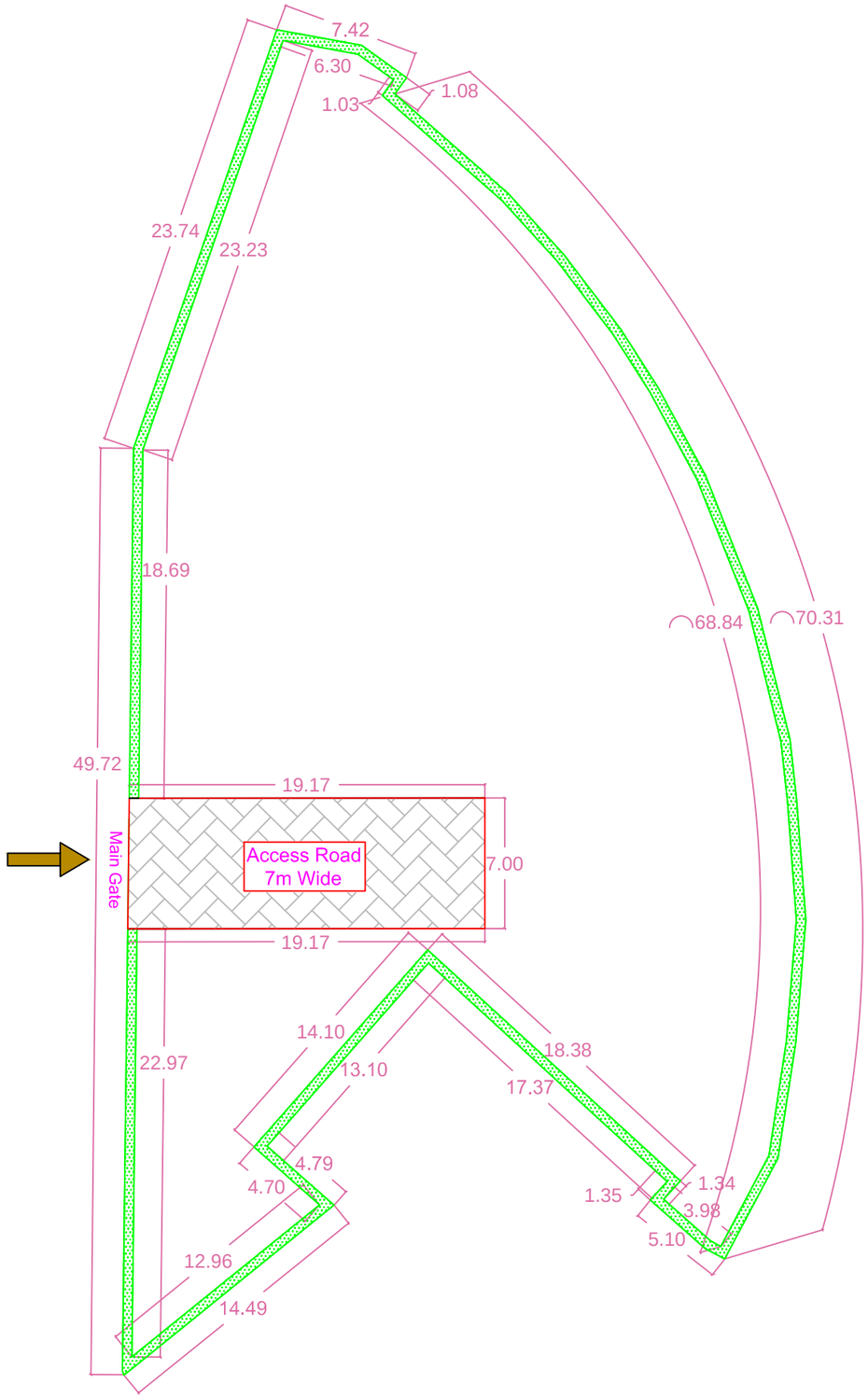

CONCRETE PAVER BLOCK ROADS

GREEN BELT AREA

AREA OF ROAD	= 133.902 Sqm
AREA OF GREEN BELT	= 99.782 Sqm

N

W E

S

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

01. AREA OF ROAD = 133.90 Sqm

02. AREA OF GREEN BELT = 99.78 Sqm

CLIENT

CMMU, AMRUT MISSION KOZHIKODE

CONSULTANT

RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
ROAD	
GLS TANK	
SCREEN	
WINDOW / VENTILATOR	
GRASS	
SHRUBS / HERBS	
VERTICAL SCREEN	
DIMENSION LINE	
CONCRETE STRUCTURE	
GLS STRUCTURE	
LANDSCAPE STRUCTURE	

DRAWING TITLE

GENERAL ARRANGEMENT OF INTERNAL ROAD & GREEN BELT

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-10	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
10/13	A3	NTS

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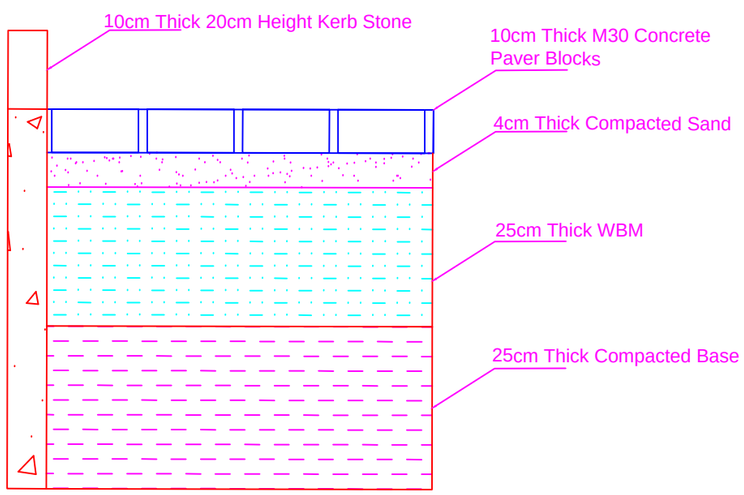
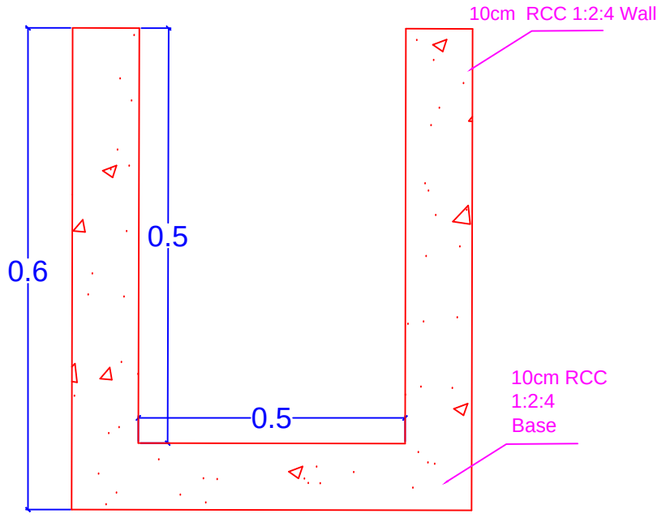


ROAD SECTION IN DETAIL



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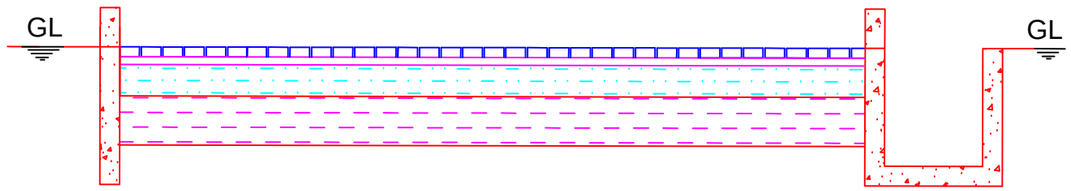

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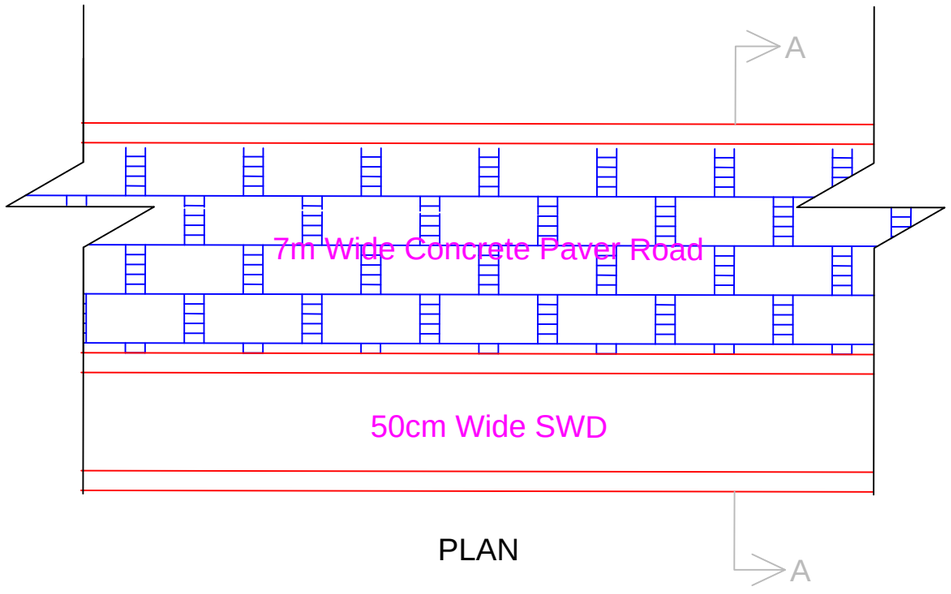

PLAN

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF INTERNAL ROADS, WALK WAYS AND STORM WATER DRAINS

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-C-11	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
11/13	A3	NTS

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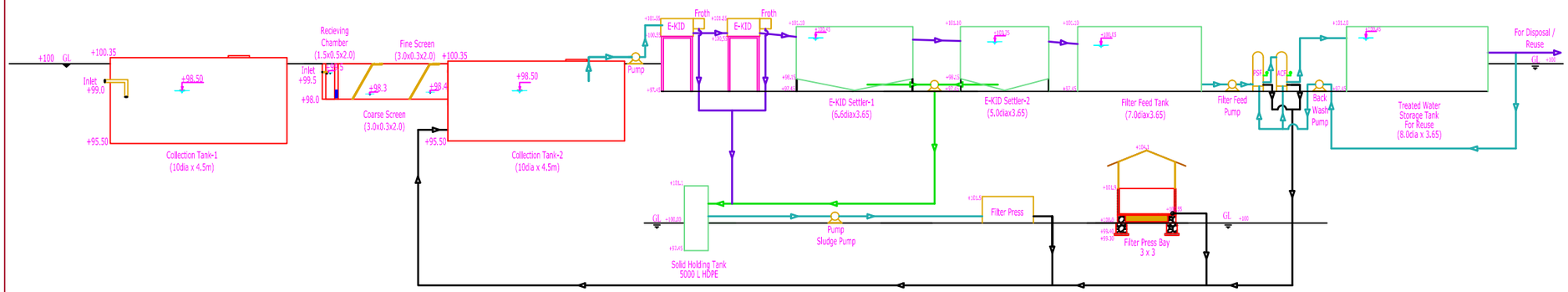
HYDRAULIC FLOW DIAGRAM



NOTES

01. ALL DIMENSIONS ARE IN METERS UNTIL UNLESS IT IS SPECIALLY MENTIONED
02. ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED
03. THICKENESS OF PCC SHALL BE TAKEN AS 10CM IF NOT MENTIONED SEPERATE

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

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Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING
GLS STRUCTURES	
CONCRETE STRUCTURES	
MECHANICAL/STEEL ELEMENTS	
MEZZANINE SUPPORTNG STRUCTURE	
PUMP	
GRAVITY FLOW LINE 1	
GRAVITY FLOW LINE 2	
UNDER FLOW PUMP LINE	
PUMPING LINE	
FLOW DIRECTION	
LIQUID DEPTH	

DRAWING TITLE

HYDRAULIC FLOW DIAGRAM

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-M-01	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
12/13	A3	NTS

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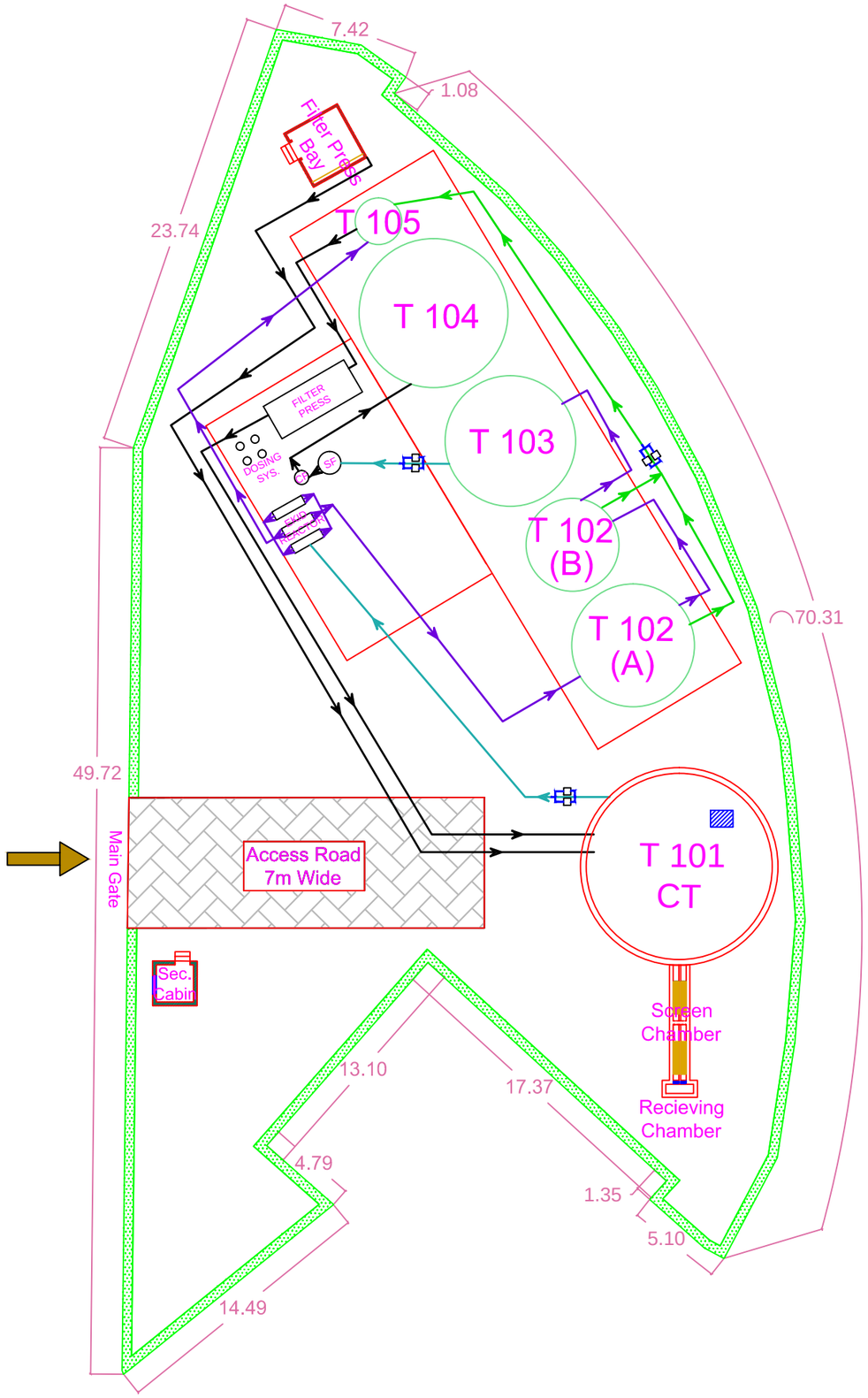
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT



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NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

CLIENT	CONSULTANT
CMMU, AMRUT MISSION KOZHIKODE	RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
ROAD	
GLS TANK	
SCREEN	
WINDOW / VENTILATOR	
GRASS	
SHRUBS / HERBS	
VERTICAL SCREEN	
PUMP	
CONCRETE STRUCTURE	
GLS STRUCTURE	
LANDSCAPE STRUCTURE	

DRAWING TITLE

PIPING & INSTRUMENTATION DIAGRAM (P&I LAYOUT)

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-M-02	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
13/13	A3	NTS

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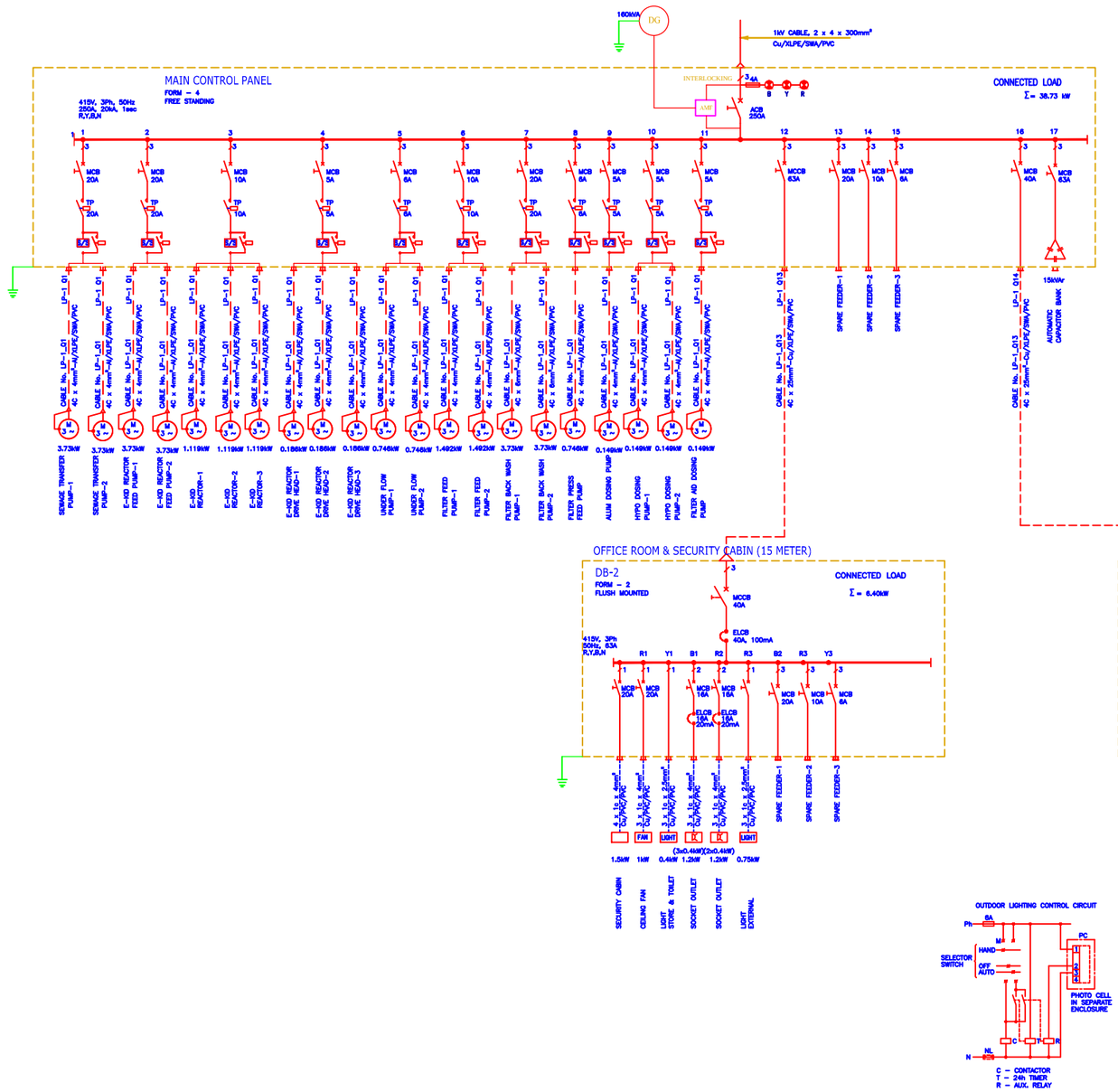
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT



LEGEND

DESCRIPTION	SYMBOL
"n" POLE	
SURGE (LIGHTNING) ARRESTOR	
11kV D.O. FUSE UNIT	
TP ISOLATOR SWITCH	
OVERHEAD LINE	
CABLE	
FUSE	
TRANSFORMER	
DISTRIBUTION BOARD	
KILOWATT HOUR METER	
MCCB / MCB THERMAL OVERLOAD AND INSTANTANEOUS MAGNETIC TRIP	
ELCB (EARTH LICKAGE CB)	
CONTACTOR	
3Ph A.C. MOTOR	
O/L RELAY	
PHASE INDICATION LAMP	
PUSH BUTTON	
FIGURE INDICATES NUMBER OF WIRES	
CABLE SEALING END	
CABLE GLAND	
AUTOMATIC FAILURE UNIT	
DIESEL GENERATOR	
EARTHING	

NOTES

01. THE LINE DIAGRAM IS PREPARED BASED ON THE OVERALL REQUIREMENT OF THE PLANT
02. CONTRACTOR SHALL PREPARE THE DETAILED DESIGN FOR EACH ITEM SEPERATE
03. ALL THE WIRES MENTIONED IN THIS DRAWING IS BASED ON THE RELEVANT IEC
4. THIS DRAWING IS PREPARED SOLELY FOR THE PREPARATION OF THE DETAILED ESTIMATE AND BOQ FOR THE ELECTRICAL ITEMS.

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER–2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

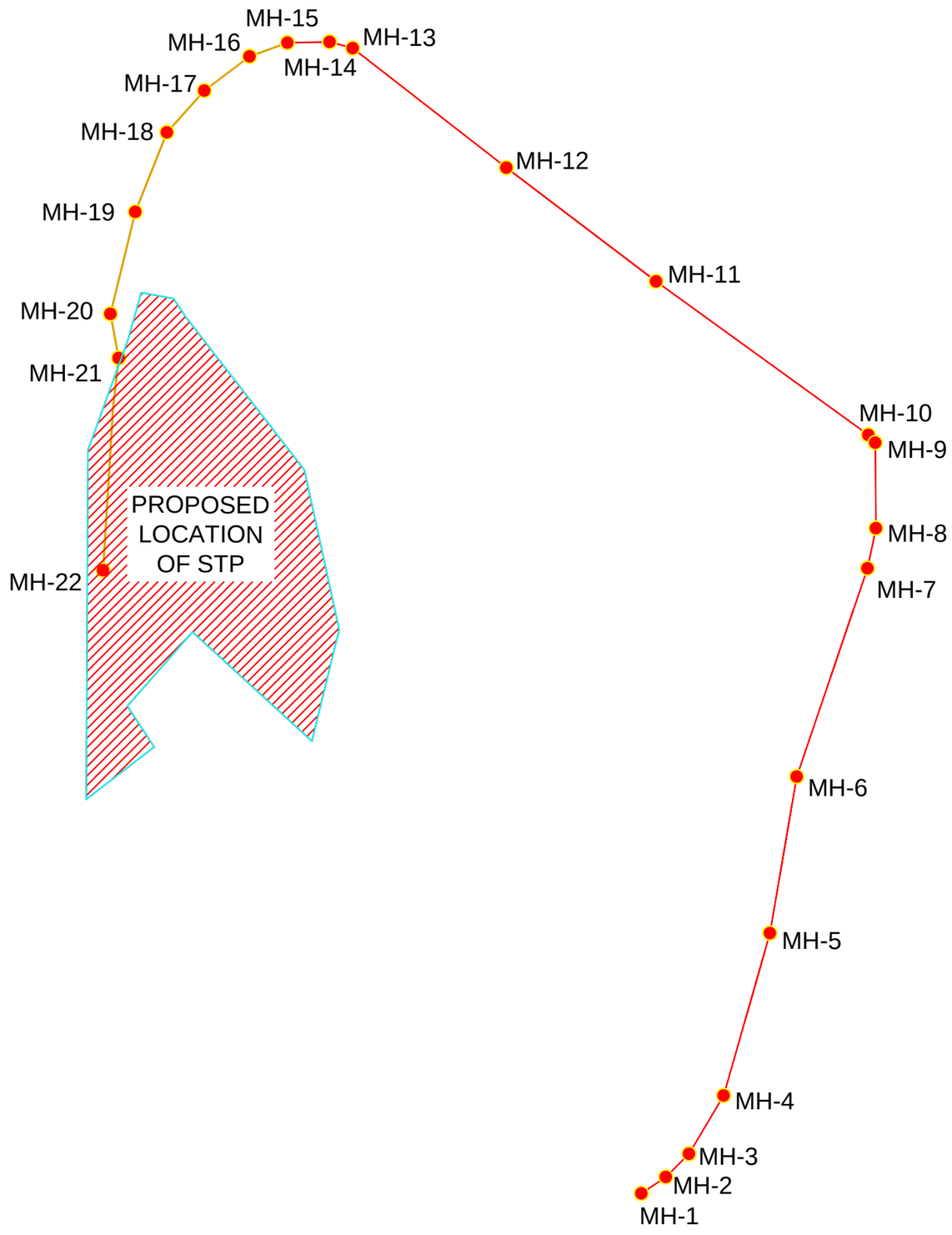
DRAWING TITLE

SINGLE LINE DIAGRAM–
POWER DISTRIBUTION

Drawing No.	Rev.
AMT–RAM–STP–KMC(2)–E–01	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
01/01	A3	NTS



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NOTES

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02. ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED
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4. ALL PIPES ARE MADE OF uPVC

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

CLIENT

CMMU, AMRUT MISSION KOZHIKODE

CONSULTANT

RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
CONVEYENCE	
DI PIPE LINE	
MANHOLE	
PROPPOSED SITE	
MANHOLE NUMBER	MH-1 TO MH-22
PLOT BOUNDARY	

DRAWING TITLE

GENERAL ARRANGEMENT OF SEWER LINE CONVEYENCE SYSTEM - WITHOUT DETAILING

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-NTW-01	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
01/05	A3	NTS

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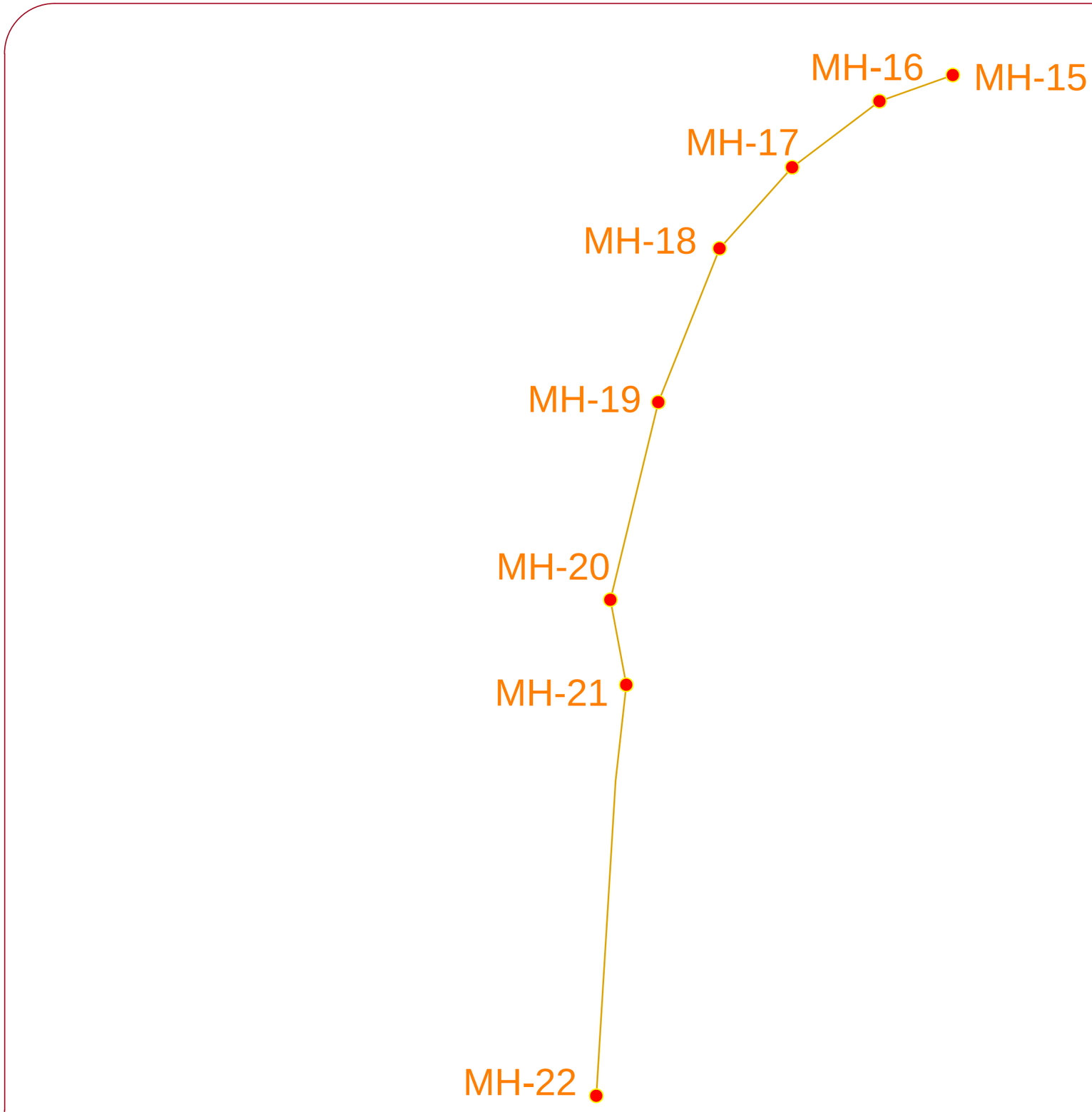

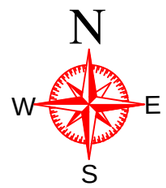

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PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

CLIENT	CONSULTANT
CMMU, AMRUT MISSION KOZHIKODE	RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
CONVEYENCE	
DI PIPE LINE	
MANHOLE	
PROPPOSED SITE	
MANHOLE NUMBER	MH-1 TO MH-22
PLOT BOUNDARY	

DRAWING TITLE

DI PIPE DRAWING BRANCH 1

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-NTW-02	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
02/05	A3	NTS

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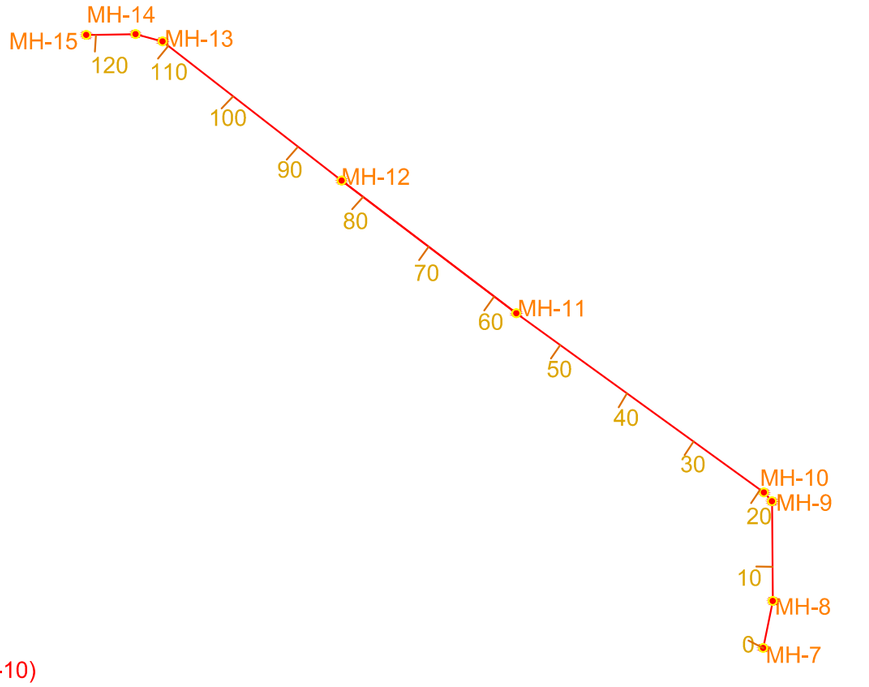

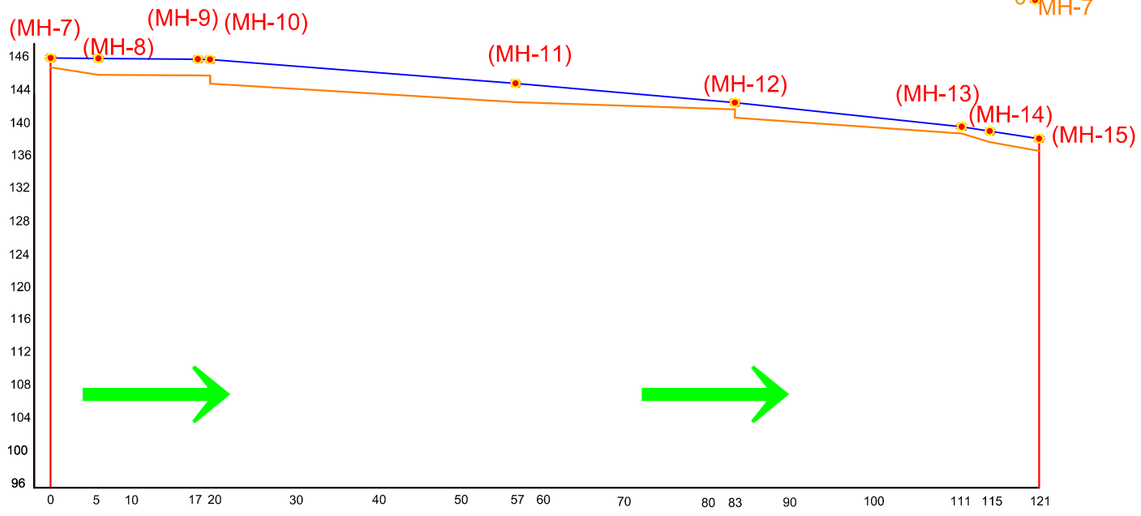

	(MH-7)	(MH-8)	(MH-9)	(MH-10)	(MH-11)	(MH-12)	(MH-13)	(MH-14)	(MH-15)
GL (m)	498.26	498.20	498.17	498.12	498.06	497.24	496.46	495.68	495.16	494.86	493.99	493.11	492.83	494.56	497.12	489.91	489.35	488.45
PIPE IL (m)	497.11	496.22	496.19	496.14	496.13	495.21	494.34	493.46	492.89	492.78	492.44	492.11	492.00	493.73	496.30	489.08	488.04	486.97
Trench Depth (m)	1.15	1.98	1.98	1.98	1.93	2.03	2.12	2.22	2.27	2.08	1.55	1.00	0.83	0.83	0.82	0.83	1.31	1.48

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

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Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING
GROUND LEVEL (GL)	
INVERT LEVEL (IL)	
FLOW DIRECTION	
MANHOLE (MH)	

REMARKS

DRAWING TITLE

LONGITUDINAL SECTION OF SEWER / CONVEYENCE LINE

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-NTW-03	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
03/05	A3	NTS

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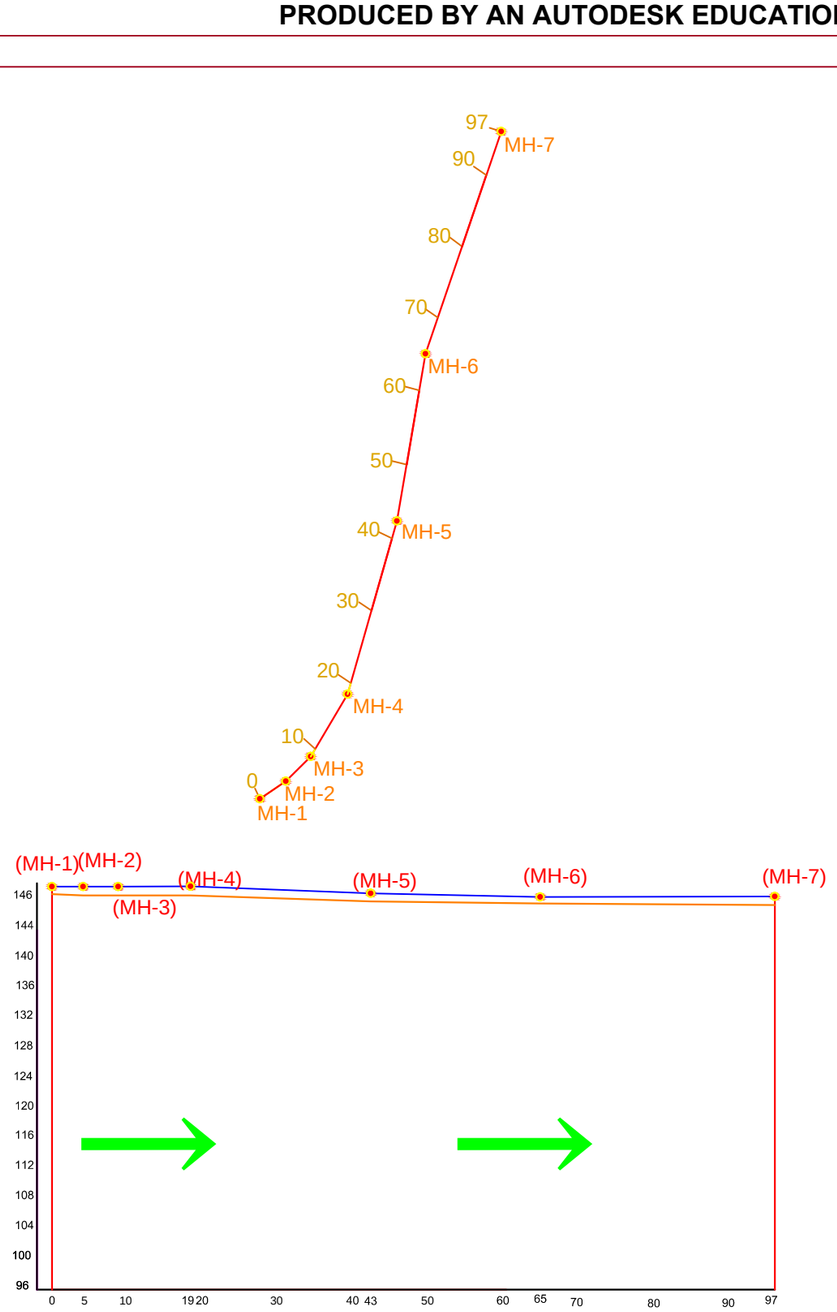

	(MH-1)	(MH-2)	(MH-3)	(MH-4)		(MH-5)		(MH-6)			(MH-7)
GL (m)	499.55	499.65	499.55	499.59 499.53	499.15	498.77 498.68	498.51	498.30	498.20	498.21	498.23	498.25	498.26
PIPE IL (m)	498.55	498.50	498.46	498.40 498.35	498.02	497.68 497.60	497.51	497.38	497.32	497.29	497.22	497.15	497.11
Trench Depth (m)	1.00	1.15	1.09	1.19 1.18	1.13	1.09 1.08	1.00	0.92	0.88	0.92	1.01	1.10	1.15

NOTES

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4. ALL PIPES ARE MADE OF uPVC

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

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Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING
GROUND LEVEL (GL)	
INVERT LEVEL (IL)	
FLOW DIRECTION	
MANHOLE (MH)	

REMARKS

DRAWING TITLE

LONGITUDINAL SECTION OF SEWER / CONVEYENCE LINE

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-NTW-04	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
04/05	A3	NTS

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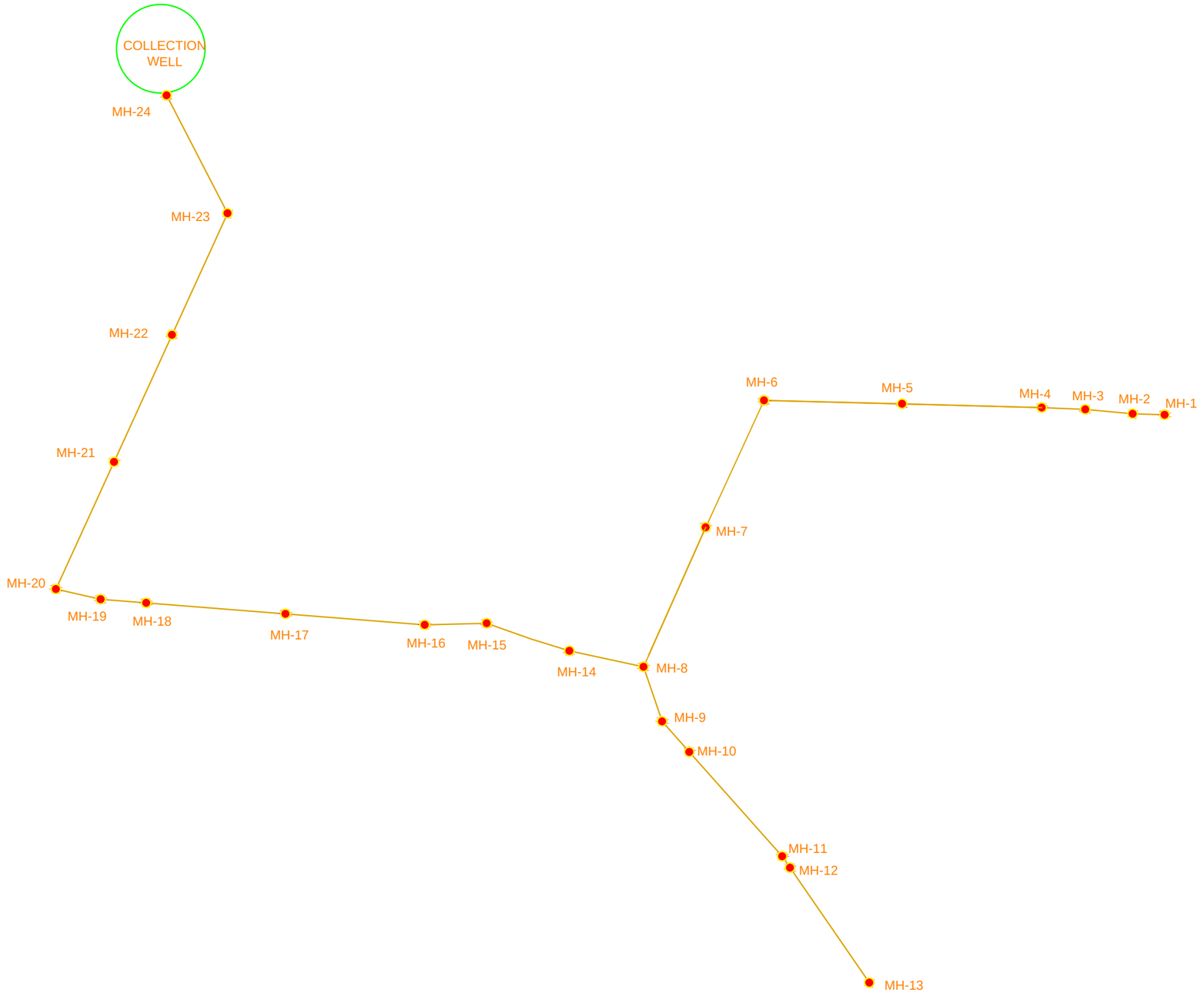

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NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

CLIENT

CMMU, AMRUT MISSION KOZHIKODE

CONSULTANT

RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
CONVEYENCE	
DI PIPE LINE	
MANHOLE	
PROPPOSED SITE	
MANHOLE NUMBER	MH-1 TO MH-22
PLOT BOUNDARY	

DRAWING TITLE

DI PIPE DRAWING BRANCH 2

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-NTW-05	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
05/05	A3	NTS

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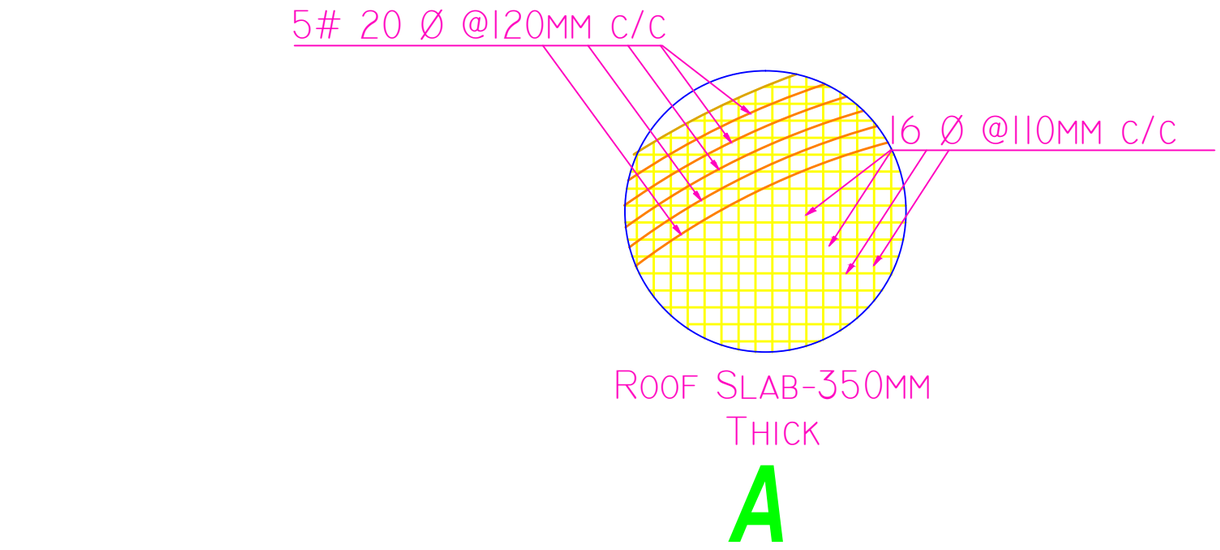

PLAN

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF COLLECTION TANK-ROOF SLAB

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-01	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
01/08	A3	NTS

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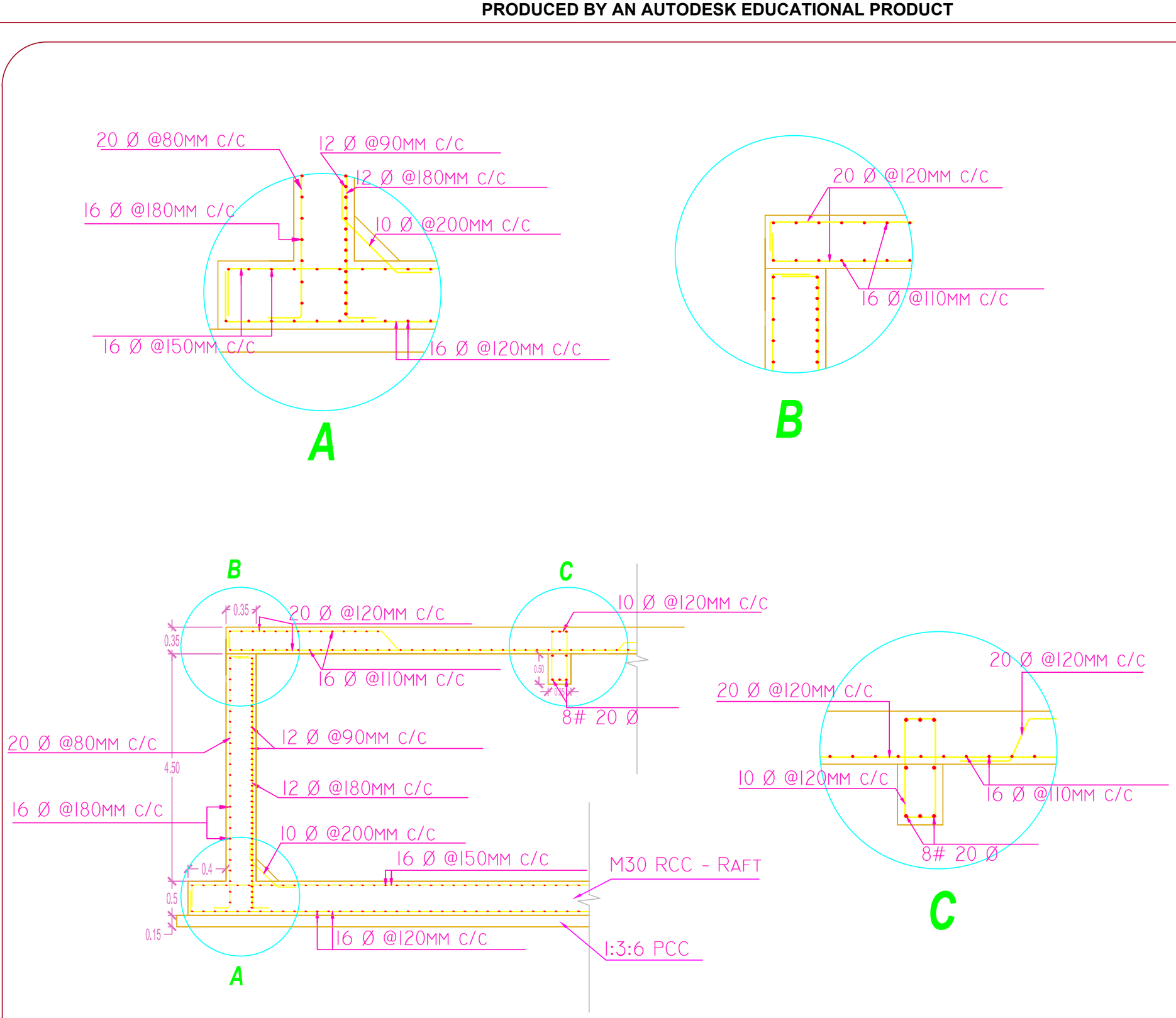

NOTES

01. ALL THE PCC WHEREVER MENTIONED IN THE STRUCTURAL/CIVIL DRAWING SHALL BE OF PCC 1:3:6.
02. ALL THE REBARS USED FOR THE STP COMPONENTS HAVING DIRECT CONTACT WITH EFFLUENT SHALL BE OF Fe415 EPOXY COATED HYSD BARS
03. ALL THE RCC WORKS OF STP COMPONENTS WHERE HAVING DIRECT CONTACT WITH EFFLUENT SHALL BE OF M30 CONCRETE WITH SRC CEMENT. MINIMUM OF CEMENT SHALL BE 350kg/m3
04. EFFECTIVE COVER OF ALL WATER TANKS SHALL BE 50mm
05. NOMINAL COVER FOR ALL STRUCTURAL COMPONENTS SHALL BE AS PER IS 456:2000.
06. THE ENTIRE WATER TANK INSIDE SHALL BE PAINTED WITH TWO COATS OF WATER PROOFING CEMENT PAINT OF APPROVED QUALITY.

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF COLLECTION TANK-SECTION

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-02	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
02/08	A3	NTS

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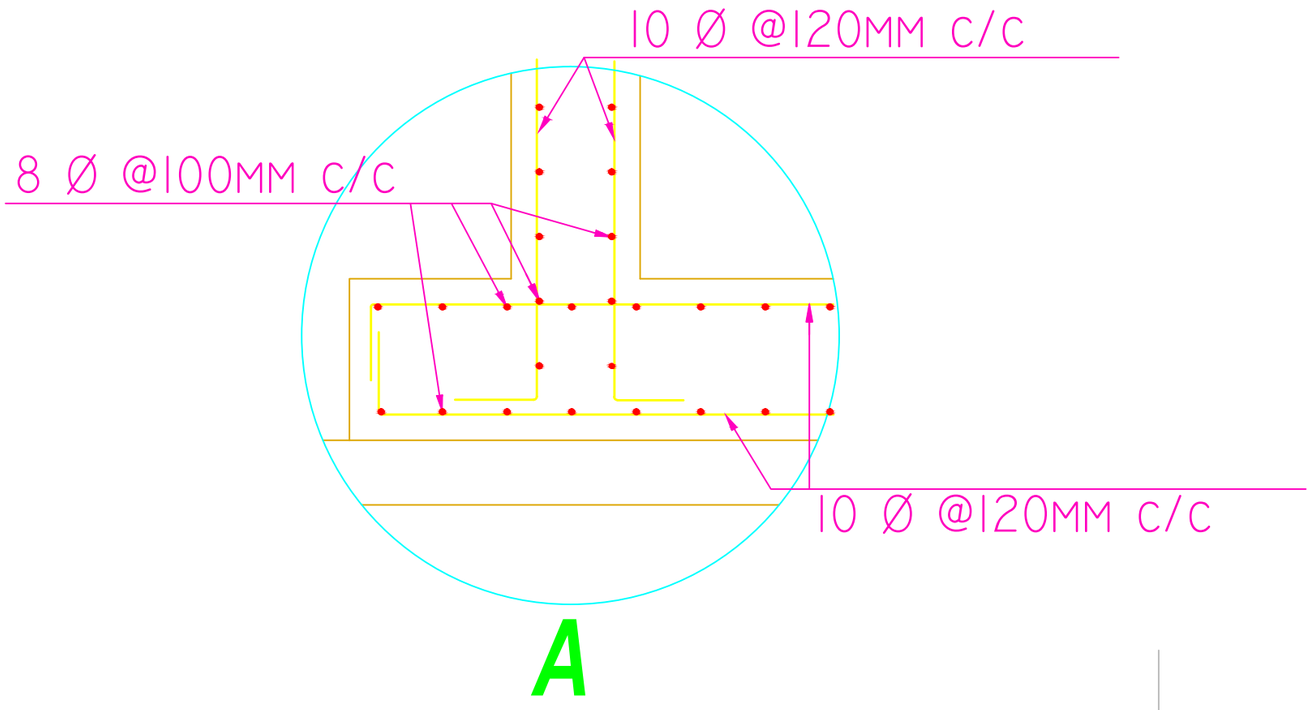

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF RECIEVING & SCREEN CHAMBERS

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-03	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
03/08	A3	NTS

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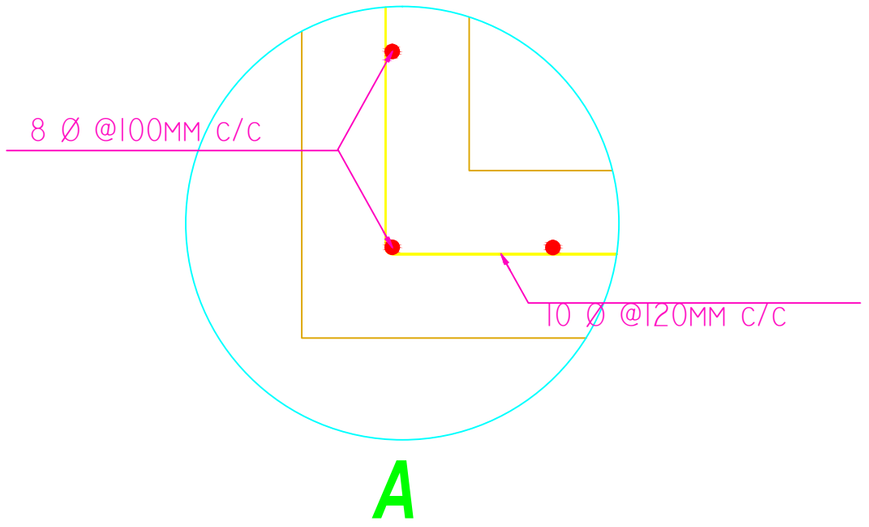

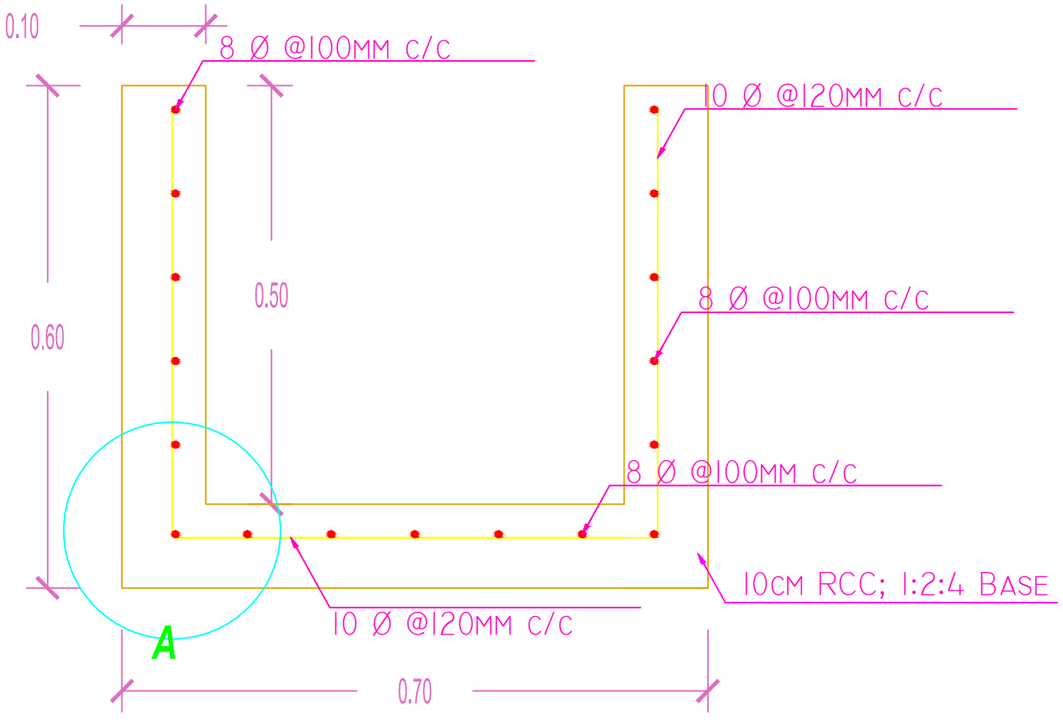

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF STORM WATER DRAIN

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-04	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
04/08	A3	NTS

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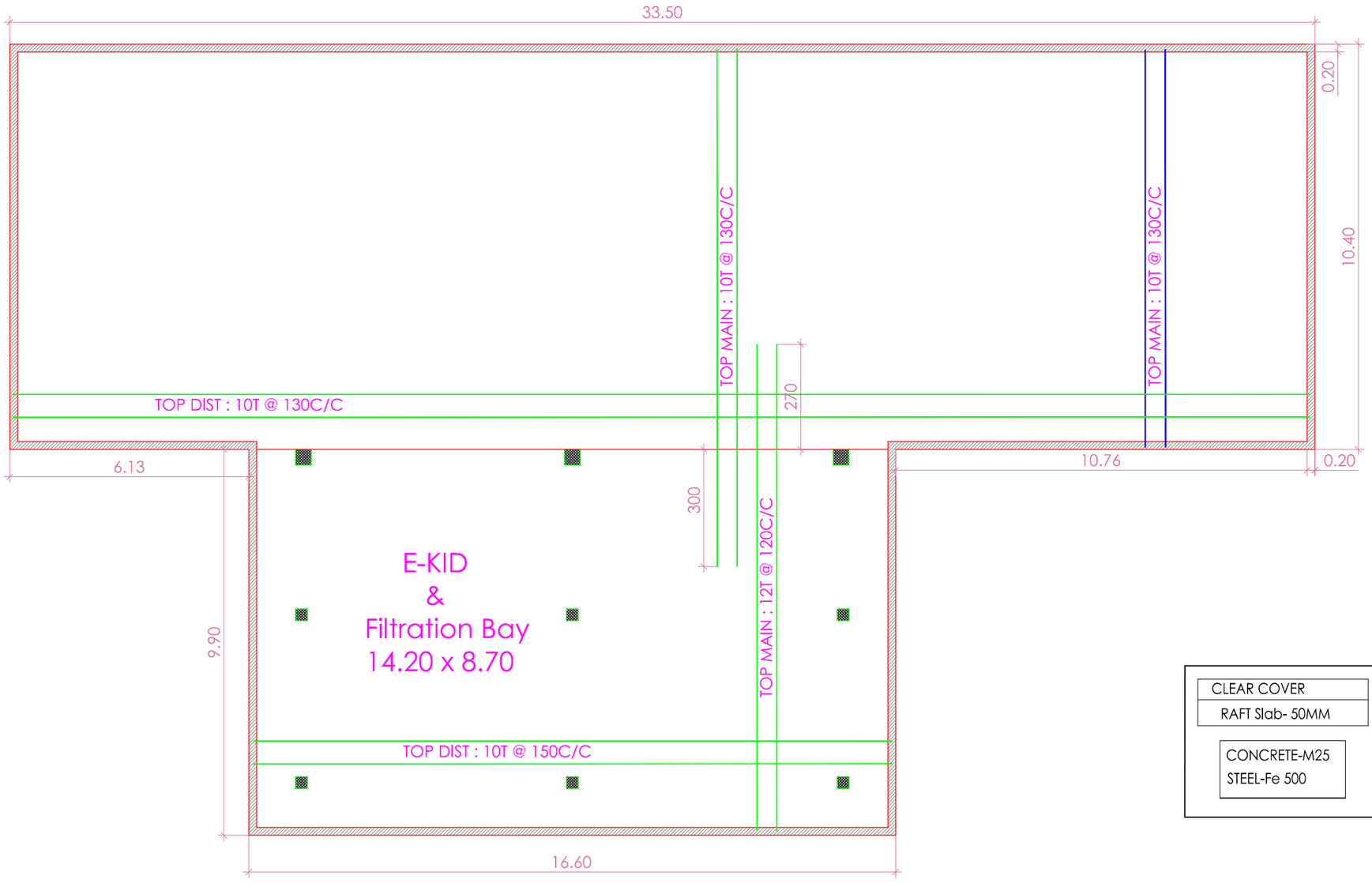

TOP STEEL

SLAB THICKNESS: 25cm

CLEAR COVER
RAFT Slab- 50MM
CONCRETE-M25 STEEL-Fe 500

NOTES

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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF RAFT SLAB - TOP STEEL ARRANGEMENT

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-05	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
05/08	A3	NTS

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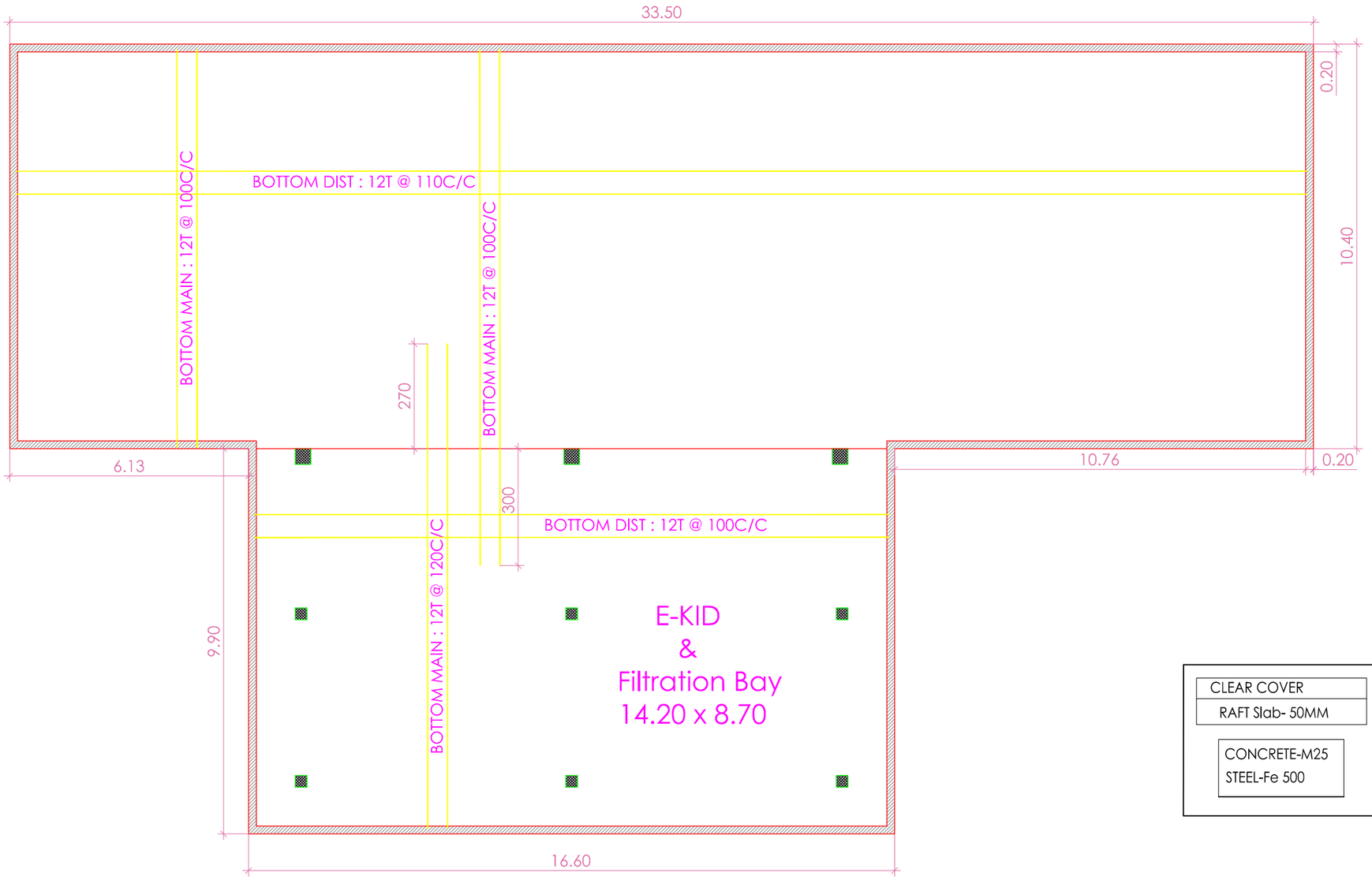

CLEAR COVER
RAFT Slab- 50MM
CONCRETE-M25 STEEL-Fe 500

BOTTOM STEEL

SLAB THICKNESS: 25cm

NOTES

01. ALL DIMENSIONS ARE IN METERS UNTIL UNLESS IT IS SPECIALLY MENTIONED
02. ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED
03. THICKENESS OF PCC SHALL BE TAKEN AS 10CM IF NOT MENTIONED SEPERATE

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF RAFT SLAB-BOTTOM STEEL ARRANGEMENT

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-06	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
06/08	A3	NTS

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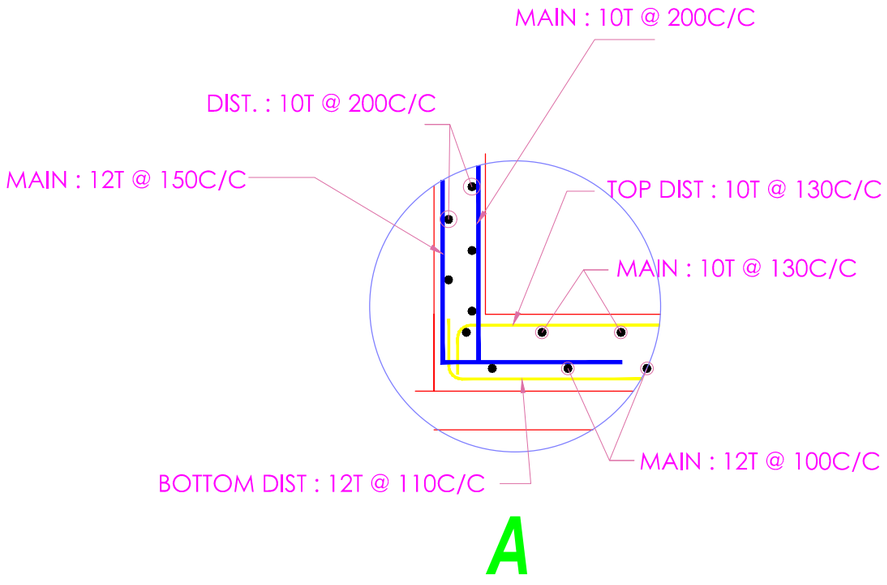

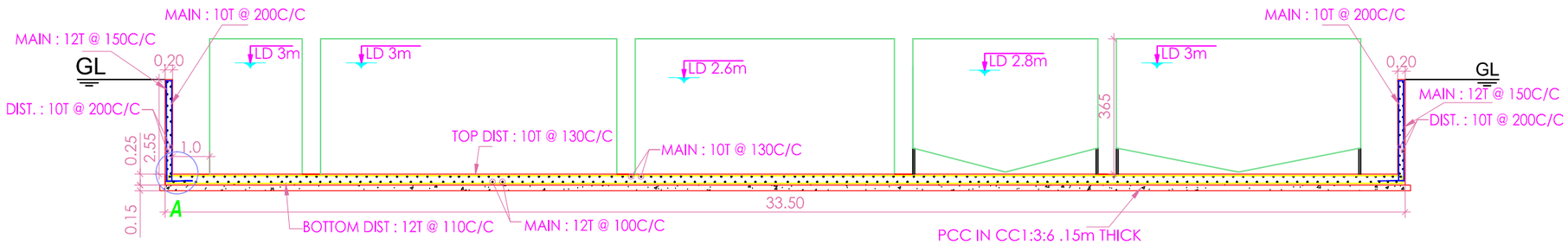

CLEAR COVER
RAFT Slab- 50MM
CONCRETE-M25
STEEL-Fe 500

NOTES

01. ALL DIMENSIONS ARE IN METERS UNTIL UNLESS IT IS SPECIALLY MENTIONED
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PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

LEGEND	MARKING

REMARKS

DRAWING TITLE

STRUCTURAL DETAILING OF FOUNDATION FOR PLANT & E-KID

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-07	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
07/08	A3	NTS

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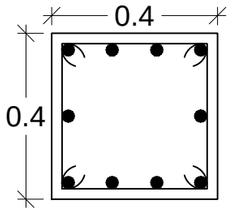
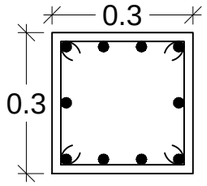
COLUMN - C1



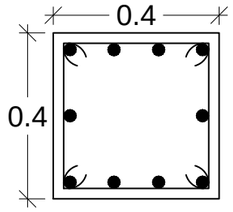
Reinf. : 12 # 25 Ø
Ties : 10 @ 150mm C/C

COLUMN - C3



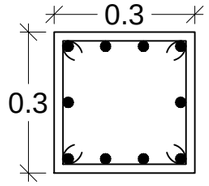
Reinf. : 8 # 16 Ø
Ties : 8 @ 150mm C/C

COLUMN - C2



Reinf. : 12 # 25 Ø
Ties : 10 @ 150mm C/C

BEAM - B1



Reinf. : 8 # 16 Ø
Ties : 8 @ 150mm C/C

NOTE:-

1) Clear cover to main reinforcement
   a) Footing - 50 mm, Side - 75mm
   b) Column - 40 mm
   c) Beam - 25 mm
   d) Slab - 20 mm
2) Lap length - 47 times dia of bars
3) Development length, Ld - 47 times dia of bars
4) Development length in compressions,
Ldc - 38 times dia of bars
5) Sizes of Footing
   (a) F1- 3.0mx3.0mx0.50m
   (b) F2- 2.0mx2.0mx0.45m
   (c) F3- 1.50mx1.50mx0.45m

NOTES

01. ALL THE PCC WHEREVER MENTIONED IN THE STRUCTURAL/CIVIL DRAWING SHALL BE OF PCC 1:3:6.
02. ALL THE REBARS USED FOR THE STP COMPONENTS HAVING DIRECT CONTACT WITH EFFLUENT SHALL BE OF Fe415 EPOXY COATED HYSD BARS
03. ALL THE RCC WORKS OF STP COMPONENTS WHERE HAVING DIRECT CONTACT WITH EFFLUENT SHALL BE OF M30 CONCRETE WITH SRC CEMENT. MINIMUM OF CEMENT SHALL BE 350kg/m3
04. EFFECTIVE COVER OF ALL WATER TANKS SHALL BE 50mm
05. NOMINAL COVER FOR ALL STRUCTURAL COMPONENTS SHALL BE AS PER IS 456:2000.
06. THE ENTIRE WATER TANK INSIDE SHALL BE PAINTED WITH TWO COATS OF WATER PROOFING CEMENT PAINT OF APPROVED QUALITY.

FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

CLIENT

Atal Mission for Rejuvenation and Urban Transformation

CMMU, AMRUT MISSION
KOZHIKODE

CONSULTANT

Ram Biologicals

RAM BIOLOGICALS
KOZHIKODE

REMARKS

1. Dimensions are in meters.
2. Do not scale out the drawing.
3. Columns, Beams sizes as per structure.

Grade of Concrete: M30
Grade of Steel: Fe 500

DRAWING TITLE

STRUCTURAL DETAILING OF FILTRATION BAY - COLUMNS & BEAMS

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-S-08	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
08/08	A3	NTS

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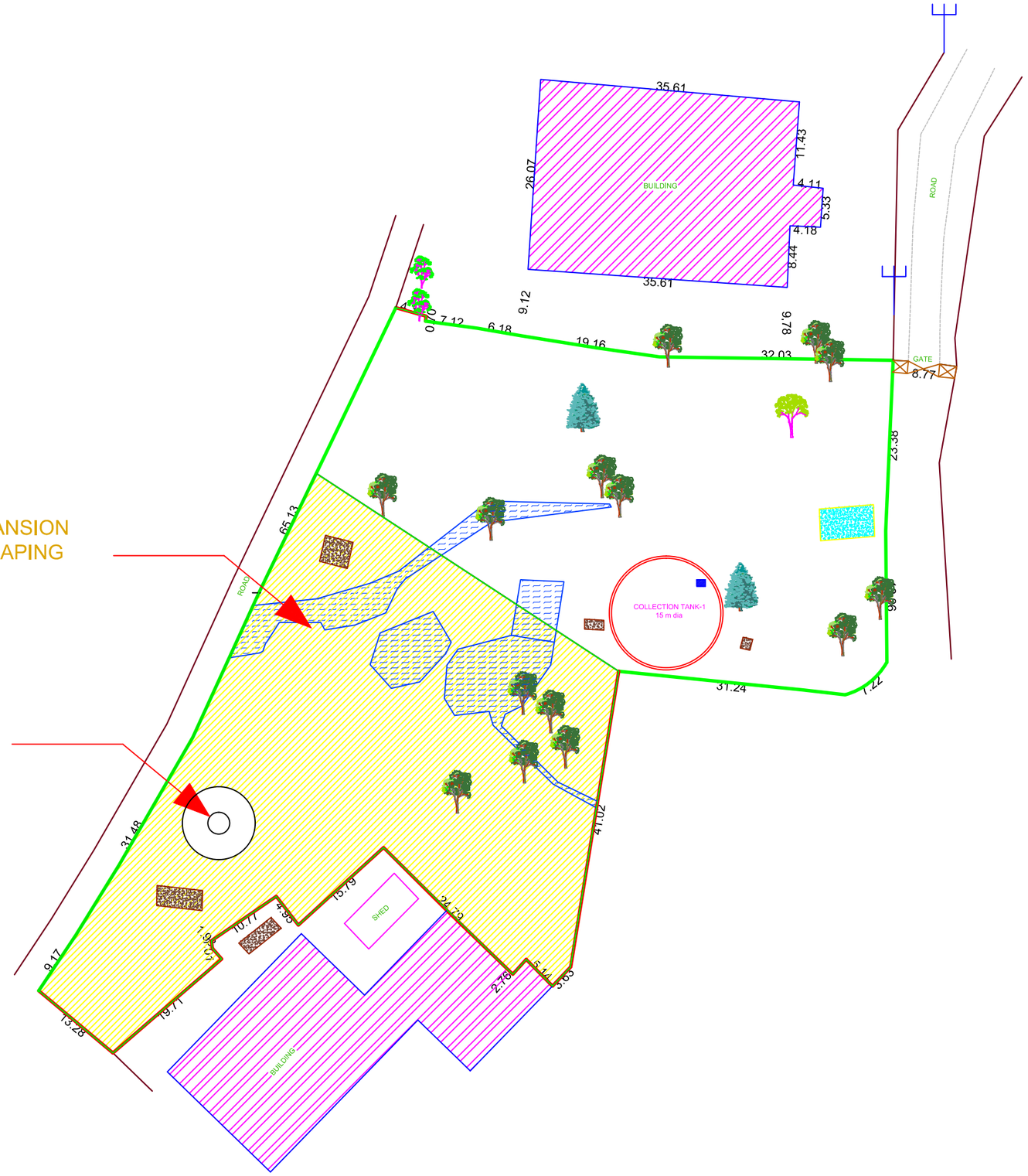

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NOTES

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02. ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED
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FOR ESTIMATION PURPOSE ONLY

PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

CLIENT	CONSULTANT
CMMU, AMRUT MISSION KOZHIKODE	RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
EXISTING BUILDINGS	
WATER BODIES	
SEPTIC TANK	
ELECTRIC POST	
PALM	
TEAK	
OTHER TREES	

DRAWING TITLE

LOCATION OF COLLECTION TANK-1: WITH DETAILING

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-SU-01	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
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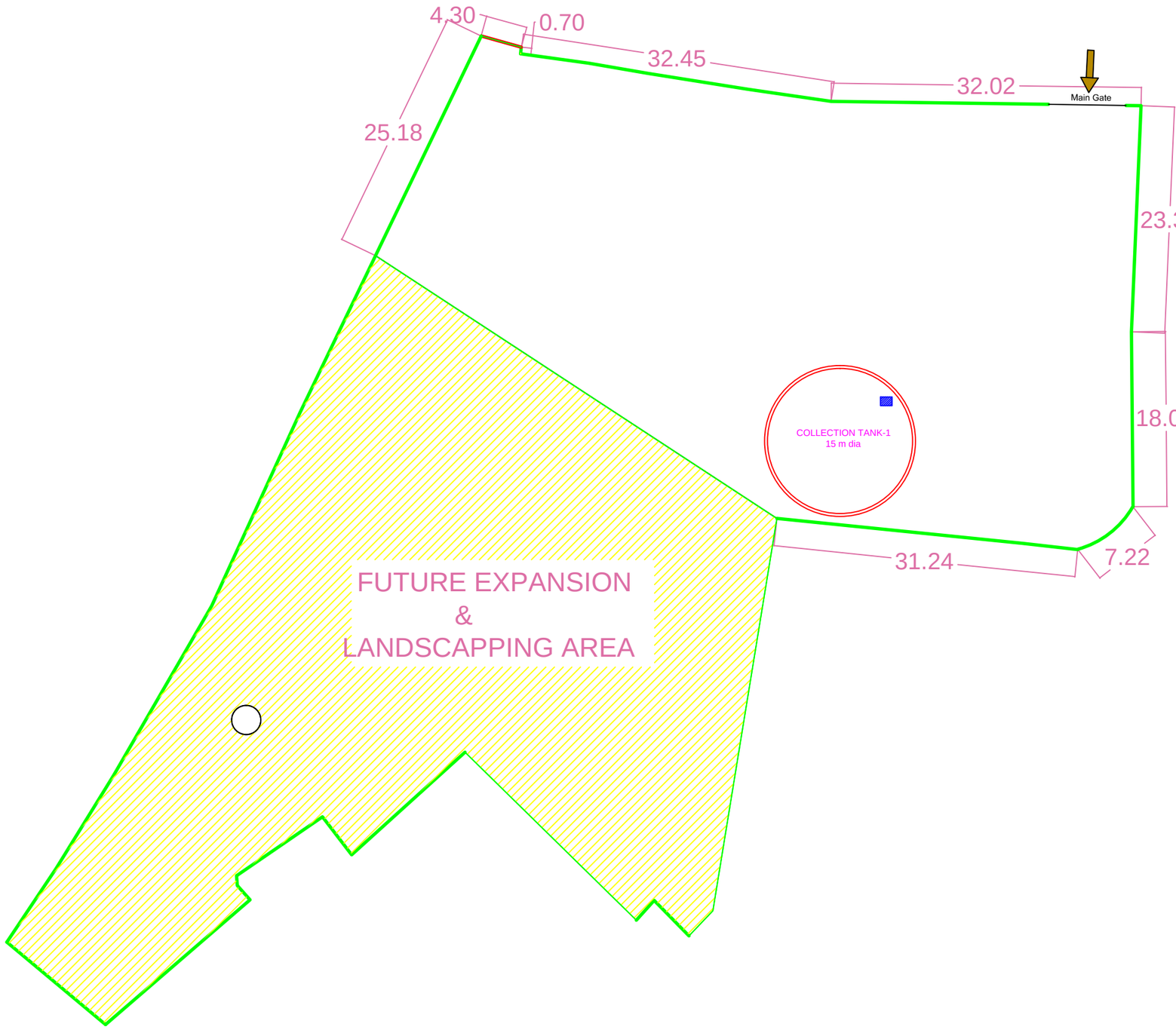

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NOTES

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PROJECT TITLE

CONSTRUCTION OF 1 MLD SEWAGE TREATMENT PLANT AT KOZHIKODE MEDICAL COLLEGE (CLUSTER-2)

REMARKS

CLIENT	CONSULTANT
CMMU, AMRUT MISSION KOZHIKODE	RAM BIOLOGICALS KOZHIKODE

LEGEND	MARKING
EXISTING BUILDINGS	
WATER BODIES	
SEPTIC TANK	
ELECTRIC POST	
PALM	
TEAK	
OTHER TREES	

DRAWING TITLE

LOCATION OF COLLECTION TANK-1: WITHOUT DETAILING

Drawing No.	Rev.
AMT-RAM-STP-KMC(2)-SU-02	00

Approved By

Drawn By	Checked By	Date
Anagh	Vyshak	05/05/2018
Sheet No.	Sheet Size	Scale
02/02	A3	NTS

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