

Detailed Scope of Work

SYSTEM SPECIFICATIONS

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1. INTENT OF SPECIFICATION

1.1. INTENT OF SPECIFICATION

1.1.1. This specification is intended to cover design, residual, engineering, manufacture, test and inspection at works, delivery to site properly packed for transportation, erection, testing, commissioning, performance demonstration at site and handing over to purchaser of **STP, WTP, Rainwater harvesting system and water distribution network** as indicated in the schedule of Requirement and scope of work and as required for reliable and effective Water & Sewage Treatment Plant, Rainwater harvesting system and water distribution network at **NLSIU, Bangalore.**

1.1.2. The specification also includes the supply of erection and commissioning of spares as specified and special tools and tackles.

1.1.3. This specification also makes it obligatory for the contractor for arranging and obtaining necessary clearance / approval from all Local / statutory authorities.

1.1.4. It is not the intent to completely specify all the details of design and construction herein. Nevertheless the equipment and installation shall confirm to high standard of engineering, design, and workmanship in all respect and shall be capable of performing continuous satisfactory operation and acceptable to the purchaser as well as to the various statutory authorities. In case of any violation of the above contract, the purchaser reserves the right to change / reject / modify the equipment / system during detail engineering.

1.1.5. Wherever material or article is specified or described by the name of particular brand, manufacturer or vendor, the specific item mentioned shall be understood as established type function and quality desired. Other manufacturer's product will be considered provided sufficient information is furnished to allow the purchaser to determine that the product proposed is equivalent to that brand.

1.1.6. The entire system shall be designed and engineered by the Bidder based on the guidelines furnished in the specification, various codes / standards. Bidder's experience and also good engineering practice. Items and quantities, which have been furnished in this specification, are tentative and indicative only. During quoting, the Bidder shall vet the above Bill of

Material and may furnish additional items necessary for satisfactory operation of the system.

1.1.7. Supplies and services to be covered under this tender specification and the conditions thereof are detailed in the subsequent sections of the specifications. In case of conflict among various sections, subsections, documents, drawings the same shall be referred to purchaser whose decision shall be final and binding to the Bidder. In all cases, the best advantages will go to the purchaser.

2. PROJECT INFORMATION

S. No.	Details	Value
1	Owner	National Law School of India University
2	Project Name	Supply, Construction, Installation, Testing & Commissioning of STP & WTP
3	Location	University Campus, Bangalore
4	Altitude above AMSL	839.025 m above AMSL at Security Shed near gate zero
5	Occupancy of Building	2545 people (approx.)
6	Working Hours per day	24/7
7	No. of Working Days in a Week	Seasonal operation
8	Building Class	Business (as per the National Building Code of India); School/educational Institutions, with or without boarding facilities(NBC, vol-2,)
9	Minimum Sewage Generation per Day	80% -90% of Total load KL
10	Maximum freshwater requirement pe day	200 KLD
11	Source of water	1. Borewell - 50 KLD 2. Borewell -150 KLD
12	Usage of Treated water	Domestic purposes such as handwash, health facets, Cooking, washing & drinking.
13	Maximum Sewage Generation per Day	300 KL
14	Peak Flow Rate of Sewage into STP per hour	100 KL/hr
15	Reuse of STP treated water	Toilet Flushing Landscape Irrigation

3. INTRODUCTION

National Law School of India University is the premier law school in India, located at Bangaluru University campus, Bengaluru. This report covers the design philosophy and broad scope of work related to all management service works Installation for the proposed campus. Following works are included in the RFP.

1. Proposed for 300 KLD STP with SBR technology.
2. Proposed for 200 KLD WTP with filtration system.
3. Proposed Rainwater harvesting system.
4. Proposed External Sewage Collection Network.
5. Proposed water distribution network.

4. DESIGN PHILOSOPHY

4.1. WATER SUPPLY AND DISTRIBUTION

Entire building with centralized UG sump and distribution by Hydro pneumatic System (HPS)

4.2. SOURCE OF WATER

Source of water supply is from BWSSB & Borewell water will be used to augment the requirement.

4.3. WATER TREATMENT

The quality of water supplied to block is in accordance with the requirements specified in IS-10500-2012- DRINKING WATER SPECIFICATIONS depending on the analysis of the water; the treatment process will work out. However, proposed to treat the Borewell water with Screen filter, Activated carbon filter and softener further worked disinfections by ultraviolet disinfection. Whereas screen filter & UV disinfection of BWSSB water & storing at common storage tank for further distribution. The location of centralized water treatment plant provided near UG sump.

4.4. SEWAGE SYSTEM

The sewerage is designed as per NBC Standards

- a. It is proposed to design as separate sanitary sewage concept separating the storm water.
- b. The sewerage system is proposed to be designed as two-pipe system with ventilating stack separately. The waste stack taken to the roof acts as vent through roof.
- c. Sewage from soil stack shall be terminated at main sewage line network, which in turn leading to the centralized sewage treatment plant.
- d. All sewage lines shall be laid on west side of the campus, in between manhole for maintenance purpose shall be provided for maintenance at regular intervals.

4.5. SEWAGE TREATMENT (DSTP)

- a. It is proposed to provide centralized Domestic Treatment (SBR) the system shall be compact type housed below ground completely.
- b. Re- Cycled water from STP is proposed to use for Toilet Flushing and Landscape irrigation.

4.6. RAINWATER HARVESTING SYSTEM

- a. Remove pavers in driveway.
- b. Create rain chambers with rings (4 to 5)
- c. Close the chamber with chamber cover.

- d. Check bore well status and get it re-bored if feasible.
- e. Build a well and protect it with safety grills and ladder for clearing.

4.7. WATER DISTRIBUTION NETWORK

- a. Providing a service trench for laying water distribution line.
- b. It is proposed for laying of one line from WTP for Domestic use, second line for STP treated water dedicated for flushing and third from STP for irrigation purpose.
- c. It proposed installing water flow meters for the measuring consumption at all blocks for both domestic line & Flushing line.

5. SYSTEM DESCRIPTION AND SCOPE OF WORK

5.1 INTRODUCTION:

All design reports and drawings shall be submitted in 2 nos. hard copy. Construction documents and drawings shall be submitted in 6 nos. hard copies.

All design reports and drawings shall be submitted in 1 nos. soft copy in an editable format to be agreed with Client/PMC/Consultant.

All deliverables shall go through applicable QA process and shall be signed by respective authority issuing, reviewing and approving the deliverable.

6 nos. printed copies of operations and maintenance manuals and a soft copy of the same, in a CD, are to be submitted for all equipment and systems.

The schematic drawings attached with this bidding document are preliminary. The successful contractor will be required to submit the Detailed Process & Structural drawings (shop drawings) incorporating the dimensional details and ratings of all required components.

These detailed drawings shall be submitted to Client/PMC/Consultant for their comments & approval which in turn shall be approved by consultant. Vendor has to submit all the technical details for equipment used for operation of plant to the client consultant and should get approval. All the works shall be carried out as per final "valid for construction drawings" only.

Testing of all equipment at his workshop shall be certified.

Inspection visit to certify all the equipment before supply shall be arranged.

Complete interconnecting piping between various units as per piping details including supply of all materials like HDPE/DWC/PVC pipes, fittings, all valves, gaskets, flanges, nuts and bolts including all materials required for necessary pipe supports, etc., complete.

Supply, erection, testing and commissioning of all the equipment required for the sewage treatment plant as per the individual equipment specifications.

All electrical works including all electrical motors for the various equipment shall be conforming to IS 5600 - 1970, cabling, LT panel, starters, etc.

All civil & structure construction works of various process tanks shall be conforming to IS 456-2002 and other relevant codes.

Commissioning of all the equipment after the electricity is supplied will be within the scope of contract.

Vendor to submit detail cost sheet for operation and maintenance, inclusive of all consumables, manpower and electrical power charges for one year with tender.

Vendor to submit the sheet for above technology with Civil, M&E costs including O&M charges.

Vendor shall provide necessary Nutrients during long vacation to keep the system in operational condition with all performance parameters guaranteed.

5.2 SCOPE OF WORK

The tender is invited on turnkey basis for Design, Engineering, Supply, and Coordinating with construction works, Erection and Commissioning

The scope of work of the Contractor shall be complete in all respect for the supply, installation, testing and commissioning of a below mentioned works. The scope shall include, but not be limited to, the following:

- Design of the system based on the schematic design provided with this document.
- Preparation of **all necessary drawings** including, at minimum, detailed drawings, general arrangement drawings, construction drawings, statutory drawings
- Supply of all materials and equipment
- Construction of all necessary tanks as per drawings provided.
- Preservation, storage and handling of materials at site
- Supply of labour
- Installation of equipment / plant / machinery
- Testing of equipment
- Commissioning of equipment
- Establishing guaranteed technical performance of plant
- Preparation of commissioning and testing reports
- Training operations and maintenance personnel
- Preparation of as-built documents and drawings
- De-snagging and rectifying the snag list / punch list.
- Obtaining certification for performance and compliance to statutory norms by an independent expert

Obtaining required statutory approvals and submission of all required drawings of drawings for statutory approvals.

1. Supply, installation, testing and commissioning Sewage Treatment Plant (STP) for **SEQUENTIAL BATCH REACTOR** (SBR technology) of capacity 300 KLD to give treated effluent quality as specified. The treated effluent from the STP shall be used for the following purposes-
 - Irrigation
 - Flushing
2. Design, Engineering, Supply, and Coordinating with construction works, Erection and Commissioning of Water Treatment Plant (WTP) with Filtration& disinfection to give treated Water quality as specified. 150 KLD WTP for Borewell water with Screen Filter followed by Activated Carbon Filter, softener, and UV disinfection. 50 KLD WTP with Screen filter and disinfection for BWSSB water. The treated water from the WTP shall be used for the following purposes-
 - Drinking
 - Cooking
 - Washing
 - Bathing

3. Design, Engineering, Supply, and Coordinating with construction works, Erection and Commissioning of Water Supply & distribution and Sewage network. Providing a service trench for laying water distribution line. Laying of one line from WTP for Domestic use, second line for STP treated water dedicated for flushing and third from STP for irrigation purpose. It proposed installing water flow meters for measuring consumption at all blocks for both domestic line & Flushing line.
4. Design, Engineering, Supply, and Coordinating with construction works, Erection and Commissioning of Rain water harvesting system. Considered two part of rain water harvesting system, which are as follows:
 1. Recharge pits along the storm water drainage system
 2. Terrace rainwater harvesting connected to borewell recharge.

This activity includes, Remove pavers in driveway, Create rain chambers with rings (4 to 5), Close the chamber with chamber cover, Build a well and protect it with safety grills and ladder for clearing.

5.3 DETAILS OF CIVIL WORKS

Make of all piping/Equipment/Motors/Cables and Pumps shall be clearly stated in the offer shall be got approved by Consultant before Supply & Installation. The decision of consultant in this regard shall be final and binding on the successful Contractor.

All equipment GA drawings shall be submitted to consultant for approval prior to construction & installation. The brought-out equipment shall be inspected at Contractor Works by Consultant and shall be dispatched to site only after obtaining clear dispatch instructions in writing from consultant.

It is obligatory on the part of the intending bidder to visit the site of work prior to submitting the offer and familiarize himself with local/site /soil conditions, availability of men, Materials and Machinery for successful and timely execution of the works. No extra shall be paid in case Contractor fails to ascertain correct site conditions before submitting the offer.

All MS hand railing/ladders shall be given two coats of synthetic enamel paint over a coat of red-oxide primer or approved make and shade, which shall be scope of Contract.

Any other item not specifically mentioned in this tender but is essential for proper and successful completion, commissioning and running of the STP, WTP, Rainwater harvesting system & distribution network for its commercial utilization is also to be included in the scope of contract.

Fresh water line shall be provided to STP area but should be coordinated with plumbing team.

“The vendor has to coordinate with Main contractor, Plumbing vendor, Electrical contractor, Project management/Builder/Client, Architect and Consultant to establish the plant and to run the plant successfully”.

Civil works carried out inside treatment plant are as below which should be scope of contract and vendor should furnish required levels and details.

5.3.1 STP

Sl. No.	Name of the Unit	Quantity in nos.	Size
1	Bar screen chamber	1	As per requirement
2	Equalization tank	1	As per drawing
3	Anoxic tank (Pre aeration tank)	2	As per drawing
4	Aeration tank (SBR Reactor)	2	As per drawing
5	Decant Tank	1	As per drawing
6	Sludge holding tank	1	As per drawing
7	Final Tank	1	As per drawing
8	Working platform, staircase etc.,	1	As per drawing
9	Miscellaneous works such as pipe / cable trenches, chambers, equipment foundations, staircase headroom at entry of STP etc., Plant Room	1	As per drawing

5.3.2 WTP

Sl. No.	Name of the Unit	Quantity in nos.	Size
1	Raw water tank	1	As per drawing
2	Treated water tank	1	As per drawing

5.3.3 Water distribution & Sewage collection Network

Sl. No.	Name of the Unit	Quantity in nos.	Size
1	Service Trench for water distribution	1	As per drawing
2	Sewage collection line with manholes at every 30 m distance		As per site condition
3	Connection of		

5.3.4 Rainwater harvesting system

Sl. No.	Name of the Unit	Quantity in nos.	Size
1	Recharge pits along storm water drain		As per site condition
2	Borewell recharge	4	As per drawing

5.3.5 DETAILS OF PIPING WORK

Piping works including excavation, back filling, masonry / structural pipe supports, puddle flanges, concrete bedding, pipe specials and GM D/F Valves (Approved or Recommended valves or approved make only with PN 10 rating) are all included in the scope of contract.

SECTION - I

6.0 GENERAL PROVISIONS

The main source of water is one from BWSSB and second from Borewell (3 nos.), effluent is wastewater resulting from Toilets, pantries & cafeteria, rainwater harvesting & laying of pipeline for sewage collection & water distribution.

The scope of work includes design, drawings, coordinating during construction, erection, commissioning and obtaining best results of domestic sewage treatment plant with electrical, mechanical, and piping. The treated effluent should be fit to reuse for landscape irrigation, and toilet flushing.

The domestic water treatment plant, the treated water quality should fulfill IS 10500 :2012 standard.

The water distribution line should be laid in a dedicated trench which runs all along the road in the landscape area. The colour coding of pipelines should be provided for easy identification as per IS 2379:1990.

The work is required to be carried out on a design basis covering a guarantee of satisfactory performance as per the standards laid for a minimum of one year.

TENDER

- Vendor to submit detail design, hydraulics, plan and section with detail equipment specs along with TENDER justifying each parameters.
- Also, vendor to submit pay back calculation, operation and maintenance cost sheet.
- The commissioning of the system shall be done in presence of membrane manufacturer.

SECTION – II

7.0 BASIC DATA

7.1 PROPOSED SEWAGE TREATMENT PLANT

7.1.1 BASIC DATA RAW WASTEWATER (DOMESTIC SEWAGE)

Quantity : 300 KLD

Parameter	Unit	Value
pH	-	6.5 – 8.5
Total Suspended solids	mg/l	200-300
BOD	mg/l	260-360
COD	mg/l	400-600
Oil &Grease	mg/l	< 10

7.1.2 TREATED WASTEWATER (SEWAGE) QUALITY

As stipulated by State Pollution Control Board (PCB) and also the treated effluent quality shall be within the following values for various parameters, for both present and future.

Parameter	Unit	PCB Norm
pH	-	6.5 – 8.5
Total Suspended solids	mg/L	10
BOD	mg/L	< 10
COD	mg/L	< 50
Oil &Grease	mg/L	< 10
E Coli	mg/L	NIL
Ammonical Nitrogen	mg/l	5
Total Nitrogen as N	mg/l	10

7.1.3 THE TREATMENT PLANT (STP)

Based on the Raw Wastewater characteristics following treatment scheme is suggested:

- a. Kitchen waste is directed through oil & grease trap before entering into the STP, shall be installed at kitchen and cafeteria blocks.
- b. The Sewage is led into a Bar Screen Chamber provided with SS Bar Screen for removal of floating and large suspended Matters.
- c. The screened effluent is collected in an equalization tank. This sump is provided to dampen the flow fluctuations and, in order to keep the solids in suspension, pre-aeration is provided with coarse bubble tubular diffusers.

- d. From the equalization tank sewage is allowed to flow through Pre-aeration tank, where sludge recirculation happens. Partial air supply is provided with fine bubble diffusers, to keep solids in suspension & to achieve Di-nitrification of sludge.
- e. From Pre-aeration chamber sewage is allowed to Aeration tank, which comprises fine pore diffusers immersed. Where, the reduction of the organics contributing to BOD/ COD by the processes of aeration, settling and recirculation of sludge.
- f. Sludge will be retained in the Aeration tank and excess sludge will be pumped/passed to sludge holding tank and then pumped to centrifugal decanter whenever MLSS measured is higher than designed.
- g. Decant water Tank / Filter Feed Tank, Biologically Treated sewage is collected in the decant water / Filter Feed Tank.
- h. Disinfection System, The objective of disinfection is to reduce the residual BOD, COD and smell/odour to an acceptable level and to disinfect the biologically treated water. The treated and disinfected sewage is pumped to the filters.
- i. Filtration System, comprising of Disc Filter & Activated Carbon Filter to remove the residual suspended solids, organics, colour and odour. The backwash water from the filters are taken back to the collection tank
- j. Output of Activated Carbon filter further treated with UV Disinfection and stored in final sump.
- k. The waste sludge from aeration tank is passed to sludge holding tank and then pumped TO Centrifugal decanter and solid cakes formed are carted out.
 - ❖ Bar screen chamber coarse
 - ❖ Fine Screen
 - ❖ Coarse bubble diffuser.
 - ❖ Equalization tank
 - ❖ Pump Room
 - ❖ Anoxic tank/Aeration tank
 - ❖ Decant Tank
 - ❖ Disc Filter
 - ❖ Activated Carbon Filter
 - ❖ Disinfection
 - ❖ Final tank
 - ❖ Centrifugal de-sludger with screw pump
 - ❖ Sludge holding tank
 - ❖ Piping and cabling
 - ❖ Units designed and proposed for LT panel

7.2 PROPOSED WATER TREATMENT PLANT
7.2.1 BASIC DATA RAW WATER (DOMESTIC WATER)

Quantity : 200 KLD

Sl. No.	Parameter	Domestic water quality
1	pH	7.59
2	Colour in Hazen units	3
3	Odour	Agreeable
4	Turbidity in Ntu	0
5	Total Dissolved Solids, in mg/l	854
6	Total Hardness as CaCO ₃ , in mg/l	416
7	Calcium as Ca, in mg/l	116
8	Magnesium as Mg, in mg/l	31
9	Total alkalinity as calcium carbonate, mg/l	412
10	Chlorides as Cl, in mg/l	103
11	Sulphate as SO ₄ , in mg/l	64
12	Nitrate, as NO ₃ , in mg/l	4
13	Iron as Fe, in mg/l	0
14	Fluoride as F, in mg/l	1
15	E. Coli Bacteria	Absent
16	Total Coliform MPN/100 ml	Present

7.2.2 TREATED WATER (DOMESTIC) QUALITY

As stipulated by Central Pollution Control Board (CPCB) and also the treated water quality shall be within the IS 10500:2012 standard for various parameters, for both present and future.

7.2.3 THE WATER TREATMENT PLANT (WTP)

Based on the Raw water characteristics following treatment scheme is suggested:

- a. Water from BWSSB stored at one tank near gate zero & Borewell water from all three borewells shall be pumped to the UG sump provided near gate zero.
- b. The water from raw water tank will be pumped through Screen filter provided for removal of floating suspended Matters.
- c. The screened water from screen filter is allowed to pass through Activated carbon Filter for the removal of colour & odour removal form the water.
- d. From Activated Carbon filter the water flows to the Softener unit for the reduction of Hardness from the water.
- e. The backwash water from the filters is pumping to STP, expect Softener unit.
- f. Water form BWSSB, pumped through screen filter followed by disinfection will be collected at same common treated water tank provided at gate zero.
- g. The treated water distribution through hydro pneumatic system to the locations.
 - ❖ Collection tank Borewell
 - ❖ Collection tank BWSSB
 - ❖ Screen Filter
 - ❖ Activated Carbon Filter
 - ❖ Softener
 - ❖ Disinfection
 - ❖ Final tank
 - ❖ Piping and cabling
 - ❖ Units designed and proposed for LT panel.

7.3 PROPOSED WATER DISTRIBUTION AND SEWAGE NETWORK

7.3.1 BASIC DATA

Quantity : **3 LINES supply lines**

1. Water Supply line-Header line
2. Flushing line-Header Line
3. Borewell supply line-Header line
4. Sewage network with manholes at every 30 m distance till STP.

Description	Approx. Length of pipeline
Proposed sewage line in rmt	1250

Proposed flush line in rmt	1380
Proposed Cauvery line in rmt	1380
Proposed Bore line in rmt	1380

All water consumption should be measured using digital water flow meters. At each building, 2 meters are to be provided, one for domestic water consumption & another for flushing water consumption.

7.4 PROPOSED RAIN WATER HARVESTING SYSTEM

7.3.1 BASIC DATA

Quantity : 3 recharge of borewells at 3 locations
50 recharge pits along the storm water drain

Location of Rainwater harvesting for borewells recharge

1. Rain well near admin block (existing well)
2. Rain well (Borewell) near Staff quarters -covering staff quarters & Training center.
3. Rain well near library (Borewell) – covering new academic block & library.
4. Rain well (Borewell) near girls Hostel covering all nearby buildings.

SECTION - III

8.0 DESIGN CRITERIA

8.1 STP:

The STP is designed on the basis of wastewater flow and quality parameters as in Para 7.0 & 7.1. Where the contractor has to submit an offer for STP with detail design and coordination with main consultant, these values shall form the design criteria for designs. Design shall be submitted as a separate offer.

Further following design criteria have been followed in the design of STP.

8.1.1 Equalization Tank (Balancing Tank)

Detention time : Min 8 hours based on peak hourly flow of raw sewage.
Approx. 220 cum.

8.1.2 Aeration Tanks

Influent BOD5 : 350 mg/lit
MLSS : 3500 - 4500 mg/lit
Oxygen requirement : 2.5 kgs per kg of BOD
Size : approx. 150 cum, 2 units

8.1.3 AUTOMATION OF SYSTEM

It is required to automate the system completely as specified below with PLC based support,

- Level transmitter at equalization tank connecting to PLC and SCADA controlling the equalization pump and decantation of clarified water. (Link between inlet and outlet)
- Electrically actuated valve at the entry of Anoxic tank to control flow to aeration tank with link between level transmitter at screen and valve.
- Level transmitter at anoxic /aeration tank to control/ monitor level and decant valves
- Flow meter at outlet of disinfection Unit before final treated water in comparison to raw sewage pump.
- The plant shall be equipped with Online Effluent water quality monitoring unit as per KSPCB specifications.

8.2 WTP:

The WTP is designed on the basis of water flow and quality parameters as in Para 7.2. Where the contractor has to submit an offer for WTP with detail design and coordination with main consultant, these values shall form the design criteria for designs. Design shall be submitted as a separate offer.

Further following design criteria have been followed in the design of WTP.

8.1.1 Treated water Tank

Detention time : Min 12 hours based on peak hourly flow of raw sewage.
Approx. 120 cum.

8.1.2 Raw water tanks

Existing tanks shall be used for storing water one from BWSSB & other from Borewell.

8.1.3 AUTOMATION OF SYSTEM

It is required to automate the system completely for overhead tank filling.

- Flow meter at both Inlet & outlet of disinfection Unit before final treated water in comparison to raw sewage pump.
- Level controller for Overhead tank filling at all locations.
- The plant shall be equipped with Online Effluent water quality monitoring unit as per KSPCB specifications.

8.3 WATER DISTRIBUTION & SEWAGE NETWORK:

The distribution network is designed on the basis of water requirement at individual building as in Para 7.3. Where the contractor has to submit an offer for distribution network with detail design and coordination with main consultant, these values shall form the design criteria for designs. Design shall be submitted as a separate offer.

The water pumping system is through hydro pneumatic system from STP (flushing Line) & WTP(Domestic line).

8.4 RAINWATER HARVESTING SYSTEM:

The size of the recharge pits are as per BWSSB guidelines, i. e., should have the recharge capacity of 30 cum/day.

The recharge of borewell are also should be as per BWSSB guidelines.

SECTION - IV

9.0 Battery Limits:

9.1 SEWAGE TREATMENT PLANT

1. Sewage Inlet up to STP,
2. Treated water up to final sump in the STP.
3. Electrical feeder up to LT panel.
4. Fresh water line up to STP.

9.2 WATER TREATMENT PLANT

1. Domestic water Inlet up to WTP,
2. Treated water up to final sump at the WTP.
3. Electrical feeder up to LT panel.

9.3 WATER SUPPLY & DISTRIBUTION AND SEWAGE NETWORK

1. Supply line starting from WTP final tank last building location, only main header line.
2. Sewage from gate zero point to STP inlet before Bar screen unit. Including intermittent manhole chambers.

9.4 RAINWATER HARVESTING SYSTEM

1. Borewell recharge near staff quarters, old academic block, Girl's hostel location, library & boy's hotel borewell points
2. Installation of filters to all down take pipes & diverting to common main line at the point of recharge.

SECTION - V

10.0 EQUIPMENT SPECIFICATION

10.1 SEWAGE TREATMENT PLANT

Sl. No.	Name of the equipment	Quantity	Capacity	Type	Motor	MOC
1	SS Bar Screen	1 no.	800 x 1000 mm	Manual	NA	SS 304
2	Raw Effluent Pumps	3no.(2W + 1 SB)	To transfer Raw Effluent from Equalisation Tank to Aeration tank	Vertical submersible type pumps Grundfos/KSB, (approved by consultant), suitable for handling the sewage with accessories.	Built in vortex pump	Body and impeller in CI
3	Diffusers - Fine pore diffusers	As per req.		Long Membranes EPDM supported on PVC pipe secured at the ends by SS clamps and construction with Necessary accessories etc complete		
	Diffusers - Coarse bubble diffusers	As per req.		Pressed PVC pipe with holes on the surface for air ejection with necessary accessories etc complete (for equalization tank, Sludge holding tank and Final Tank)		
4	Air blowers	As per req		Roots type of air blowers		INGERSOLL RAND / CVT/Everest (approved by consultant)
5	Return Sludge Pumps	As per req	To transfer sludge from secondary clarifier to Aeration Tanks & sludge thickener.	Horizontal centrifugal non-clog Self priming, open impeller, pumps Grundfos (approved by consultant)	TEFC Motor, with IP-55 protection and suitable for 400/440 V, 50 HZ A/c supply	Body and impeller in CI. Air cock with priming funnel, Flexible Coupling with

					of Kirloskar or siemens make.	guard, Base frame, foundation bolts etc.,
6	Disinfection by UV	As per req		UV disinfection		Alfa laval WWR series
7	Multistage screw pump/Sludge pumps	As per req				Alfa / Hydroprokav (approved by consultant)
8	Centrifugal desludger with decanting mechanism	as per BOQ.				Make : Clarie fontaine
9	Filter Feed pumps	As per req	to pump the water from decant tank to Disc filter & activated Carbon Filter	Horizontal centrifugal submersible type pumps Grundfos/KSB, (approved by consultant), with motor & accessories.	Built in vortex pump	Body and impeller in CI
10	Disc Filter	Refer: BOQ				Make (approved by consultant)
11	Activated Carbon Filter	Refer: BOQ	Ion exchange (approved by consultant)	Resin	MS with FRP coating for internal and epoxy for external.	Perforated bottom plate with plastic strainers or central headers and laterals

10.2 WATER TREATMENT PLANT

Sl. No.	Name of the equipment	Quantity	Capacity	Type	Motor	MOC
1	Raw water transfer Pumps	3no.(2W + 1 SB)	To transfer Raw water from raw water Tank to screen filter			
2	Screen filter	As per req.	To filter TSS up to 70mm	Amiad filters		
3	Activated carbon Filter	As per req.	Ion exchange (approved by consultant)	Carbon media more than 500 Iodine value	MS with FRP coating for internal and	Perforated bottom plate with plastic

					epoxy for external.	strainers or central headers and laterals
4	Softener	As per req		Resin-Cation resin with Sodium based.	MS with FRP coating for internal and epoxy for external.	Perforated bottom plate with plastic strainers or central headers and laterals
6	Disinfection by UV	As per req		UV disinfection		Alfa laval WWR series

10.3 WATER DISTRIBUTION AND SEWAGE COLLECTION NETWORK

1. Water supply: Type: HDPE, for both supply & flushing line
2. Sewage line: Hume pipe

10.4 RAINWATER HARVESTING.

As per BWSSB guidelines.

SECTION – VI

DETAILS OF ELECTRICAL WORKS

11.0 LT SWITCHBOARDS (PANELS)

11.1 GENERAL

The switchboard shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on low voltage power, 415V, 3 phase 4 wire, 50 Hz system.

The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of

inspection, cleaning and repairs for use in installations where continuity of operation is of prime importance.

11.2 STANDARDS:

Following equipment shall conform to the requirements as per the latest revisions of the following standards:-

1. Moulded Case Circuit Breaker (MCCB) : IS 13947 - 1.2/ IEC 947 - 1,2
2. Contactors- : IS 13947-1,4
3. Miniature Circuit Breaker(MCB) : IS 8828- /IEC898
4. Residual Current Circuit Breaker (RCCB) : IS 12640 - / IEC 1008
5. HRC fuse link : IS 9224 and BS 8 :8
6. Current Transformer : IS 2705 and IEC 185
7. Potential Transformer- : IS 3156
8. Relay -(For Static Relays) : IS 3231 and IS 8686
9. Indicating Instrument- : IS 1248

11.3 TYPE AND CONSTRUCTION

- a) The switchboard shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on medium voltage power, 3 phase 4 wire 50Hz system.

11.4 GENERAL CONSTRUCTIONAL FEATURES:

The switchboard shall be:

- a) CRCA-Sheet steel enclosed, indoor floor mounted free standing cubicle type & CNC fabricated.
- b) Made up of the requisite vertical sections modular type which when coupled together shall form continuous switchboards as per Form-4 constructional features.

- c) Dust, vermin and damp proof and enclosure protection not less than IP 42 for indoor & IP55 for outdoor applications and IP:32 for Battery Chargers.
- d) Each feeder/instrument compartment shall be provided with a hinged door interlocked with MCCB/LBS inside the compartment such that door can only be opened when MCCB/ in off position.
- e) Readily extendable on either side by the addition of vertical sections after removal of the end covers.
- f) Switchboards shall have access to the feeders, bus bars, cable termination, cable alley, etc. as required.
- g) All CTs for metering/protection shall be mounted in respective feeder compartments either in front or on the rear side of the same compartment for easy maintenance without disturbing other feeders.
- h) Mounting of any metering OR instrumentation equipment in Bus chamber is not envisaged.
- i) All CT wiring shall be done with CT terminal block with shorting facility mounted in the metering compartment.
- j) Wherever control wiring is done between the shipping sections, terminal blocks shall be provided on both sides of shipping sections with TB diagram pasted near to the TBs.
- k) The total height of the panel shall not be more than 2300 mm unless otherwise specified and maximum height of switch operating handle shall not be more than 1800mm from FFL. The total depth of the panel shall be adequate to cater for proper cabling space.
- l) Doors shall be of minimum 2mm thick sheet steel and covers/partitions of 1.6mm thick sheet steel, gland plate shall be 3mm thick sheet steel. All sheet steel work forming the exterior of switchboards shall be smoothly finished, levelled and free from flaws. The corners should be rounded.
- m) The Components in the switchboards shall be so arranged as to facilitate ease of operation and maintenance and at the same time to ensure necessary degree of safety.
- n) Components forming part of the switchboards shall have the following minimum clearances:

Between phases	-	25mm
Between phases and neutral	-	25mm
Between phases and earth	-	20mm
Between neutral and earth	-	19mm

Creepage distances shall comply to those specified in relevant standards.

- o) All insulating material used in the construction of the equipment shall be of non-hygroscopic material treated to withstand the effects of high humidity, high temperature and tropical ambient service conditions.

- p) Functional units such as circuit breakers, fuse switches, MCCBs, etc. shall be arranged in multi-tier formation except that not more than two air circuit breakers shall be housed in a single vertical section.
- q) Metallic/insulated shrouding shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:
- r) Main busbars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.
- s) Cable terminations of one functional unit, when working on those of adjacent unit/units.
- t) All covers providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.
- u) Provision shall be made for permanently earthing the frames and other metal parts of the switchgear by two independent distinct connections.
- v) Thickness tolerance for sheets shall be as applicable in relevant IS.
- w) All capacitor control panels shall be of compartmentalized design. All capacitors & reactors shall have individual compartments. Exhaust fans shall be provided for ventilation purpose.
- x) The complete panel shall be designed such that its rating is as per SLD without de-rating considering ambient temperature & temperature rise as per IS/IEC. De-rating of MCCBs/ACBs or the whole panel shall not be accepted. Panel shall be provided with necessary ventilation arrangements to meet the above requirement.

11.5 **BUS BARS**

- a) The bus bars shall be made of high conductivity, Electrical grade Aluminium or copper (As specified in SLD), suitable for 415 volts, 3phase 4 wires 50 Hz, with minimum STC of 16KA for 1 Sec, unless otherwise specified.
- b) The bus bars shall be suitably supported with non-hygroscopic supports to provide a fault withstand capacity as specified.
 - a) High tensile (8.8 grade) bolts and spring washers shall be provided at all bus bar joints.
 - b) Fish plates of equal type and size shall be used at all joints.
- c) The bus bars shall have uniform cross section throughout and shall be capable of carrying the rated current at 415V continuously. The bus bars shall be designed to withstand a temperature rise of 40 Deg. C above the ambient temp. of 50 deg. C.
A current density (Amp/Sq.mm) shall not exceed 1.5A/sq.mm for copper & 0.8A/Sq.mm for Aluminium.

- f) The neutral bus bars shall have a continuous rating of at least 50% of the phase bus bars unless otherwise mentioned.
- g) Bus bars shall be fully sleeved using heat shrunk PVC sleeves appropriately color coded to identify different phases and neutral bar.
- h) All UPS output panels/SMSBs shall be provided with neutral bus rated double the size of Phase Busbars.
- i) All lighting & raw power panels/SMSBs shall have at least 50% neutral bus.
- j) MCCBs of rating 200A & above rating shall have copper spreaders on terminals & then connected to main busbars.
- k) All panels shall be provided with aluminium earth bus, which shall run throughout the length of switch board at top or bottom as required. Following size of earth bus shall be provided as per the switchboard rating:

PANEL RATING	Al. EARTH BUR RATING
Up to 100A	25x3mm
250A	25x6mm
315A	25x10mm
400 to 630A	30x10mm
800 to 1000A	50x6mm
1250 to 2000A	50x10mm
2500 to 3200A	50x10mm
4000A	60x10mm

11.6 MCCB - MOULDED CASE CIRCUIT BREAKER

The Moulded Case Circuit Breaker shall be incorporated in the switchboard wherever specified and shall be of the current limiting type. MCCB shall conform to IS 2516, IS 13947-1/IEC 947-1 (part I & II / section 1) 1977 for general rules. It should be suitable for Horizontal and Vertical mounting and line load reversibility. MCCB shall be suitable either for Single Phase AC 230V Or Three Phase 415V. The MCCB shall be available in four pole versions for neutral isolation. It shall have tropicalisation as standard feature.

The MCCB cover and case shall be made of high strength heat-resistant and flame-retardant thermosetting insulating material. The operating handle shall be quick make, quick break, trip - free type. The operating handle shall have suitable 'ON' 'OFF' 'TRIPPED' indicators and in order to ensure suitability for isolation complying with IS 13947-2/IEC947-2, the operating mechanism shall be designed such that the toggle or the handle can only be in 'OFF' position, if the main contacts are actually separated.

11.6.1 ACCESSORIES :

MCCB shall be designed to have following accessories and it shall be fittable at site.

- 1) Under voltage trip
- 2) Shunt trip
- 3) Alarm switch
- 4) Auxiliary switch

11.6.2 INTERLOCKING :

MCCB shall be provided with following interlocking devices for interlocking the door of a switch board.

- a) Handle(Pad lock) interlock to prevent unnecessary manipulations of the breaker.
- b) Door interlock to prevent door being opened when breaker is in ON position.
- c) The interlocking defeating device to open the door even if the breaker is in ON position.

In addition to the above, all other features indicated in the Bill of Quantities/SLD shall also be provided.

11.6.3 BREAKING CAPACITY :

Short time with-standing capacities & breaking capacities for different ratings of MCCB's shall be as specified in the SLD.

Preferably Ics shall be equal to Icu or all breaking capacities shall be considered for Ics.

11.6.4 RELEASES:

Unless otherwise specified all MCCBs up to 250A (including 250A) shall be provided with thermal magnetic releases & all MCCBs of rating 315A & above rating shall be provided with Microprocessor releases.

Irrespective of ratings, all MCCBs used in UPS I/P side, O/P side in UPS input & output panels shall be with thermal magnetic releases.

All MCCBs with Thermal magnetic releases shall be provided with adjustable overload of 70-100% & fixed short circuit releases.

All MCCBs with Microprocessor releases shall be provided with adjustable overload of 50-100% & adjustable short circuit releases.

Wherever earth fault module is required it shall be inbuilt with other releases, i.e. separate module for E/F is not recommended.

11.7 MINIATURE CIRCUIT BREAKERS/RCCBs :

11.7.1 MCB:

MCB shall be in 1,2,3,4, pole versions. MCB casing shall be made of self-extinguishing, tropicalised material.

MCB shall comply with IS 8828-1996/IEC 898-1995. It shall be suitable for use in frequency range 40Hz to 60Hz and shall accommodate AC/DC supply according to requirements. It shall have a trip-free mechanism and toggle shall give a positive contact indication. It shall be

suitable for mounting on 35mm DIN rail/surface mounting. It may be installed horizontally, vertically on the ceiling in any place without any change in electrical performance.

Line supply may be connected to either top or bottom terminals i.e. There should be no line-load restriction. Degree of protection when the MCB is flush mounted, shall be IP40. MCB shall be supplied with clamping terminals fully open. Contact closing shall be independent of the speed of operator. The breaking capacity of the MCB shall be 9KA/10KA. The MCB shall be capable of being used as Incomer Circuit Breaker and shall be suitable for use as isolator. In case of multiple MCBs in a single location (DB), it should be possible to remove any MCB without having to disturb other MCB in the vicinity.

C' curve type MCB used for lighting loads & D' curve type MCB shall be used for UPS Circuits. MCBs used in UPS circuits shall be suitable for non-linear loads.

11.7.2 RCCB - RESIDUAL CURRENT CIRCUIT BREAKER :

RCCB shall be available in 2 pole and 4 pole versions and threshold sensitivities of 30mA, 100mA, 300mA and current ratings from 16 to 63A. Rating and sensitivities shall be as per Bill of Quantities.

RCCB shall comply with IS 12640-1988/IEC 1008. The short circuit withstand of the RCCB without the associated short circuit/overhead protection shall not be less than 3 KA. It shall be operationally independent of line voltage. The sensitivity thresholds (30mA,100mA,300mA) shall be of non-user adjustable type by construction.

RCCB shall be suitable for SMPS loads (I.e. unaffected by the d.c pulsated components, harmonics etc, Lighting, line disturbances due to other component) and shall not give nuisance tripping.

11.8 CONTACTORS:

Contactors shall comply with IS 13947-1 for general rules and IS 13947 - 4.1 for Standards pertaining to Contactor and Motor Starter.

The Contactors shall be capable of withstanding breaking and making capacities per following :

AC3 category	Making Current 10 x Rated Current Breaking Current 08 x Rated Current
AC4 category	12 x Rated Current 10 x Rated Current

Contactors shall be capable of withstanding an impulse voltage of 8KV and have an insulation voltage of 1000V.

Contactors shall be suitable for aluminium termination with a maximum permissible temperature rise of 65 Deg C at the terminals with an ambient temperature of 50 Deg C.

The coils shall have three terminals and the insulation should be of class H type.

The auxiliary contact block shall have a switching capacity of 220V, 2A.

Contactors shall have one auxiliary contact built in and it should be possible to have additional NO/NC contacts in steps of two.

11.9 METERS

All instruments and meters shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. They shall be calibrated to read directly the primary quantities. They shall be accurately adjusted and calibrated at Works and shall have means of calibration, check and adjustment at site.

Indicating instruments shall be flush mounted, digital type. The size of all instruments shall be 96mm x 96 mm.

The Ammeter and Wattmeter current coils shall withstand 200% of rated current continuously and 10 times the rated current for 0.5 seconds without loss of accuracy. Voltmeter and Wattmeter potential coils shall withstand 120% of rated voltage continuously and twice the rated voltage for 0.5 sec. without loss of accuracy.

11.9.1 VOLTMETER

- a) Voltmeter shall be of Digital type with accuracy class of 1.
- b) All Voltmeters are 96sq.mm in size & suitable for flush mounting on panels.
- c) Type, Sl.No., accuracy class and borders of the Voltmeter shall be indicated on the meters.

11.9.2 AMMETER

- a) Ammeter shall be of Digital type with accuracy class of 1.
- b) Ammeter shall be CT operated (5A) with a dial marked for line currents.
- c) Ammeter are 96sq.mm in size & suitable for flush mounting on panels.
- d) Type, Sl.No., Accuracy class, Operating Current, Burden etc., shall be indicated on the meters.

11.9.3 MULTI DATA METERS / ENERGY METERS

Multi data meters & kWh meters shall be of Electronic & 3 phase 4 wire type suitable for measurement of unbalanced loads. They shall be 96sq.mm in size & suitable for flush mounting with back connecting terminals.

The Energy Meter shall be connected to the secondaries of potential transformers and current transformers rated for LT supply. These meters shall conform to IS : 13010 and have an accuracy of class 0.5 or better for kWh meter.

The current coil of the meters shall have a continuous overload capacity of 200% for both accuracy and thermal limits. Also the current coils shall withstand atleast 10 times the rated current for 1 second without loss of accuracy.

Multi data meters shall read the following minimum parameters,

- a) Current
- b) Voltage
- c) KW
- d) KVA
- e) kWh
- f) Power factor
- g) KVA max. demand
- h) KW max. demand
- i) Total Harmonic distortion (THD)

Multi data meters shall be provided with communication capability through RS 485 port (Wherever specified in the SLD). All necessary hardware & software items shall be considered for integration with BMS, the preferred protocol is MODBUS.

11.10 RELAYS:

All Relays shall conform to applicable approved standard. Relays shall be suitable for flush mounting & connections from the rear.

All Protective Relays shall be of draw out or plug in type/Modular cases with proper built in test facilities. Test blocks and switches shall be located immediately below each relay for testing. The auxiliary relays shall be self-reset type.

All protection relays shall be numerical & draw out type with 24V DC auxiliary supply. All other relays like tripping relays, aux.relays shall be electromechanical type.

All AC Relays shall be suitable for operation at 50Hz. AC Voltage operated relays shall be suitable for 110/v3 Volts PT secondaries and Current operated relays for 5Amp. CT secondaries as specified in this specification. Voltage operated relays shall have adequate thermal capacity for continuous operation.

Auxiliary Relays and Timers shall have pairs of contacts as required to complete the scheme i.e. separate set of aux.contacts for tripping & alarm. Contacts shall be silver faced with spring action.

All Protective Relays, Auxiliary Relays and Timers except the lockout relays and Interlocking relays specified shall be provided with self reset type contacts. All Trip Relays and Timers shall be provided with externally hand reset positive action provided with description subject to Client/Consultant approval. Timers shall be of the electromagnetic or solid state type.

Wherever solid state relays are used the following requirement shall be met with:

All Relays shall be designed for operating under an ambient temperature 50 Deg.C and 100% relative humidity.

All accessories required for correct operation of each relay shall be supported by the Contrator without any extra cost.

The solid state relays shall be stable and suitably protected against transient/induced over voltages. The Bidder shall state clearly in his list special requirements, if any, for DC input arrangement or cabling considered necessary for satisfactory operation of solid state relays quoted by him.

11.11 CONTROL COMPONENTS:

11.11.1 INDICATING LAMPS:

All indicating lamps shall be of LED type & 22.5m dia in size.

Indicating lamps shall be suitable for panel mounting with screw connections on backside.

11.11.2 PUSH BUTTONS/ILLUMINATED PUSH BUTTONS:

All push buttons shall be of spring return & flush type. All push buttons shall be with minimum 1NO+1NC contacts.

Emergency stop PB shall be mushroom head, stay put type with turn to release feature. All Mushroom PB shall be with minimum 2NO+2NC contacts. rating

All illuminated PBs shall be with LED type lamps & 22.5m dia. in size with minimum 1NO+1NC contacts.

Rating of all Push Button contacts shall be 10A AC 230V OR 3A 110V DC.

11.11.3 SELECTOR SWITCHES:

All selector switches shall be rotary type & shall be of 10A for AC circuit & 16A for DC circuits. Selector switches shall be with at least two poles.

Breaker control switches shall be of 25A rating & with minimum two poles. It shall be with sequence locking device, pistol grip handle and spring return to neutral position from both close and trip positions.

11.12 FACTORY TESTING

The following tests shall be conducted on all typical panels, these tests shall form part of this package & necessary items, cost of travel etc..Shall be included:

- a) Routine tests as per IS (Megger, HV test etc..)
- b) Functional test
- c) Paint thickness test, scratch test etc..
- d) Heat run test for all typical feeders/incomers of rating 400A & above, i.e. one or two feeders/incomers of each rating shall be tested.

11.13 CABLE TRAYS AND ACCESSORIES

The cable trays shall be complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories and hardware. All hardware (i.e. bolts, nuts, screws, washers, etc.) shall be hot dip galvanized.

CABLE TRAYS - CONSTRUCTION NOTES

LADDER TYPE

A) The ladder type cable trays shall be made out of MS sheet steel & shall be complete with associated accessories such as coupler plates, tees, elbows etc., the trays shall be fabricated from 2.5mm thick for above 300mm size, up to 300mm shall be with 2mm thick sheet steel. Cable tray covers shall be fabricated from 16 gauge perforated (1.60 mm thick) m.s. sheets (cover shall be provided if specified in the BOQ).

B) The cable trays shall be supplied in standard lengths of 2500 mm and clear inside width x height of trays shall be as follows:

Ladder type trays: 300x50mm, 450x50mm, 600x75mm, 750x75mm and 1000x75mm mm.

C) Cable trays, accessories and covers shall be galvanized.

D) The spacing of rungs for ladder type of trays shall be 250 mm unless otherwise specified.

E) All finished cable trays and accessories shall be free from sharp edges, corners, burrs and unevenness.

F) The thickness of galvanizing shall be 610 gm / Sq. mtr. (87 Microns) in line with IS: 4759.

PERFORATED TYPE

A) The perforated type cable trays shall be fabricated out of GI sheet, the associated accessories such as coupler plates, tees, elbows etc., shall be fabricated from 2mm thick for trays above 300mm, up to 300mm shall be with 1.6mm mild steel/GI sheets. Cable tray covers with 1.6mm thick GI perforated sheet shall be provided if specified in the BOQ.

B) The cable trays shall be supplied in standard lengths of 2500 mm and clear inside width x height of trays shall be as follows:

Ladder type trays: 300x50mm, 450x50mm, 600x75mm, 750x75mm and 1000x75mm mm.

C) Cable trays, accessories and covers shall be galvanized.

D) All finished cable trays and accessories shall be free from sharp edges, corners, burrs and unevenness.

E) The thickness of galvanizing shall be 610 gm / Sq. mtr. (87 Microns) in line with IS: 4759.

CABLE TRAYS - INSTALLATION NOTES

Cable trays shall be installed generally at the elevations shown in respective cable tray layout drawings. If any major modifications in the drawings are envisaged in the field, these should be carried out after getting approval from design office.

Before laying the trays, contractor shall submit the shop drawing & take the approval from client/consultant.

A) It shall be the responsibility of the electrical contractor to mark up all the field modifications on the latest issues of the drawings and return two copies of all such "as constructed" drawings to client/consultant's design office.

B) The type and size of tray to be used shall be as mentioned in the individual layout drawings.

C) The maximum size of cable tray when used in trenches shall be of 750 mm width.

D) Cable trays shall be welded to the mounting/carrier structures. Trays shall be supported with suitable angle/hitech rod supports.

E) Each continuous laid out length of cable tray shall be earthed at minimum two places by M.S. flats of minimum size 25x6 mm (unless otherwise noted) to the purchaser's earthing system. The distance between earthing points shall not exceed 10 meters.

F) The following shall be checked before laying the cables on trays.

a) Check for proper painting and identification nos. of the trays.

b) Check for continuity of cable trays over the entire route.

c) Check that all sharp corners, burrs and waste materials have been removed from the tray.

d) Obtain clearances from piping contractor / engineer that no piping will be taken in the way of cable trays.

e) Check for earth continuity & earth connection of cable trays.

G) Cable tray installation work shall comply with all currently applicable statutes, regulations and safety codes in the locality/country where the installation is to be carried out.

SECTION – VIII

12.0 INSTALLATION AND COMMISSIONING

12.1 TEST/TRIAL RUNNING AND COMMISSIONING

The Contractor shall have to test the each equipment used for the plant for at least 72 hours continuous running with designed load and to the full satisfaction of Consultants. Any defects found, has to be rectified by the contractor at his own cost immediately and within reasonable time to be decided by client.

Necessary Instruments, Gauges, Labour/Supervisory Staff, Laboratory analysis etc., are to be furnished/provided by the Contractor free of cost to client. Vendor has to specify the value added services in his offer letter.

12.2 COMMISSIONING/HANDING OVER

During trial runs as described above, the Contractor shall satisfy Consultant in all respects regarding the satisfactory quality of effluent, quality of materials, equipment and workmanship used in the plant. Only after satisfying itself/ himself regarding the above points, client will take over the plant and such date of taking over shall be deemed as date of commissioning for all purposes, guarantees, and payment terms mentioned elsewhere in this tender. The guarantee period described elsewhere in the tender shall start from the date of commissioning.

End of section

SECTION – VIII

13.0 GUARANTEE

The under mentioned clauses shall govern in case of any contrary provisions given elsewhere in the document.

13.1 Manufacturer's Guarantees

The manufacturer's guarantee for design, workmanship and performance for all bought out items shall be made available to the owner and shall be valid at least for the entire defects liability period.

In the event of failure of any particular equipment, which fails more than three items during the guarantee period as mentioned in clause below, the contractor shall replace at his own cost that equipment. Manufacturer's/Contractor's guarantee, as mentioned in clause above, for such replaced equipment shall also be made available to the Owner and should be kept at least for one year from the date of last replacement.

13.2 Performance Guarantee

The Contractor shall give guarantee for a period of one year from the date of successful commissioning of the treatment plant against design, defective materials, workmanship, performance and guaranteed effluent quality. In the event the commissioning of the plant is not possible due to non-availability of effluent, contractor shall be issued mechanical completion certificate by client/consultant provided each equipment is tested satisfactorily as directed by Consultant. However, the contractor shall have to maintain the plant at his own cost, in such a case for a period for three months beyond which period, if he is required to maintain further, he will be paid extra at mutually agreeable rate. However, the Contractor shall carry out testing and commissioning of the plant during the Defects Liability Period. Any defects found in the workmanship, materials or performance of the plant shall be made good by the Contractor at his own expense within the time specified by client/consultant.

13.3 For this purpose, the retention amount will be as follows:

10% of the total value of Contract shall be retained and also treated as performance guarantee. The Successful Tenderer as per general conditions of contract shall be retained till the completion of satisfactory commissioning as stated above. The contractor at his own expense shall start and

commission, the plant and prove that it is giving satisfactory service and desired characteristic of the treated effluent, for two months before handing over the plant to the Owner. During this, the contractor shall train the Owner's operational stall without any extra cost to the Owner. The Contractor shall also have to guarantee the quality of the treated final effluent to meet the specification mentioned already. In case the quality of treated effluent varies from what is required, the contractor shall rectify the plant at no extra cost so as to achieve the requisite performance guarantee and satisfactory commissioning of the plant to the client/Consultant. In Case the contractor fails to achieve any of the aforesaid guarantees he will be penalised by an amount up to 10% (ten percent) of the total contract value. For this purpose any money due to the contractor shall be forfeited and adjusted against such penalty.

The contractor shall furnish the figures for average daily consumption of nutrients / Chemicals, if any. All the above guarantees will be based on collection and analysis of samples as mentioned in clause below.

13.4 Oxygenation Capacity of Diffusers.

The contractor, if directed by Consultant, shall at his own cost prove the Oxygenation capacity guaranteed by him for the diffusers provided by conducting Oxygenation capacity tests on the unit by any standard and internationally recognized method to be approved by the Consultants.

13.5 MECHANICAL GUARANTEES

The Contractor shall guarantee for a period of one year for the failure of any particular part of the equipment. In the event of failure of any particular part of the equipment more than three times during the guarantee period, the Contractor shall replace it. In case it is found that the above mentioned failure is due to some other connected part of the equipment, that part shall also be rectified or replaced by the contractor to avoid such failures in the future. The guarantee for such replaced parts shall be extended by one year from the date of last replacement.

SECTION – IX

14.0 OPERATION AND MAINTENANCE

14.1 COLLECTION AND ANALYSIS OF SAMPLES

The guaranteed water & treated wastewater shall be based on complete analysis of samples collected after stabilization of the plant.

One Treated water & wastewater samples per month shall be collected and got analysed at the Pollution control Board approved Laboratory and should be submitted to consultant for approval Efficiency of plant and process after secondary clarifier should be presented to consultant by collecting sample at outlet of clarifier and analysing the sample for BOD_{5 days} and TSS.

14.2 ANNUAL MAINTENANCE

The contractor shall include in the offer for maintaining the treatment plant including all the consumables etc., qualified personnel shall be posted on the site on shift basis, to take the sampling and carry out the tests. A complete record has to be maintained for all the tests carried out at regular intervals.

One operator per shift and one supervisor during general shift based on 3 shifts/day shall be posted. The senior process Engineer of the contracting firm shall visit at least once a week for monitoring plant operation.

Also one Senior Mechanical Technician shall visit the plant for inspection and supervision of maintenance of all equipment.

End of section

SECTION – X

15.0 DATA SHEET

RAW SEWAGE PUMP

Flow rate lts/Sec : As per BOQ
 Discharge pressure : As per BOQ
 Motor : Electrical Supply
 Type : Voltage 415+/- 10%
 Make : Frequency 50
 Rating : No. Of Phases 3

SLUDGE TRANSFER PUMP

Flow rate lts/Sec : As per BOQ
 Discharge pressure : As per BOQ
 Motor : Electrical Supply
 Type : Voltage 415+/- 10%
 Make : Frequency 50
 Rating : No. Of Phases 3

Description	
Bar Screen Chamber	
Quantity	
Size	
MOC	
Screen Bars	

Raw Sewage Transfer Pumps	
Make	
Type	
Flow Rate (LPM)	
Head	
MOC	
Motor	
Make	
Type	
Rating	
RPM	
Air Blowers for Collection Sump, Aeration, Sludge sump & Treated Water Tank	
Make	
Flow	

Head	
MOC	
Type	
Coarse Bubble Diffusers	
Make	
Type	
Size	
MOC	
Fine Bubble Diffusers	
Make	
Type	
Size	
MOC	
Centrifugal desludger with decanting mechanism	
Make	
Type.	
MOC	
Quantity	
Capacity	
RPM.	
Dosing Pumps	
Make	
Type	
Service	
Flow range	
Max.Pressure	
MOC	
Quantity	
Load Details	

ANNEXURE - A

Project	:	
Building	:	
Client	:	
Contractor	:	
Non-Tendered Item no.	:	
Reference Drg. No.	:	
a) Issued by		
b) Revision no.		
c) Dated		
Location		
Unit		
Rate claiming		
Approx. Quantity		

<u>Detailed Specification</u>	:	
<u>Why Non-tendered Items</u>	:	

		Orally	In writing	Date
Authorized by	:			

Status of Non-tendered item:

	Quantity		
a) Executed			
b) Work in progress	Qty Executed		Balance Quantity
c) To be executed	Approximate quantity		
Contractors Signature			

SECTION - XI**LIST OF RECOMMENDED MAKES**

Raw effluent pump	Grundfos/xylem/johnson/ KSB
Sludge pumps	Johnson/Kirloskar/
Disinfection unit	Alfa level/Clariefontaine
Motors	Grundfos / ABB / equivalent make as approved by consultant
HDPE pipes	Supreme/ equivalent make as approved by consultant
cpvc pipes and fittings	Supreme / equivalent make as approved by consultant
Gate valves/Non-return valves	Leader / Audco/ L&T equivalent make as approved by consultant
Foot valves	Leader / Zoloto /equivalent make as approved by consultant
Butterfly valve	Audco / Lehry / equivalent make as approved by consultant
Deslugger	Clarie fontaine
Flow meter; (Both Inflow-Electromagnetic & Out flow meters-Ultrasonic type)	Clarie fontaine / Forbes marshall

LIST OF RECOMMENDED MAKES - ELECTRICAL COMPONENTS

ACB	ABB / MERLIN GERIN / SIEMENS
MCCB	ABB / MERLIN GERIN / SIEMENS
MPCB	ABB / MERLIN GERIN / SIEMENS
CONTACTORS / OLRS	ABB / MERLIN GERIN / SIEMENS
MCB / ELCB	LEGRAND / MERLIN GERIN / HAGER
MCB DB	LEGRAND / MERLIN GERIN / HAGER
INSTRUMENT TRANSFORMERS	KAPPA / PRAGATHI / INSTRANS
PROTECTION RELAYS	ABB / AREVA / MERLIN GERIN
DIGITAL METERS	AE / CONZERV / RISHAB
LED INDICATING LAMPS / PBS	TECHNIC / SIEMENS/ VAISHNO
INDUSTRIAL METAL CLAD PLUG & SOCKET	NEPTUNE / SCHNEIDER / GEWISS

PVC-FRLS INSULATED COPPER WIRES	RAJANIGANDHA / POWERFLEX / ANCHOR / SBEE
FRLS CONDUITS	VIP / PRECISION / AVON
MS CONDUITS	SUPREME / BHARATH / GB
LT CABLES	RPG / POLYCAB / UNIVERSAL / PRIMECAB
LT SINGLE-MULTI CORE COPPER CABLES	RAJANIGHANDA / FINOLEX / SBEE / POLYCAB
CONTROL CABLES	RPG / POLYCAB / UNIVERSAL
END TERMINATION MATERIALS	DOWELS / SMI / JAINSONS
LT PANEL BUILDERS	ELINS / LOTUS POWER GEAR / SEQUENT AUTOMATION
CABLE TRAY	STORACK / PATNI / TECHNOFAB/PROFAB
TVSS	ASCO / OBO / PHEONIX

Disclaimer:

1. The capacity of STP is fixed based on the Manpower headcount of 2545, details provided in the Masterplan document.
2. The proposed location of STP is behind Student activity center which is the lowest contour point, however same needs to be confirmed by NLSIU.
3. The capacities & assumptions are for the STP, WTP, Rainwater harvesting system, distribution network & sewage collection network is prepared for current Master plan details.
4. The design & Structural drawings shall be provided by the respective structural consultant based on the proposed layout and details for STP & WTP based on the site conditions and to be tendered out.
5. Rainwater harvesting pits are being proposed in the storm water drain areas as per the master plan layout.
6. Main Sewage manhole chamber depths shall be aligned and to depths shall be checked w.r.t the existing building chambers invert level and with adequate slope to be maintained and connected to the main sewer line.