



RAIPUR MUNICIPAL CORPORATION

AUGMENTATION OF WATER SUPPLY SCHEME PART -I, RAIPUR UNDER AMRUT MISSION

TENDER DOCUMENT Form "F" (Lump-sum Contract)

Name of Work: Augmentation of water supply scheme of Raipur under Amrut mission on Turnkey basis. (Form "F") including O & M for 5 years O & M of existing and proposed WTPs,CWPs & RWPs including PLC- SCADA automation, monitoring and Control system covering all existing & proposed , WTPs, CWPs, RWPs,OHSRs, FCVs, Electromagnetic& bulk flow meters complete

PAC-(For complete project including 5 years O & M of existing and proposed WTPs,CWPs & RWPs including PLC- SCADA automation, monitoring and Control system covering all existing & proposed WTPs, RWPs, CWPs ,OHSRs, electromagnetic bulk flow meters, FCVs complete)-

Rs.14316.19 Lakhs

COST OF TENDER DOCUMENT & BID PROCESSING FEE —Rs. 60,000.00

**Office of the Commissioner
Municipal Corporation, Raipur
Chhattisgarh**

Web Site: www.municipalcorporationraipur.com

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TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

INDEX

S.No.	CONTENTS	PAGE No.
1	Salient Features of Tender	6
2	Notice Inviting Tender (In English)	7
3	Detailed Notice Inviting Tender	9
4	Form “F” – Tender for Lump Sum Contract	42
5	Conditions of Contract	43
6	Annexure - “A”- Model Rules relating to labour, water supply and sanitation etc.	49
7	Annexure - “B”- Contractor’s Labour Regulations	51
8	Annexure “C” - Statement showing the Lead of Materials	52
9	Special conditions of contract	53
10	Annexure “D” - Form of Income Tax Clearance Certificate	54
11	Annexure - “E-I”- Specifications of Raw Water Pumps,Clear water Pumps and substation	55
12	Annexure – E-II- WTP(80MLD) based on Lamella Clarifier & recirculation of used back wash water ---Mechanical Works --Civil Works	102
13	Annexure - “E-III”- Specifications for Water Pumping Main & Distribution network	151
14	Annexure E-IV: OHSR	199
15	Annexure E-V: O & M of WTP, Raw Water P/House, Clear water p/House , PLC-SCADA 80 MLD WTP	214
16	Annexure E-VI: PLC-SCADA Automation system	229
17	Annexure E- VIII: Ancillary Civil works	
18	Annexure “F-” – Main Breakup of payment -Price Schedule	301
19	Annexure “F1”- Clear water Pumps—Price Schedule	310
20	Annexure F-2—OHSRs—Price Schedule	310

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

21	Annexure F-3—Raw water,clear water rising mains,distribution networks,house service connections etc –Price Schedule	333
22	Annexure F-4—WTP 80 MLD	333
23	Annexure F-5—Operation and maintenance	341
24	Annexure “G-1” – Guarantee Bond Annexure G-II—Guarantee Bond	342 344
25	Annexure “H” – Special Conditions of NIT	346
26	Annexure “I” - INFORMATION & INSTRUCTIONS TO THE BIDDERS FOR ONLINE ELECTRONIC GOVERNMENT PROCUREMENT SYSTEM (e-GPS).	351
27	Annexure – ‘J’ Pre contract Integrity Pact	354
28	Performance Security for Works & O&M Period of Contract	360
29	Appendices	

LIST OF DRAWINGS

S. No.	Drawing Name	Drawing No.	Sheet No.
	WARD MAP OF RAIPUR CITY INCLUDING 7 VILLAGES	IPE/AMRUT/CG/R/WS-01	1
	INDEX MAP SHOWING PROJECT AREA	IPE/AMRUT/CG/R/WS-02	1
	PROPOSED ZONES	IPE/AMRUT/CG/R/WS-03	1
	EXISTING INTAKE & RAW WATER FEEDER MAIN ALIGNMENT UPTO EXISTING& PROPOSED 150 MLD WTP	IPE/AMRUT/CG/R/WS-04	1
	LAYOUT OF EXISTING WTPs (150 MLD, 80 MLD & 47.7 MLD)	IPE/AMRUT/CG/R/WS-05	1
	LAYOUT OF EXISTING & PROPOSED WTP (EXISTING WTP OF 150 MLD, 80 MLD & 47.7 MLD AND PROPOSED WTP OF 80 MLD CAPACITY) AND INTER CONNECTION OF SUMP	IPE/AMRUT/CG/R/WS-06	1
	EXISTING FEEDER MAIN & OHRs OF 150 MLD WTP	IPE/AMRUT/CG/R/WS-07	1
	EXISTING FEEDER MAIN & OHRs OF 80 MLD WTP	IPE/AMRUT/CG/R/WS-08	1
	EXISTING FEEDER MAIN & OHRs OF 47.7 MLD WTP	IPE/AMRUT/CG/R/WS-09	1
	EXISTING & PROPOSED FEEDER MAIN & OHRs FEEDING FROM 180 MLD (150+30) WTP PS	IPE/AMRUT/CG/R/WS-10	1
	EXISTING& PROPOSED FEEDER MAIN & OHRs FEEDING FROM 50.0 MLD PS of 80 MLD WTP	IPE/AMRUT/CG/R/WS-11	1
	OHR AMASEONI – WATER DISTRIBUTION NETWORK SHOWING DMAs	IPE/AMRUT/CG/R/WS-12	1
	OHR AMASEONI – WATER DISTRIBUTION NETWORK DRAWING	IPE/AMRUT/CG/R/WS-13	8
	OHR AMASEONI – WATER DISTRIBUTION NETWORK DESIGN	IPE/AMRUT/CG/R/WS-14	6
	OHR KACHNA – WATER DISTRIBUTION NETWORK SHOWING DMAs	IPE/AMRUT/CG/R/WS-15	1
	OHR KACHNA – WATER DISTRIBUTION NETWORK DRAWING	IPE/AMRUT/CG/R/WS-16	13
	OHR KACHNA – WATER DISTRIBUTION NETWORK DESIGN	IPE/AMRUT/CG/R/WS-17	2
	OHR JORA – WATER DISTRIBUTION NETWORK SHOWING DMAs	IPE/AMRUT/CG/R/WS-18	1
	OHR JORA – WATER DISTRIBUTION NETWORK DRAWING	IPE/AMRUT/CG/R/WS-19	5
	OHR JORA – WATER DISTRIBUTION NETWORK DESIGN	IPE/AMRUT/CG/R/WS-20	6
	OHR DEVPURI & DUMARTARI – WATER DISTRIBUTION NETWORK SHOWING DMAs	IPE/AMRUT/CG/R/WS-21	1

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

S. No.	Drawing Name	Drawing No.	Sheet No.
	OHR DEVPURI & DUMARTARI – WATER DISTRIBUTION NETWORK DRAWING	IPE/AMRUT/CG/R/WS-22	26
	OHR DEVPURI & DUMARTARI – WATER DISTRIBUTION NETWORK DESIGN	IPE/AMRUT/CG/R/WS-23	12
	OHR BORIAKHURD & DUNDA – WATER DISTRIBUTION NETWORK SHOWING DMAs	IPE/AMRUT/CG/R/WS-24	1
	OHR BORIAKHURD & DUNDA – WATER DISTRIBUTION NETWORK DRAWING	IPE/AMRUT/CG/R/WS-25	22
	OHR BORIAKHURD & DUNDA – WATER DISTRIBUTION NETWORK DESIGN	IPE/AMRUT/CG/R/WS-26	11
	STANDARD DRAWINGS		
	TYPICAL TRENCH PIPE CROSS SECTION	IPE/AMRUT/CG/R/WS-27	1
	SLUICE VALVE CHAMBER – TYPE S1 & S2	IPE/AMRUT/CG/R/WS-28	1
	BUTTERFLY VALVE CHAMBER – TYPE B1,b2 & b3	IPE/AMRUT/CG/R/WS-29	1
	WASHOUT VALVE CHAMBER ON LINE TYPE W1	IPE/AMRUT/CG/R/WS-30	1
	AIR VALVE CHAMBER, type a1,a2,a3	IPE/AMRUT/CG/R/WS-31	1
	FLOW METER CHAMBER – type f1 & f2	IPE/AMRUT/CG/R/WS-32	1
	THRUST BLOCK – H BEND	IPE/AMRUT/CG/R/WS-33	1
	THRUST BLOCK – V BEND	IPE/AMRUT/CG/R/WS-34	1
	TYPICAL HOUSE CONNECTION	IPE/AMRUT/CG/R/WS-35	1
	GA DRAWING OF OHR	IPE/AMRUT/CG/R/WS-36	1
	SINGLE LINE DIAGRAM OF 80 MLD WTP	IPE/AMRUT/CG/R/WS-37	1

SALIENT FEATURES OF THE TENDER

1.	Name of work	Augmentation of water supply scheme of Raipur under AMRUT mission on Turnkey basis. (Form “F”) including O & M for 5 years O & M of existing and proposed WTPs,CWPs & RWPs including PLC- SCADA automation, monitoring and Control system covering all existing & proposed , WTPs, CWPs, RWPs,OHSRs, FCVs, Electromagnetic& bulk flow meters complete
2.	Name of contractors A. Class of Contractor registered in Appropriate Class B. Postal Address C. Telephone Number & Email ID	...............
3.	Probable amount of contract	[For complete project including 5 years O & M of existing and proposed WTPs,CWPs & RWPs including PLC- SCADA automation, monitoring and Control system covering all existing & proposed WTPs, RWPs, CWPs ,OHSRs, electromagnetic bulk flow meters, FCVs complete] Rs.14316.19 Lakhs
4.	Earnest Money	Rs. 7158000.00 (Rupees Seventy one lakhs and fifty eight thousand only)
5.	Date of Issue	14 th March 2017
6.	Money receipt no. and date	

Note - This tender document with Annexure and notice inviting tender shall be part of the agreement.
Signature and seal of contractor/firm or his authorised representative

**Commissioner
Municipal Corporation
Raipur, Chhattisgarh**

NOTICE INVITING TENDER

NIT. No.

RAIPUR/Dated:

Date of Issue of N.I.T: 14-3-2017

Date of receipt of tender: Upto 1730 HRS on 22-4-2017

Online tender are invited by the Commissioner, Municipal Corporation, Raipur for the following work in **Form “F”** for lump Sum contract from the contractors registered in Class ‘A’ with Unified Registration System (Single Window) on GoCG PWD e-Procurement System Portal (<https://cgeprocurement.gov.in>) through sub portal <https://uadd.cgeprocurement.gov.in>

Group No.	Name of work	Probable amount of contract (Rs. in lacs)	Earnest money (Rs. in lacs)	Time allowed for completion (including rainy season)	Bid Submission fee & Cost of Tender Document	Validity of offer (opening or of financial offer)	Class of Contract
1	2	3	4	5	6	7	8
1.	Augmentation of water supply scheme of Raipur under AMRUT Mission on Turnkey basis. (Form “F”) including O & M for 5 years O & M of existing and proposed WTPs,CWPs & RWPs including PLC-SCADA automation, monitoring and Control system covering all existing & proposed , WTPs, CWPs, RWPs,OHRSRs, FCVs, Electromagnetic& bulk flow meters complete	Rs.14316.19 Lakhs	Rs. 71.58 lakhs (Rupees Seventy one lakhs and fifty eight thousand only)	30 Months including rainy season from the date of issue of work order.	Rs 60,000.00 (Rupees Sixty Thousand only) Payable at the time of Bid Preparation and Hash Submission through online payment Gateway.	120 days	In Class ‘A’

The tender documents containing detailed terms & conditions are available for free download on GoCG e-Procurement portal (<http://eproc.cgstate.gov.in>) Bidders have to quote online their prices along with Technical and Commercial bids in prescribed formats on the above mentioned portal only.

The Bidders intending to participate in this Tender are required to get enrolled on the above mentioned website. Enrolment on the above mentioned Portal is mandatory. As the online Bids are required to be digitally signed, Bidders are required to obtain Class – II Digital Signature Certificates (DSCs). The Bidders may contact M/s Mjunction Service Ltd., on helpdesk Toll free number **18002582502 or through Email ID – helpdesk.eproc@cgswan.gov.in or they may contact to Mr. Shailesh Kumar Soni, Sr. Manager, Chhattisgarh Infotech and Biotech Promotion Society (CHIPS) on Tel. No. **0771-4014158** or email- pro-chips@nic.in**

The Bidders are also invited to get themselves trained on the operations of the e-Procurement System.

Bidders may get in touch with the Service Provider of the e-Procurement System for confirming the time and date for their training session.

A prebid meeting in this context shall be held in the office of the Commissioner Raipur Municipal Corporation on ____ ____2017 for preparation of Corrigendum/Ammendments /Clarifications on the basis of which the contractors shall quote their offers.

Endt. No...../2017

Copy forwarded to :-

1.
2.
4. Notice Board.

**Commissioner
Municipal Corporation
RAIPUR, Chhattisgarh**

**MUNICIPAL CORPORATION RAIPUR,
CHHATTISGARH
DETAILED NOTICE INVITING TENDER**

NIT. No.

RAIPUR/Dated :

Date of Issue of N.I.T: 14-3-2017

Date of receipt of tender: Upto 1730 HRS on 12-4-2017

Online tender for the works mentioned below are invited by the Commissioner, Municipal Corporation, RAIPUR for the following work in Form “F” for lump Sum contract from the contractors registered in class A with Unified Registration System (Single Window) on GoCG PWD e-Procurement System Portal (<https://cgeprocurement.gov.in>) through sub portal <https://uadd.cgeprocurement.gov.in>.

Group No.	Name of work	Probable amount of contract (Rs. in Lacs)	Earnest money (Rs. in Lacs)	Time allowed for completion (including rainy season)	Bid Submission fee & Cost of Tender Document	Validity of the Offer	Class of the Contractor
1	2	3	4	5	6	7	
1.	<p>Augmentation of water supply scheme of Raipur under AMRUT Mission on Turnkey basis. (Form “F”) including O & M for 5 year O & M of existing and proposed WTPs,CWPs & RWPs including PLC- SCADA automation, monitoring and Control system covering all existing & proposed , WTPs, CWPs, RWPs,OHSRs, FCVs, Electromagnetic& bulk flow meters complete as given below:-</p> <p>I. Provision of Clear Water Rising Main from 150 MLD WTP, 80 MLD WTP and New 80 MLD WTP to Existing and 7 no. proposed OHSRs installation and commissioning with 12 months trial run as given below:-- 50mm dia.- length 105m, 200mm dia.- length 462m, 250mm dia.- length 5027m,</p>	Rs.14316.19 Lakhs	Rs. 71.58 Lacs (Rupees Seventy one lakhs and fifty eight thousand only)	30 months	Rs. 60,000.00 (Rupees Sixty Thousand only) payable at the time of Bid Preparation and Hash Submission through online payment Gateway.	120 days	In Class ‘A’

<p>300mm dia.- length 7627m, 350mm dia.- length 1315m, 400mm dia.- length 2444m, 500mm dia.- length 5300m, 700mm dia.- length 116m, 900mm dia.- length 78m, Total length 22.474 Km, DI Class K-9 pipe. M.S. pipe 300mm dia 8 mm thk length 50m, M.S. pipe 600 mm dia 10 mm thk length 50m, MS Pipe,Dia 1000 mm 10mm thick 400 m.</p> <p>II. Construction of five no. OHSRs of total capacity 7500 kL complete with inlet , outlet over flow and wash out pipes , water tightness testing and 12 months trial run complete :</p> <ul style="list-style-type: none"> i. Ama Seoni, 1000 KL with Staging 18 Meters ii. Kachana, 1000 KL with Staging 18 Meters iii. Jora, 1000 KL with Staging 18 Meters) iv. Devpuri (1 No. of 2000 KL with Staging 20 Meters) v. Boria khurd (1 No. of 2500 KL with Staging 20 Meters) <p>III. Provision of Distribution Network total length 166.64 Km with DI K-7 Pipe with dia. {From 100mm to 600mm}complete with 12 months trial run as given below:-</p> <p>100mm dia.- length 125708m, 150mm dia.- length 19159m, 200mm dia.- length 10014m, 250mm dia.- length 5406m, 300mm dia.- length 3144m, 350mm dia.- length 1523m, 400mm dia.- length 240m, 500mm dia.- length 1411m, 600mm dia.- length 33m</p>					
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<p>MS pipe,200 mm dia-100m MS pipe,300 mm dia-50m MS pipe,400 mm dia-100m MS pipe,600 mm dia-50 m</p> <p>IV. Provision of House Service Connection 7,604 nos. with AMR Compatible water meter including GIS Mapping, Consumer survey & Billing application complete with 12 months trial run.</p> <p>V. Provision of Electromechanical works for Inkate well for 150 MLD (Sagar) complete</p> <p>VI. Provision of Construction of 80 MLD WTP (lamella clarifier Type) at Rawan bhata, existing WTP premises including all treatment units (with 20 % overloading), all electro mechanical equipment with recirculation of wastewater and sludge with PLC-SCADA automation , monitoring and control system, complete.</p> <p>VII. Construction of Recirculation system including Sludge Sump, Thickeners, Thickener feed pumps, Thickened Sludge sump, Centrifuges, Centrifuge feed pumps, Supernatant and Centrale collection sump and recycle pumps, DWPE dosing system, centrifuge building, etc. for 230 MLD (150 + 80) existing WTPs complete.</p> <p>VIII. Provision of electromechanical works for (150 MLD WTP + 30 MLD from new 80 MLD WTP) 180 MLD, HSC Pumps - 2046 Cum/hr discharge @ 65 m head (4W+2S) complete.</p> <p>IX. Provision of Electro-mechanical works for Existing 80 MLD WTP,HSC Pumps -995</p>						
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<p>Cum/hr discharge @ 45 m head - 04 Nos complete.</p> <p>X. Provision of Electro-mechanical works for Proposed 80 MLD WTP, HSC Pumps - 620 Cum/hr discharge @ 60 m head (4W+2S) including Installation, Testing, Commissioning and shifting to old Transformer, Cable and Pole etc. From Existing 47.5 MLD WTP to Proposed 80 MLD WTP</p> <p>XI. Dismantling of Existing Pumping Machinery & Installation of same in existing 80 MLD Intake well, Existing 150 MLD Intake well, Existing 150 MLD CWPH & Existing 80 MLD CWPH and to be handed over to PHED Raipur.</p> <p>XII. Provision of Electromagnetic Flow meter (For Distribution network including OHT outlets & DMA= 21 nos. and For Feeder Main Flow meters =46 nos. dia. From 100mm to 1200 mm) and Flow control with Level Control valves (38 nos. for all OHSRs) complete with 12 months trial run.</p> <p>Details as below EMF dia. 100mm 2 nos., dia. 150mm 6 nos., dia. 200mm 3 nos., dia. 250mm 3 nos., dia. 300mm 10 nos. dia. 400mm 28 nos. dia. 500mm 10 nos. dia. 600mm 2 nos., dia. 900mm 1 nos., dia. 1000mm 1 nos., dia. 1200mm 1 nos. FCV- dia. 250mm 1 nos., dia. 300mm 5 nos., dia. 400mm 23 nos., dia. 500mm 8 nos., dia. 600mm 1 nos.</p> <p>XIII. Provision of PLC - SCADA automation monitoring and control system complete covering Works for 80 MLD ,</p>						
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TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

	<p>150 MLD Intake well, 150 MLD WTP, 80 MLD WTP, New 80 MLD WTP & 38 nos. OHSRs, electromagnetic bulk flow meters FCVs complete</p> <p>XIV. Miscellaneous works for Construction of internal Roads of Proposed WTP complex, Compound wall with Gate at Proposed Five nos. OHSR sites complete.</p>					
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Note:

1. Registration and subsequent empanelment for e-tendering website (<https://eproc.cgsstate.gov.in>) and department's sub-portal is mandatory.
2. The tender documents containing detailed terms & conditions are available for free download on GoCG e-Procurement portal (<http://eproc.cgstate.gov.in>) Bidders have to quote online their prices along with Technical and Commercial bids in prescribed formats on the above mentioned portal only.
3. The Bidders intending to participate in this Tender are required to get enrolled on the above mentioned website. Enrolment on the above mentioned Portal is mandatory. As the online Bids are required to be digitally signed, Bidders are required to obtain Class – II Digital Signature Certificates (DSCs). The Bidders may contact M/s Mjunction Service Ltd., on **helpdesk Toll free number 18002582502** or through Email ID – **helpdesk.eproc@cgswan.gov.in** or they may contact to Mr. Shailesh Kumar Soni, Sr. Manager, Chhattisgarh Infotech and Biotech Promotion Society (CHIPS) on Tel. No. 0771-4014158 or email- **pro-chips@nic.in**.
4. **Validity of offer - 120 days from date of opening of financial offer.**
5. **Pre-bid Meeting** shall be held in the office of the Commissioner RAIPUR Municipal Corporation on **3rd April 2017, at 1200 HRS (Noon)**. The contractors shall give their suggestions and conditions in writing based on which Corrigendum/Amendments/ Clarifications shall be framed and uploaded.
6. The Technical offer shall be opened in presence of the Bidders or their authorized representatives, who may choose to be present. The date and place of opening of financial offer will be intimated to the Bidders subsequently after opening of technical offer.
7. The Tenderers are required to submit 'Envelope "A" and "B"' physically as per dates Indicated in Key Dates. The Physical Envelope 'A' should contain the following: -
 - i. The Earnest Money, of **Rs 7158000.00 (Rupee Seventy one Lakhs fifty eight thousand only) in the form of FDR of a Nationalised /Scheduled bank of India in** favour of the "Commissioner, Municipal Corporation, RAIPUR" payable at 'RAIPUR' which will be returned to the unsuccessful Bidders after the award of contract. The bank should have a local branch in RAIPUR. The Earnest Money of the successful Bidders will be retained as part of the Security Deposit.
 - ii. Also the technical Bid shall be submitted physically but the financial offer shall be submitted online. In all cases the submission which is online shall prevail.

Technical Pre-qualification Criteria	
The minimum eligibility criteria in respect of particular experience to be fulfilled by the applicant are as under:---	
(a)	The bidder should have executed/completed Procurement Construction / Design-Build / Design-Build-Operate contract including design, installation, supply, construction, testing and commissioning successfully of following works within the last five years
(i)	Providing and laying, jointing, testing & Commissioning of water supply pipelines of 50 % of largest diameter ie. $(900/2)=450$ mm) of a minimum half of the total length of largest diameter ie. $78/2 = 39$ m. overall quantity laid of diameter 100mm and above should not be less than half of the desired combined estimated length i.e $(189.11/2)=95$ KM in a single contract or in multiple contracts
(ii)	At least one completed drinking Water Treatment Plant of at least 50% of the required capacity ie. $(80/2)= 40$ MLD in a single contract.
(iii)	Over Head Service Reservoir of at least 50% of the desired combined capacity $(7500/2)= 3750$ KL) with atleast one OHSR of minimum 1000 kL @ 20 m staging in a single or multiple contracts
(iv)	a) Pump– motor works of at least 50% of the desired capacity including all civil, mechanical and electrical works under a single or multiple contracts. <ol style="list-style-type: none"> i. Raw water V.T Pumps of total discharge capacity i.e $10820/2=5410$ cum/hr ii. Clear water Horizontal centrifugal Pumps of total discharge capacity ie. $(14644/2)=7322$ cum /hr

TECHNICAL PREQUALIFICATION CRITERIA FOR SUPPLYING & FIXING OF CONSUMER METERS

1. Manufacturer's written authorization **who fulfills the the specifications of meters as** specified in the Annexure E of the Bid documents will have to be submitted alongwith the tender.
2. Authorization must be submitted on Rs.100 stamp paper, duly stamped and signed by manufacturer's authorized signatory
3. In case supplier fails to supply the mentioned quantity, RMC reserve the right to permit the use of other make having quality as per specifications.
4. Manufacturer must have capacity to manufacture 10000 meters per month.
5. The manufacturer or bidder must have in-house computerized calibration test bench to offer after sales service in India.
6. The Tenderer must offer three years warranty against manufacturing defect, backed by supplier / manufacturer after installation and commissioning of watermeters.
7. The contractor who was blacklisted anywhere in India or abroad in last 5 years or stopped/abandoned /was asked to stop metering job, will not be eligible to bid for this tender. The contractor shall submit an affidavit in this regard.
8. Tenderer should submit necessary company incorporation certificate.

Technical Prequalification Criteria for Provision of PLC –SCADA Monitoring and Control System

1. Bidder should be a System integrator of Sensors (Flow, Pressure, level)/ PLC-SCADA Systems/ Water quality monitoring systems
2. If bidder is Not Manufacturer or a Authorized Dealer or system Integrator of Sensors (Flow, Pressure, level) /PLC-SCADA Systems, Water quality monitoring systems, then the Bidder should form MOU on One Hundred Rupee Stamp Paper with the Manufacturer/Authorized Dealer of Sensors (Flow, Pressure, level)/PLC-SCADA Systems/ Water quality monitoring systems.
3. The Manufacturer /Authorized Dealer should have Experience of successful installation and commissioning of automation in single or multiple contracts of water supply with automation at head works and pumping Machinery operations / WTP and water quality monitoring / ESR operations
4. The bidder should submit the Manufacturer /Authorized Dealer experience certificate from the officer not below the rank of Superintendent Engineer in PHED/Municipal Corporation of any state Govt/Central Govt.
5. For Automation, certificates issued by Private listed Organizations can also be considered if supported by valid documents
6. Experience for the maintenance of Instrumentation including Sensors (Flow, Pressure, and level)/Automation systems for 3 years is must.

**Commissioner
Municipal Corporation
RAIPUR, Chhattisgar**

FINANCIAL PRE-QUALIFICATION AS PER LATEST NORMS

To qualify in the Tender each Tenderer must have in last Five years

Cost of Package I	Details	Rs. Lacs	In	Rs. 14316.19 Lakhs
1	Achieved in "any one financial year" a financial turnover (in all classes of Construction Works related to Water Supply works) value of construction work of at least 60% (Sixty percent) the amount equal to the probable amount of contract for which bid has been invited. AND	Rs. Lacs	In	
2	Satisfactorily completed at least one water supply work equal in value 40% (forty percent) of the Probable amount of contract as on date of submission of financial offer. OR	Rs. Lacs	In	
3	Satisfactorily completed at least two water supply works total costing equal to value 40% (forty percent) of the probable amount of contract for which the tender is invited as on date of submission of financial offer. OR	Rs. Lacs	In	
4	Satisfactorily executing at least one water supply work having received payment of value not less than 40% (forty percent) OR Two water supply works having received aggregate payment of value not less than 40% (forty percent) of the value of probable amount of contract as on date of submission of financial offer. OR	Rs. Lacs	In	
5	One water supply work completed & satisfactorily executing one water supply work Total aggregate value in both the water supply works shall be minimum 40%(forty percent) of the value of probable amount of contract for which tender is invited as on date of submission of financial offer. Note: - 1) The turn over shall be indexed at the compounded rate of 10% (Ten percent) for each earlier year. Note (2) (1) The value of completed work shall be updated to the value of current financial year @ compounded rate of 10% (Ten percent) per year from completion year of work	Rs. Lacs	In	

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

The Key Dates of Tender are

Seq No	RAIPUR MUNICIPAL CORPORATION	Supplier Stage	Start Date & Time	Expiry Date & Time	Envelopes
1	Tender Preparation and Release of NIT	-			-
2	-	Tender Download	.....	.....	EMD Envelope, Technical Envelope, Price Bid Envelope
3	-	Submit Bid-Hash Online and Payment	.....	.....	EMD Envelope, Technical Envelope, Price Bid Envelope
4	Pre bid meeting for General Conditions		.....	
5	Short listing of Terms and Conditions				
6	Preparation of Common set of Conditions				
7	Close for bidding(Generation of Super-Hash)	-	.....		EMD Envelope, Technical Envelope, Price Bid Envelope
8	-	Submit Bids Online	.....		EMD Envelope, Technical Envelope, Price Bid Envelope
9	Open Envelope-A	-	.....		EMD Envelope
10	Evaluation and Shortlisting of Envelope - A	-			EMD Envelope
11	Open Envelope-B	-	.....		Technical Envelope
12	Evaluation and Shortlisting of Envelope -B	-			Technical Envelope
13	Open Envelope - C (Price Bid)	-	.....		Price Bid Envelope
14	Evaluation and Shortlisting of Envelope - C	-			Price Bid Envelope
15	View Lump Sum Form	-			Price Bid Envelope
16	Tender Award	-	.....		Technical Envelope, Price Bid Envelope

8. Other condition including qualification and details of work can be seen in the office of the undersigned during office hours and downloaded online directly from the portal (<http://eproc.cgstate.gov.in>) through Urban administration & Development Department sub portal and shall be submitted online on or before **22-4-2017 up to 17:30 P.M.** This NIT shall also form the part of agreement. The details can be viewed on the website (<http://eproc.cgstate.gov.in>) from **16-3-2017 17:31 PM** onwards.

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Valid registration in Class ‘A’ with with Unified Registration System (Single Window) on GoCG PWD e-Procurement System Portal (<https://cgeprocurement.gov.in>) through sub portal <https://uadd.cgeprocurement.gov.in>

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- Note:- a) **No Joint ventures shall be allowed for the bidding process**
b) **The experience for last five years shall only be considered for prequalification criteria**

9.0 Payment for Service Provider Fees: In addition to the Tender Document Fees payable to Municipal Commissioner RAIPUR, the Contractors will have to pay Service Providers Fees of Rs.through online payments gateway service available on Electronic Tendering System. For the list of options for making online payments, the Contractors are advised to visit the link E-Payment Options under the section E-Tendering Toolkit for Bidders on the Home Page of the Electronic Tendering System

Steps to be followed by Contractors to participate in the e-Tenders

I. Registration in Class ‘A’ in Unified Registration (Single Window) System on (<https://eproc.cgsstate.gov.in>) and subsequent empanelment for e-tendering website (<https://eproc.cgsstate.gov.in>) and department’s sub-portal is mandatory.

II--. Online viewing of Detailed Notice Inviting Tenders:

The Contractors can view the Detailed Tender Notice along with the Time Schedule (Key Dates) for all the Live Tenders on the Portal (<https://eproc.cgsstate.gov.in>) and <https://municipalcorporationRAIPUR.com>

III--. Download of Tender Documents:

The Pre-qualification / Main Bidding Documents are available for free downloading. However to participate in the online tender, the bidder must deposit Bid Processing and tender document fee online by filling up details of Demand Draft .

IV--. Online Bid Preparation and Submission of Bid Hash (Seal) of Bids:

Submission of Bids will be preceded by online bid preparation and submission of the digitally signed Bid Hashes (Seals) within the Tender Time Schedule (Key Dates) published in the Detailed Notice Inviting Tender. The Bid Data is to be prepared in the templates provided. The templates may be either form based,

extensible tables and / or uploadable documents. In the form based type of templates and extensible table type of templates, the Contractors are required to enter the data and encrypt the data using the Digital Certificate.

In the uploadable document type of templates, the Contractors are required to select the relevant document / compressed file (containing multiple documents) already uploaded in the briefcase.

Notes:

A The Contractors upload a single document or a compressed file containing multiple documents against each unuploadable option.

B. The Hashes are the thumbprint of electronic data and are based on one – way algorithm. The Hashes establish the unique identity of Bid Data.

C. The bid hash values are digitally signed using valid Digital Certificate issued any Certifying Authority. The Contractors are required to obtain Digital Certificate in advance. **The Bidders may contact M/s Mjunction Service Ltd., on helpdesk Toll free number 18002582502 or through Email ID – helpdesk.eproc@cgswan.gov.in or they may contact to Mr. Shailesh Kumar Soni, Sr. Manager, Chhattisgarh Infotech and Biotech Promotion Society (CHIPS) on Tel. No. 0771-4014158 or email- pro-chips@nic.in**

D. After the hash value of bid data is generated, the Contractors cannot make any change / addition in its bid data. The bidder may modify bids before the deadline for Bid Preparation and Hash Submission as per Time Schedule mentioned in the Tender documents.

V- Close for Bidding (Generation of Super Hash Values):

After the expiry of the cut – off time of Bid Preparation and Hash Submission stage to be completed by the Contractors has lapsed, the Tender will be closed by the Tender Authority. Tender Authority shall generate and digitally sign the Super Hash

VI--Decryption and Re-encryption of Bids (submitting the Bids online):

After the time for generation of Super Hash values by the Tender Authority has lapsed, the Contractors have to make the online payment of Rs. 1,038/- towards the fees of the Service Provider.

After making online payment towards Fees of Service Provider, the Contractors are required to decrypt their bid data using their Digital Certificate and immediately re-encrypt their bid data using the Public Key of the Tendering Authority. The Public Key of the Tendering Authority is attached to the Tender during the Close for bidding stage.

Note: The details of the Processing Fees shall be verified and matched during the Technical Opening stage. At this time, the Contractors are also required to upload the files for which they generated the Hash values during the Bid Preparation and Hash Submission stage.

The Bid Data and Documents of only those Contractors who have submitted their Bid Hashes (Seals) within the stipulated time (as per the Tender Time Schedule), will be available for decryption and re-encryption and to upload the relevant documents from Briefcase. A Contractor who has not submitted his

Bid Preparation and Hash Submission stage within the stipulated time will not be allowed to decrypt / re-encrypt the Bid data / submit documents during the stage of Decryption and Re-encryption of Bids (submitting the Bids online).

10.0 Documents Comprising the Bid

I-- Technical Bid – (Envelope ‘A’)

- 1) EMD---A Scanned Copy of FDR drawn in favour of “**Municipal Commissioner RAIPUR**” payable at “**RAIPUR**” towards Earnest Money Deposit as specified in the Notice Inviting Bid.
- 2) Bid processing fee & Cost of tender ---- Scanned Copy of DD drawn in favour of “**Municipal Commissioner RAIPUR**” payable at “**RAIPUR**” towards Bid processing fee & cost of tender document as specified in the Notice Inviting Bid.

II-- Pre-Qualification Details (Envelope ‘B’)

- a) Registration in Class ‘A’ In Unified Registration System (Single Window) on GoCG PWD e-Procurement System Portal of Chhattisgarh (<https://eproc.cgstate.gov.in>) through sub portal <https://uadd.cgeprocurement.gov.in>
- b) Valid Commercial Tax Certificate of Chhattisgarh
- c) Experience certificate of successful completion of work of similar work in last 05 years i. e., 2011 to 2016 as indicated in Technical PQ criteria.
- d) Details of work in hand with their value.
- e) Financial Turn Over of similar works for the last **5 years** (upto 31/3/2016) certified by a Chartered Accountant.
- f) ITR of last 05 years & PAN Card, TIN No.
- g) List of Tools & Plants available with bidder
- h) Power of Attorney/Letter of authorization to sign the bid
- i) Partnership deed /MOA of company
- j) Declaration for NOT BEING BLACKLISTED
- k) BID CAPACITY
- l) Affidavit regarding not being declared CDR by any bank
- m) Undertaking for validity of bid for 120 days.
- n) Appendix ‘1’ Qualification Information
- o) Appendix ‘2’ Experience of similar nature of work
- p) Appendix ‘3’ List of other construction work
- q) Appendix ‘4’ Existing Commitments
- r) Appendix ‘5’ Machinery available with the tenderer
- s) Appendix ‘6’ Technical Personnel available with the tenderer
- t) Appendix ‘7’ Financial report
- u) Appendix ‘8’ Current claims and arbitration
- v) Appendix ‘9’ List of plants and machinery required
- w) Appendix ‘10’ List of plants and machinery to be deployed
- x) Appendix ‘11’ List of personnel to be deployed

- y) Appendix '12' Contact persons (Clients for whom the work has been carried out by the bidder)
- y) Appendix '13' Affidavit

**Commissioner
Municipal Corporation
RAIPUR, Chhattisgarh**

III- Technical Details & Declaration

- a) Proposed work programme (work method, time schedule and financial flow), Description, and charts as necessary (Duly to be signed digitally) to comply with the requirement of the Bidding Document.
- b) Methodology to be used for carrying out this proposed Water Supply Scheme

IV – Financial Bid – (Envelope 'C')

- i) Duly Quoted for Construction and Operation & maintenance period separately. For construction Bidder has to quote in Part-A and for O&M for 5 years in Part B.

NOTE:- a) All the documents should be digitally signed.

11.0 Bid Opening and Evaluation

Bid Opening

- (1) The Municipal Corporation RAIPUR will open the bids received (except those received late). In the event of the specified date for the submission of bids being declared a holiday for Municipal Corporation RAIPUR, the Bids will be opened at the appointed time and location on the next working day.
- (2) The files containing the technical bid shall be opened. The document marked “cost of bidding document” will be opened first and if the cost of the bidding documents is not there, or incomplete, the remaining bid documents will not be opened, and bid will be rejected.
- (3) In all other cases, the amount of Earnest Money, forms and validity shall be announced. Thereafter, the bidders' names and such other details as the Municipal Corporation RAIPUR may consider appropriate, will be announced by the Municipal Corporation RAIPUR at the opening.
- (4) The Municipal Corporation RAIPUR will prepare minutes of the Bid opening, including the information disclosed to those present in accordance with relevant Clause of NIT.
- (5) Evaluation of the technical bids with respect to bid security, qualification information and other information furnished in Part I of the bid in pursuant to relevant Clause of NIT shall be taken up and completed and a list will be drawn up of the responsive bids whose financial bids are eligible for consideration.

- (6) The Municipal Corporation RAIPUR shall inform, by email, telegram or fascimal, the bidders, whose technical bids are found responsive, date, time and place of opening as stated in the Notice Inviting Bid.
In the event of the specified date being declared a holiday for the Municipal Corporation RAIPUR, the bids will be opened at the appointed time and location on the next working day through they or their representative, may attend the meeting of opening of financial bids.
- (7) At the time of the opening of the 'Financial Bid', (**Envelope 'C'**) the names of the bidders whose bids were found responsive in accordance with relevant clause of NIT will be announced. The financial bids of only these bidders will be opened. The responsive bidders' names, the Bid prices, the total amount of each bid, and such other details as the Municipal Corporation RAIPUR may consider appropriate will be announced by the Municipal Corporation RAIPUR at the time of bid opening.
- (8) **Process to be Confidential** Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any attempt by a Bidder to influence the Municipal Corporation RAIPUR's processing of bids or award decisions may result in the rejection of his Bid
- (9) Clarification of Bids and Contacting the Municipal Corporation RAIPUR
- (10) No Bidder shall contact the Municipal Corporation RAIPUR on any matter relating to its bid from the time of the bid opening to the time the contract is awarded.
- (11) Any attempt by the bidder to influence the Municipal Corporation RAIPUR's bid evaluation, by any means, bid evaluation, bid comparison or contract award decision may result in the rejection of his bid.

12.0 Examination of Bids and Determination of Responsiveness

- 1) During the detailed evaluation of "Technical Bids" (**Envelope 'B'**), the Municipal Corporation RAIPUR will determine whether each Bid
- meets the eligibility criteria defined relevant Clauses.
 - has been properly signed;
 - is accompanied by the required securities; and
 - is substantially responsive to the requirements of the bidding documents.

During the detailed evaluation of the "Financial Bids" (Envelope 'C'), the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications and drawings.

- 2) A substantially responsive "Financial Bid" is one, which conforms to all the terms, conditions, and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one
- which affects in any substantial way the scope, quality, or performance of the Works;

- (b) which limits in any substantial way, inconsistent with the bidding documents, the Municipal Corporation RAIPUR 's rights or the Bidder's obligations under the Contract; or
 - (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.
- 3) If a "Financial Bid"(Envelope 'C') is not substantially responsive, it will be rejected by the Municipal Corporation RAIPUR, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

12.1 Corrections of Errors

(1) Bids determined to be substantially responsive, will be checked by the Municipal Corporation RAIPUR for any arithmetic errors. Errors will be corrected by the Municipal Corporation RAIPUR as follows:

- a) where there is a discrepancy between the rates in figures and in words, the rate in words will govern; and b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.

(2) The amount stated in the Bid will be adjusted by the Municipal Corporation RAIPUR in accordance with the above procedure for the correction of errors and shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount, the Bid will be rejected, and the Earnest money shall be forfeited in accordance with relevant Clause of NIT.

12.2 Evaluation and Comparison of Bids

(1) The Municipal Corporation RAIPUR will evaluate and compare only the bids determined to be substantially responsive in accordance with relevant Clause of NIT.

(2) In evaluating the bids, the MUNICIPAL CORPORATION, RAIPUR will determine for each Bid the evaluated Bid price by adjusting the Bid price by making correction, if any, for errors pursuant to relevant Clause of NIT.

(3) If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate/PAC of the cost of work to be performed under the contract, the Municipal Corporation RAIPUR may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Municipal Corporation RAIPUR may require that the amount of the performance security set forth in relevant Clause of NIT be increased as described in relevant clause.

Commissioner
Municipal Corporation
RAIPUR, Chhattisgarh

SUBMISSION OF TENDERS:

The Bidders shall also have to submit Bids online (decrypt the bids using their Digital Certificate and encrypt the bids) as per mentioned key dates. There shall be three separate Online envelopes as under:-

ENVELOPE - A

The first online envelope shall contain the details of Earnest Money, scanned copy of the Physical Earnest Money.

The Physical Earnest Money which is to be submitted manually in Physical Envelope –A where it should be clearly written on the envelope as under:-

ENVELOPE - A

EARNEST MONEY

From - (... Name of Contractor...)

and should reach Commissioner, Municipal corporation, RAIPUR. as per date and time mentioned in the key dates

ENVELOPE - B

The Second Online envelope shall contain terms and conditions and all the technical details and specifications of the proposed work. The Scanned copy of terms and conditions, along with technical specifications and drawings etc.

i Experience certificate of successful completion of work of same nature in contractor's/firm's/company's own name indicating agreement no., work order no. and date, amount of contract, stipulated period of completion, actual period of completion during last five year i.e. 2011-2012 to 2015-2016. The certificate should be issued by an officer not below the rank of Executive Engineer and shall be countersigned by the officer not below the rank of Executive Engineer or equivalent. The experience of subletted works shall not be considered

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iii The details of works in hand indicating name of work, Agreement no., work order no., and date, amount of similar contract, period of completion, value of work and balance work in hand with details of work on the date of submission of Tender.

iv Valid registration certificate in Class 'A'.

v Financial turnover of similar works during last five financial years i.e. 2011-2012 to 2015-2016. should be submitted online in Envelope "B".

ENVELOPE - C

This Envelope shall contain only the Lump-sum offer. The tenderer shall have to duly fill their Lump-sum offer in appropriate online form meant for it.

EARNEST MONEY

Tenderer will submit with the Earnest Money, **Rs. 7158000.00 (Rupee Seventy one Lakhs and Fifty eight thousand only)** in the form of Fixed Deposit Receipt in favour of the "Commissioner, Municipal

Corporation, RAIPUR payable at “RAIPUR, Chhattisgarh”. This will be returned to the unsuccessful tenderer. The Earnest Money of the successful tenderer will be retained as part of the Security Deposit.

FORM OF EARNEST MONEY

In shape of FDR from Nationalised bank or scheduled bank drawn in the favour of “**The Commissioner, RAIPUR Municipal Corporation, RAIPUR**” payable at RAIPUR will be submitted by the bidder.

EARNEST MONEY IN SEPARATE COVERS

The Earnest Money, in any one of the prescribed form should be deposited as mentioned under para 2.5. If the Earnest Money is not found in accordance with the prescribed mode, the tender of the tenderer shall not be opened.

ADJUSTMENT OF EARNEST MONEY

The Earnest Money which has been deposited for a particular work will not ordinarily be adjusted towards the earnest money for another work, but if the tender of a contractor for a work in the same Division has been rejected and the Earnest Money has not been refunded to him due to some reasons it may be adjusted for this work by the Executive Engineer, provided amount retained is equal or more than required Earnest Money for this work.

SECURITY DEPOSIT:-

- (a) The Security Deposit to be taken for the due performance of the contract under the terms and conditions printed on the tender form will be the earnest money plus an amount to make it equal to 5% (five percent) of the accepted cost of the work, as per clause 1 of condition of contract of form “F”. The five percent Security Deposit may be converted into Fixed Deposit Receipt of any Nationalised and Scheduled Bank. The security deposit shall be recovered from the running bills @ 5 percent as per clause-1 of the agreement read with para 3.5 of the N.I.T.
- (b) The amount of the E.M. shall not be adjusted when value of work done reaches the limit of the amount of contract or exceeds the probable amount of contract.
- (c) The five percent Security Deposit may be converted into Fixed Deposit Receipt. Bank Guarantee shall not be accepted.

IMPLICATION OF SUBMISSION OF TENDERS:-

Bidders are advised to visit the site sufficiently in advance of the date fixed for the submission of the tender. The Tenderer shall be deemed to have full knowledge of all relevant documents and site conditions etc. whether he inspects it or not.

The submission of a tender by a contractor implies that he has read the notice, conditions of the tender and all the contract documents and has made himself fully aware of all the standards and specifications in this respect laid down in the relevant IS specifications, IRC specifications, manual on water supply and treatment, and Annexure-E having the scope and the specification of the work to be done. The contractor will be deemed to have seen the site of works.

The contractor shall make his own arrangement for supply of water for construction, purposes. No lead and lift for any material including water will be paid. The tender offer should be inclusive of all leads and lifts for the materials. The contractor should himself verify the leads & Royalti Charges of different materials before submitting his tender.

ESCALATION:-

The scope of work includes all costs, and no escalation will be paid on this account.

LIST OF WORKS IN PROGRESS :-

Tenders must be accompanied by a list of Contracts already held by the tenderer at the time of submitting

the tender, in the Department and elsewhere showing therein the amount of each contract balance of work remaining to be done and the amount of solvency-certificate produced by him at the time of enrolment in the department

RELATIONSHIP :-

The contractor shall not be permitted to tender for works in the Corporation, (responsible for award and execution of contract) in which his near relative is posted. He shall intimate the names of his near relative working in Chattisgarh. State and Municipal Corporation, RAIPUR. He shall also intimate the name of person working with him in any capacity or subsequently employed by him and who are near relatives to any Gazetted Officer in the Chattisgarh. Any breach of this condition by the contractor would render him self liable to be removed from the approved list of contractors.

NOTE: - By the term “near relative” is meant wife, husband, parents and son, Grand son, brothers, sisters, brothers in laws, father in law and mother in law.

OPENING AND ACCEPTANCE OF TENDERS :-

PLACE AND TIME OF OPENING :-

The tenders shall be opened at time and place stated in para 1. In the first instance, the Physical envelope containing the earnest money shall be opened. If the earnest money is found proper, the online envelope - A containing the Earnest Money details, its scanned copy and scan copy of documents required as minimum qualification to bid shall be opened. If the tenderer found qualified as per minimum qualification, the online Envelope B containing the terms and conditions will be opened in the presence of such contractors, who choose to be present.

The tenders shall be opened at time and place stated in para 1. In the first instances, the of documents required as minimum qualification to bid shall be opened. If the tenderer found qualified as per minimum qualification, the online Envelope B containing the minutes of prebid meeting (amendments/corrigendum/clarifications) will be opened in the presence of such contractors, who choose to be present.

After short listing of prequalified contractors, their online financial offers shall be opened. The contractor having quoted lump sum offer in prescribed online proforma and arrived at a minimum cost shall be declared as the lowest bidder.

POWER OF THE COMMISSIONER/ EXECUTIVE ENGINEER :-

The Commissioner/ Executive Engineer does not bind himself to accept or recommend for acceptance to the higher authority, the lowest or any tender or to give any reasons for his decision.

CONDITIONAL TENDER :-

Conditional tenders are liable to be rejected.

CANVASSING:-

Canvassing for support in any form for the acceptance of any tender is strictly prohibited. Any tenderer doing so will render himself liable to penalties which may include removal of his name from the Register of approved contractors of penal action under section 8 of M.P. Vinirdishta Bhrashtachar acharan Nivaran Vidheyak, 1982.

SUBMISSION OF TENDER :-

Sealed envelope of EMD and other sealed envelope stipulated in the NIT after pre-bid meeting shall only be opened.

AUTHORITY OF EXECUTIVE ENGINEER :-

The authority competent to accept a tender, reserves the right for accepting the tender for the whole work or for a distinct part of it, or distributing the work between two or more Bidders.

All works to be executed under this contract shall be executed under the direction and subject to the approval in all respects, of concerning Engineer-in-charge of the Municipal Corporation RAIPUR under which the work is being executed, for time being who shall be entitled to direct at what point or points and in what manner they are to be commenced and from time to time carried out.

VALIDITY OF OFFER :-

Tender shall remain valid up to 120 days from the date of opening of Envelope - C and in the event of the Bidders withdrawing the offer before the aforesaid date for any reason whatsoever, Earnest Money Deposited with the tender shall be forfeited to the Government.

TIME OF COMPLETION :-

The time allowed for carrying out the work **i.e. 30 months** including rainy season shall be strictly observed and shall be reckoned from the date of issue of written order to commence the work. Delay beyond the specified time limit will subject to liquidated damages according to relevant clause of Form "F" of Lump sum contract.

TIME SCHEDULE:-

The work shall be done by the contractor according to the schedule fixed in consultation with the competent authority. BAR/PERT/CPM chart showing detailed programme shall have to be submitted and adhered to by the contractor.

VEHICLES FOR CONSTRUCTION SUPERVISION

The contractor shall arrange two four wheeled vehicles (Maruti Desire or equivalent) for field Engineers of Municipal Corporation RAIPUR for the Project period which will be deployed on work for supervision. The average run per-vehicles will be 2000 Km./ month including POL.

TESTING LABORATORY AT CONSTRUCTION SITE

The contractor shall arrange a testing laboratory with all testing equipments and trained staff required for proper testing of construction material likely to be used in execution of work. at his own cost.

SITE OFFICE

The contractor shall provide two site office one at Intake works site and other at Water Treatment site consisting two rooms along with one attendant for Municipal Corporation RAIPUR field Engineers.

OFFICE EQUIPMENT ON SITE OFFICE

The contractor shall provide minimum two number desktop and four number Laptops with latest configuration including two number laser printer to the staff for monitoring of execution and maintenance work.

FIXED LINE PHONE

One fixed Tele phone will also be provided in each site office for the Project period.

ACCESS ROAD TO SITE OF WORK: Access road has to be provided by the contractor at his own cost for transportation of construction material and equipment and manpower.

LABOUR REPORT

Contractor will submit a report of daily labours engaged and copy of the same be attached with the running account bill, failing which no payment will be made to the contractor.

The Contractors shall made his own arrangement at his own cost for housing his staff and stores for the work and M.P. Model Rules relating to layout, water supply and sanitation shall be followed.

Observance of Law - The contractor shall conform to the regulations and by-laws of any local authority and/or of any water or power (electricity) companies, with whose system the structure is proposed to be connected from work site, except with the written permission of the Engineer-in-Charge.

PAYMENTS BY CHEQUES/ ONLINE ACCOUNTING SYSTEM:-

The running payments shall be made in accordance with the Break up schedule of payment as per “Annexure G” (As per clause 15 of form “F”)

SPECIFICATIONS:-

The detailed specifications for the work have been given in the enclosed Annexure-E. However, the following order of priority regarding specifications shall be followed by the contractor.

Specifications given in the Annexure-E enclosed.

Specifications for pipes, valves, specials, rubber, gaskets RCC and other civil works and materials shall be governed by the relevant latest IS codes, CPHEEO Manual and National Building code of India (latest revision).

Manual on water supply and treatment (latest edition) published by CPHEEO, New Delhi.

Any other specifications, not covered under the above said standards, as shall be decided by the Engineer-in-Charge i.e. Executive Engineer.

CHANGE IN SPECIFICATIONS:-

Nothing in earlier clause shall, however, curtail the right of the Executive Engineer to alter the specifications for any part or whole of the work if he considers it necessary in the interest of work. On all matters where there is difference of opinion, between the contractor and the Executive Engineer, the matter will be decided by the Commissioner, Municipal Corporation RAIPUR, which shall be binding to the bidders.

CEMENT:-

The Contractor shall procure minimum 43 grade, unless otherwise stated separately confirming to BIS specifications, ordinary Portland cement, as required in the work only, from reputed manufacturers such as Ultra Tech, Birla Uttam, ACC, Gujarat Ambuja, Cement Corporation of India. etc. of cement having a production capacity of one million tones per annum or more, and as approved by Employer, Ministry of Industry, Government of India and holding license to use BIS certification mark for their product, whose name shall be got approved from Engineer-in-Charge. Supply of cement shall be taken either in silos or in 50 kg. bags bearing manufacturer’s name and BIS marking. Samples of cement arranged by the Contractor shall be taken by the Engineer-in-Charge and got tested in accordance with provisions of relevant BIS codes. Cost of such tests shall be borne by the contractor. In case test results indicate that the cement arranged by contractor does not conform to be relevant BIS codes the same stand rejected and shall be removed from the site by the Contractor at his own cost within one week time of written order from the Engineer-in-charge.

The cement shall be brought at site in bulk supply of approximately 50 tonnes from the manufacturer direct, or as decided and approved by the Engineer-in-charge, as the case may be.

The cement godown of the sufficient capacity should be constructed by the contractor and at all time it should have a stock of minimum of 2000 bags. The contractor shall facilitate the inspection of the cement godown by the Engineer-in-Charge at any time. Storage of cement shall be as per CPWD specification.

CEMENT BROUGHT AT SITE AND CEMENT REMAINING UNUSED AFTER COMPLETION OF WORK SHALL NOT BE REMOVED FROM SITE WITHOUT WRITTEN PERMISSION OF THE ENGINEER-IN-CHARGE.

MISCELLANEOUS CONDITIONS:-

SUBLETTING WORK:-

The contractor shall not without the prior approval of the competent authority, in writing, sublet or assign to any other party or parties the whole, or any portion of the work under the contract. Where such approval is granted, the contractor shall not be relieved of any obligation or duty or responsibility which he under takes under the contract.

BLASTING:-

In case limited/suppressed blasting resorted to by the contractor in excavation of trenches, it will be the responsibility of the contractor to observe all rules and regulations permission licence, procurement, preservation and storage of Explosive material etc.

TAXES:-

“All charges regarding taxes including the sales tax, Royalties, Octroi, Excise, Turnover tax, commercial tax & works contract tax levied on the contract work by Govt., local bodies or private individuals will be payable by the contractor executing the work, but will not entertain any claim on this account. It will be the contractors’ duty to ascertain the above taxes and include in his Lump sum offer. No separate claim shall be entertained on this account by the department. In case there is any change in the existing taxes of State/Central Government, the Contractor will be reimbursed the same or deduction will be made from the contractor’s payment on production of document to this effect.

ROYALTY:-

Minerals extracted for works carried out on behalf of the government, from the quarries in possession of and controlled by the State Government or otherwise is subject to payment of Royalty by the contractor to whom it shall not be refundable.

**MODEL RULES RELATED TO LABOUR, WATER SUPPLY AND SANITATION IN
LABOUR CAMPS.**

The contractor will be bound to follow the Model Rules, relating to layout Water Supply and sanitation in labour camps, as per Annexure - A and the provisions of the National Building Code of India, in regard to construction and safety.

FAIR WAGES:-

The contractor(s) shall pay not less than the fair wages to labour engaged by him on the work (copy of the Rules enclosed as Annexure - “A”)

WORKS IN THE VICINITY:-

The Executive Engineer, reserves the right to take up Departmental work or to award works on the contract in the vicinity without prejudice to the terms of contract.

BEST QUALITY OF QUARRIED MATERIALS:-

If the quarry material of more than one quality is found, the material approved by the Executive Engineer will only used by the contractor. If the materials of required Specification is not available in the near by area/quarry, the contractor shall have to arrange the same from the place where it is available.

REMOVAL OF UNDESIRABLE PERSONS:-

The contractor shall on receipt of the requisition from the Executive Engineer, at once remove any person employed by him on the work who in the opinion of the Executive Engineer is unsuitable or undesirable.

AMOUNT DUE FORM CONTRACTOR:-

Any amount due to Government from the Contractor on any account of concerning work may be recovered form him as arrears of Land Revenue.

TOOLS & PLANTS:-

The contractor shall arrange at his own cost all Tools and Plants required for proper execution of work. Certain plants, may however, be issued to the contractors by the Department, as special case as per provision of W.D. Manual Vol. 1 if are available .

RIGHT TO INCREASE OF DECREASE OF WORK:

The competent authority reserves the right to increase or decrease any item of work during the currency of the contract and the contractor will be bound to comply with the order of the competent authority without any claim for compensation or higher rates for additions and alterations.

LABOUR REPORT:-

Contractor will submit a report on labour engaged to local employment office and copy of same may be attached with the running account bill, failing which Rs.50/- will be deducted from each running bill. Total recovery on this account may be effected on the final bill.

LABOUR LICENCE :-

Every contractor who employs on any day of the preceding 12 months, twenty or more workers on contract is required to obtain license from the Licensing Officer or the Contract as per provision contained under Sub-section 4 (b) of section 2 of the Contract Labour (Regulation and Abolition) Act 1970 as per provision contained in Section 12 of Act. No, contractor shall execute any work without obtaining licence, contravention of above is punishable and contractor is liable to be prosecuted. The successful tenderer is liable to produce licence as and when demanded by the Executive Engineer, obtained form labour Department as laid down in chapter 4 of Contract labour (Regulation and abolition) Act 1970. The labour license shall be insisted upon to be obtained by the Contractor after the award of contract.

LABOUR HUTMENT :-

The contractor shall make arrangement, at his own cost, for housing his staff and stores for the work and Model Rules relating to labour Water supply and sanitation shall be followed.

NOTICE TO BE GIVEN BEFORE WORK IS COVERED UP

The contractor shall give not less than five days notice in writing to the Engineer- in- Charge or his subordinate in charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is so covered up or placed beyond the reach of measurement and shall not cover up or place beyond the reach of measurement any work without the consent in writing of the Engineer-in-Charge or subordinate-in-charge of the work, and if any work shall be covered or placed beyond the reach of measurement without such notice having been given or consent obtained the same shall be uncovered at the contractor's expense or in default thereof no payment or allowance shall be made for such work or materials with which the same was executed.

SITE ORDER BOOK

An order book, to be called, as site order book shall be kept at the Site office of Municipal Corporation RAIPUR. As far as possible, all orders regarding the work are to be entered in this book. All entries shall be signed and dated by Municipal Corporation RAIPUR officers in direct charge of the work and noted by the contractor or his accredited representative. The site order book shall not be removed from work site, except with the written permission of the Engineer-in-Charge.

CONTRACTORS PROJECT MANAGER AND CONTRACTORS STAFF –

The contractor shall, in his own absence keep constantly on the works a competent and well qualified and experienced Project Manager, and any direction or explanations given by the Superintending Engineer or his staff to Contractor's Project Manager shall be held to have been given to the contractor. The contractor

shall further provide all staff that is necessary for the supervision, execution and measurement of the work to ensure full compliance with the terms of contract.

INSURANCE

The Contractor shall take such insurance in connection with the work in accordance with the tender condition as acceptable to the Municipal Commissioner RAIPUR.

The cost of the insurance premium paid by the Contractor.

PRODUCTION, SUBMISSION AND APPROVAL OF ENGINEERING DOCUMENTS-

The production, submission and approval procedure for design & drawings and documents shall comply with the following requirements.

Meaning:

The following meanings shall apply:

"Preliminary drawings" means drawings which the Contractor submits to the Engineer-in -Charge for approval and any drawings returned by the Engineer-in-Charge marked "Preliminary" or not marked "Approved".

"Approved Drawings" means drawings which the Engineer-in-Charge has marked

"Approved" and returned to the Contractor. Approval in this context means that the work described thereon may proceed.

"Preliminary" and "Approved" as applied to designs and documents shall have the same meanings as applied above to drawings. A drawing which forms part of an approved design or document shall not be considered as approved drawing unless it has been marked "Approved".

Numbering and Titling :

The Contractor shall institute a reference numbering system for designs, drawings and documents so that each number used is unique. The numbering and title information on designs, drawings and documents shall be designed so that management, transmittal and communication therewith can be carried out expeditiously.

Submission Procedure :

Every drawing submitted by the Contractor to the Engineer-in-Charge through Project Development and Management Consultants for checking and approval shall be based on previously approved designs or documents. Interrelated drawings shall be submitted at the same time in a complete and self-sufficient set. In the case of first submissions by the Contractor to the Engineer in charge for approval, each design, drawing and document shall reach the Engineer's review office in time to allow 30 working days (excluding weekends and national holidays) for checking by the Engineer-in-Charge before return to the Contractor.

Manufacture's and Contractor's Certificate:

Where certificates are required by the Specification or relevant Reference Standard, the original and one copy of each such certificate shall be provided by the Contractor.

Certificates shall be clearly identified by serial or reference number where ever possible to the material being certified and shall include information required by the relevant Reference Standard or Specification Clause.

The instruction manuals shall describe the installation as a whole and shall give a step-by-step procedure for any operation likely to be carried out during the life of such item of Plant, including the erection, commissioning, testing, operation, maintenance, dismantling and repair.

Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedures to be carried out daily, weekly, monthly and at longer intervals to ensure trouble-free operation. Where applicable, fault location charts shall be included to facilitate tracing the cause of malfunction or breakdown.

A section dealing with procedures for ordering spares shall also be included in the instruction.

Three draft copies of the manual shall be submitted to the Engineer's Representative prior to commissioning the works. Five final copies of the amended and corrected manuals and drawings shall be provided at the commencement of the period of Maintenance.

All the electrical and mechanical equipments shall be subjected to approved third party inspection at place of manufacture, at contractor's cost.

Transit insurance of all equipments shall be the contractor's responsibility.

Contractor shall have to take the certificate from the Electrical Inspector for regarding all electrical equipments before commissioning of plant.

Important instructions charts shall be framed and fixed at appropriate and prominent places.

Maintenance Instructions:

A maintenance manual shall be provided as supporting documents to the equipment manufacturer's instructions.

(i) Maintenance Manual

Checking, testing and replacement procedures to be carried out on all mechanical and electrical plant items on a daily, weekly and monthly basis or at longer intervals to ensure trouble free operations. Fault location and remedy charts to facilitate tracing the cause of malfunctions or breakdown and correcting faults.

A complete list of recommended lubricants, oils and their charts.

A spares schedule, which shall consist of a complete list of item wise spares for all electrical and mechanical plant items with ordering references and part numbers.

A complete list of manufacturer's instructions for operation and maintenance of all bought-out equipment. The list shall be tabulated in alphabetical order giving the name of the Supplier/Manufacturer, identification of the plant item giving the model number and the literature provided including instruction leaflets and drawing numbers.

Preventive maintenance details.

Record Drawings:

The Contractor shall provide record drawings including those drawings submitted by the Contractor to show the whole of the plant as installed and all civil works as built. These shall include all such drawings, diagrams and schedules as are necessary for a complete understanding of the works. Information given on record drawings shall include tolerance, clearances, loadings, finishes, materials and ratings of Plant and associated civil works. The Contractor shall ensure that the approved and completion drawings are marked up, to show the condition of plant as installed and associated Civil Works, as built and two copies of such marked up prints shall be submitted to the Engineer-in-Charge for approval prior to the preparation of Record Drawings. Submission to and approval by the Engineer-in-Charge or Record

Drawings shall be pre-requisite for the last taking over certificate. All the Record Drawings shall be of A2 size, in five copies, out of which 3 sets shall be plastic laminated for long-life. In addition, one set of Microfilm of all the Record Drawings also shall be furnished. The text of all the reports shall be prepared on a widely used IBM compatible MS Word / MS Excel, and all the Drawings shall be prepared using AutoCAD Software and in .pdf form. When reports, drawings are furnished to Municipal Corporation RAIPUR, two copies of the processor files together with 2 copies of a descriptive memorandum linking these files to the text, drawings etc., shall also be provided to the Municipal Corporation RAIPUR on CDs, Pen drive, data base preferable on MS office and AutoCAD latest versions and in .pdf form.

Programme of Work:

The works to be carried out under this Contract form an important part of the execution of this Water Supply Project, Satisfactory progress of the entire project as a whole depends upon the timely completion of these works. For this reason, great importance needs to be attached for proper programming for the works with adequate provision for guarding against all the delays normally encountered in execution of various activities.

The contractor shall include with his tender a critical path network diagram which commences from the date of issue of Order of Commencement and includes inter alia the various activities as per the programme of works, furnished as specified in Schedule.

- Activity duration in months and event times should be in months from the first event on the network and event numbers:
- A tabulation of months from the starting date of the network to enable earliest and latest event dates to be read off; duration in months to be the last day of the month and the monsoon months of 15th June to 15th October to be specially indicated in the Table:
- The timing of events shown in the programme of work to be adhered to and shown in the network;
- The erection programme shall be shown in detail (with not more than 15 activities) with durations in weeks shown in brackets behind the duration in months on the network diagram wherever considered necessary;
- The programme for setting-up, treating, delivery, storage (if necessary) and placing of filter media (where appropriate) the
- Placing being a part of the erection programme referred to in (iv) above; and
- Programme for submission of Instruction Manuals and Record Drawings;

As soon as practicable, and in any case not later than four weeks, after acceptance of his tender the Contractor shall submit to the Engineer-in-Charge for his approval a programme showing the order of procedure in which he proposes to carry out the works.

Particulars to be shown on the programme shall include:

- Submission of drawings;
- Placing of work orders;
- Stages of manufacture;
- Tests at place(s) of manufacture;
- Deliveries to Site;
- Construction of Civil works ready for erection of Plant;
- Mechanical completion of erection at site;
- Tests at site;

Finishing and completion of civil and electrical works.

Any approval of or consent to the Contractor's programme by the Engineer-in-Charge shall not relieve the Contractor of his duties and responsibilities under the Contract.

PROGRESS :

The Contractor shall submit to the Engineer-in-Charge during the first week of each month a "Monthly Progress Report" with weighted activities all in an approved format so that actual progress at the end of the preceding month may be compared with the Contractor's programme.

The progress report shall also include status report on the following approved individual formats:

- Drawings;
- supplies of Plant Items;
- Construction programme;
- Construction Progress;
- Overall Progress Curve;

From time to time the Municipal Commissioner RAIPUR or Engineer-in-Charge will call meetings in their office or at the Engineer's Site Office, as they deem necessary for the purpose of control of the Contract, a responsible representative of the Contractor shall attend such meetings.

The Contractor shall regularly review his programme in the light of the progress actually achieved and shall submit for approval updated PERT/CPM network and bar charts at intervals to be agreed with the Engineer-in-Charge. If progress falls behind that needed to ensure timely completion of the various parts of the works, the Contractor shall submit proposals for improving his methods and pace of working to the satisfaction of the Engineer-in-Charge shall carry out such measures as are needed to ensure that the works are completed on time.

LEGAL JURISDICTION

All the disputes regarding this contract will be subjected to the Chhattisgarh High Court Jurisdiction.

TECHNICAL SUPERVISION :-

The Contractor shall employ as per norms of PQ Document, Graduate Engineers during the execution of the work:-

The technical staff should be available at site whenever required by the Executive Engineer to give instructions.

In case the contractor fails to employ a Graduate Engineer as aforesaid Deptt. Shall have the right to take suitable remedial measures.

The contractor should give the names and other details of the Graduate Engineer/Diploma holder Sub-Engineers when he intends to employ or who is under employment, before he commences the work.

The contractor should give a certificate to the effect that the Graduate Engineer is exclusively in his employment.

It is not necessary for the contractor (or partner in case of firm/company) who is himself an engineer to employ engineer for the supervision of the work so long as the Contractor/partner works similar to what would have been done by and Employed Engineer.

The retired Engineer who is holding Diploma in Civil Engineer or a Diploma holder having relevant experience will be treated as Graduate Engineer, for the operation of above clause.

In case of the contractor fails to employ the technical staff as aforesaid he shall be liable to pay to the

government a sum of **Rs. 20,000/- (Rupees Twenty Thousand) for each month of default.**

LEAD AND LIFT FOR WATER- The contractor shall make his own arrangement for supply of water for construction, testing and other purposes. No lead and lift for water will be paid.

LEAD AND LIFT OF MATERIALS- No lead and lift for any material will be paid. The tendered amount should be inclusive of all lead and lift for the materials. The contractor should himself verify the lead of different materials before submitting his tender.

The contractor will have to arrange for the temporary electric connection at site of work at his own cost for dewatering, curing, vibrator, testing and internal and outside electric fittings, etc.

DEWATERING- The lump-sum offer shall include dewatering, bailing foundation water, river water and rain water if any, which shall be required to be done by the contractor at his own cost and for which no payment will be admissible under any circumstances. The tenderer shall assess the work of dewatering that may be required for execution of work and include in his lump-sum offer. No dewatering shall be payable separately under any circumstances whether natural, artificial or man-made.

Notes:

The tenderers will have to submit at the time of submitting the tender an outline plan elevation and section of proposed civil works, equipment and hydraulic flow diagram, levels and all other works as detailed in attached specification. He shall also submit with tender itself the approximate quantities of various items involved such as cement, steel, stone or brick work for civil construction job, and the list of all pipes, equipments and installations required for it with their specification, make, capacity etc. complete.

The layout plan and designs will be subjected to the approval of the department and can be altered to suit the specific departmental requirement and the contractor shall have no extra claim on that account. The responsibility for the Planning, design, construction, erection, commissioning and testing will however rest solely with the contractor. He will have to rectify the defect immediately within a fortnight and when noticed either during construction period or after construction till the end of defect liability period, at his own cost and risk.

The tender for works shall not be witnessed by a contractor or contractors who himself/themselves has/have tendered for the same work. Failure to observe this condition shall render the tender of the contractor tendering as well as of those witnessing the tender liable for rejection.

Detailed specification and leaflets giving make etc. for all components to be provided shall be submitted with the tender.

Tender of any contractor who proposes any additions alternations to any of the conditions laid down here is liable to be rejected.

Accident -Hoardings - Lighting Observations :

When there is any Likelihood of accidents, the contractor shall comply with any requirements of law on the subject, and shall provide suitable hoarding, lighting and watchman as necessary or directed by Engineer-in charge.

It shall be contractor's sole responsibility to protect - the public and his employees against accident from any cause and he shall indemnify Municipal Corporation RAIPUR, against any claims for damages for injury to person or property, resulting, from any such accidents; and shall where the provision of the workmen's compensation Act apply, take steps to properly insure against any claims there under.

On the occurrence of an accident which results in the death of any of the workman employed by the contractor or which is so serious as to be likely to result in the death of any such workman, the contractor shall, within 24 hours of the happening of such accident, intimate in writing to PDMC AMRUT Mission C.G. of the Municipal Corporation RAIPUR /Police the facts of such accident. The contractor shall indemnity Municipal Corporation

RAIPUR against all losses or damage sustained by Municipal Corporation resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or fines if any payable by Municipal Corporation RAIPUR as consequence of failure to give notice under the Workmen's Compensation Act.

In the event of an accident in respect of which compensation may become payable under the workman's compensation act VIII of 1923 whether by the contractor or by the Government as principal it shall be lawful for the Engineer-in-Charge to entertain out of monies due and payable to the contractor such sum or sums of money as may in the opinion of the said Engineer-in-Charge be sufficient to meet such liability. The opinion of Municipal Commissioner RAIPUR shall be final in regard to all matters under this clause.

AGREEMENT :-

The Notes and specifications given in the detailed notice inviting tenders and its annexure are to be read in conjunction with conditions given in the short notice inviting tenders and the conditions of Contract. These have been intended to supplement the provisions, in the NIT and the conditions of the Contract. All these will be binding on the contractor and shall form part of the agreement. However, in case of any contradiction between Corrigendum/Clarifications /Amendments and the NIT, the CORRIGENDUM/CLARIFICATIONS/AMENDMENTS will supersede.

EXECUTION OF AGREEMENT :-

The Tenderer whose tender has been accepted shall have to execute the agreement within a fortnight of the communication of the acceptance of his tender by the competent authority. Failure to do so will result in the Earnest Money being forfeited to Govt. and tender being cancelled.

EXCISE EXEMPTION: Municipal Corporation RAIPUR, will provide necessary certificate for exemption in Excise duty on pipe and other materials covered under the circular issued by Finance Department Govt. of India.

ANNEXURE :-

Other than form 'F, Special conditions' and condition of contract documents appended as annexures with this N.I.T. and these shall be part of Contract Agreement.

SPECIAL CONDITIONS:

- (1) The contractor must have experience of executing nature of works.
- (2) Joint ventures shall not be allowed in the bidding process.
- (3) The experience of last five years shall only be considered for prequalification criteria.
- (4) The tenderer shall prepare a technical report for design and construction of the said work incorporating complete information, specifications and data for submission along with his tender.
- (5) On acceptance to tender the contractor will have to submit structural details, designs and drawings of the entire structure including allied works within 30 days from the date of acceptance of his offer.
- (6) The contractor will have to submit general layout drawing showing the arrangement of installations of vertical turbine pumping sets 6 No., piping arrangement at discharge floor, location of their starters control panels, main switch board, cable laying etc. Design, supply and erection of pumping machineries and their electrical parts are included in this contract along with the entire civil works related to these items viz. foundations for pump, motor, cable trenches ducts, opening in slabs for pump opening pumps, cables and pipes etc. are to be provided by the contractor and shall be a part of this contract.

- (7) Project Development & Management Consultants (PDMC) & IRMA (Independent Review & Monitoring Agency) engaged by SUDA C.G., will carry out complete supervision, quality control of activities carried out by contractor including checking measurement, designs, drawings, contractors bill, all deliverables till completion of the contract & rectification of deliverables.
- (8) **APPROVAL OF DESIGNS & DRAWINGS:**
All design calculations & detailed drawings of all components (Electrical, Mechanical & Structural) of the project shall be got approved by Govt. Engg. College in Chattisgarh / NIT, Raipur at the cost of contractor and then submitted to RAIPUR Municipal Corporation.
(a) The successful bidder shall first submit General Arrangement drawing accommodating all the proposed units & submit the same for approval by PDMC.
(b) Contractor shall also prepare & submit hydraulic designs & after its approval shall prepare & submit structural design & architectural drawings, get them approved by Govt. Engg. College / NIT, Raipur and finally submit them for approval of Engineer –in- charge through PDMC. All costs shall be borne by the contractor.
- (9) **THIRD PARTY INSPECTION** of all items beyond procurement shall be carried out by **DGSD/SGS/ RITES** based on Datasheets, Quality Assurance Plan & complete specifications as submitted by the Contractor to Engineer –in- charge. Third Party Inspection charges will be borne by the Contractor. Third Party Inspection (TPI) of all pipes, fittings and all kinds of valves , Electro-mechanical equipment shall be carried out based on the Quality Assurance Plan duly prepared and submitted by the contractor. These TPI charges will be borne by the contractor. Further for witnessing the tests at works of the manufacturer by 2 No. officials of the RAIPUR Municipal Corporation , the contractor shall arrange the same and bear the entire cost.
- (10) **PERFORMANCE SECURITY:** Performance Security in the form of Bank Guarantee is to be taken from the contractor not later than the date specified in the contract and shall be issued in an amount specified in SCC, by a Bank acceptable to the Employer and denominated in the types and currencies in which the total cost of securities is payable.
The Performance Security shall be five percent of the work Order amount and valid until 28 days from the date of issue of the Certificate of Completion in the case of Bank Guarantee.
REFUND OF PERFORMANCE SECURITY: 50% performance security shall be refunded within one month after completion of work as certified by Engineer in Charge. Remaining 50% performance security shall be released after TWELVE months of trial run is satisfactorily completed.
- (11) **RECEIPT FOR PAYMENT BY PARTNERS HAVING POWER OF ATTORNEY:** All correspondence with the Employer and receipts for payments made on account of a work when executed by a firm must be signed in the name of the firm by one of the Partners holding Power of Attorney.
- (12) **MOBILISATION ADVANCE:** Mobilization advance up to 5% (Five percent) of the contract value shall be given if requested by the contractor with in one month of the date of order to commence the work. In such a case the contractor shall furnish Bank Guarantee from schedule bank for the equal amount in favour of the Commissioner before sanction and release of the advance. The advance shall be Interest free. The 5% (Five percent) advance shall be given in two stages
Stage-1: 2% (Two percent) of the contract value payable after signing of the agreement

Stage-2:3% (Three percent) of the contract value payable on receipt of the certificate from the contractor that he has established complete central and field testing laboratories and has engaged workers/technicians and have brought requisite plants and machineries at work site, and also that the work is physically started and only after construction programme is submitted by the contractor and is duly approved by the Executive Engineer

- (13) **RECOVERY OF ADVANCE:** The recovery of above advances (mobilizations, plants and machineries) shall be recovered in equal monthly installments on pro- rata basis (after 15% (Fifteen percent) of contract work is executed) from each of the further running bills. However all these advances shall be fully recovered when 80% (Eighty percent) contract sum is complete or when 75% (Seventy Five percent) of stipulated or validity extended period is over – which ever event is earlier.
- (14) 3 % of bill amount shall be deducted from each bill for hydraulic testing of pipeline work done (as stipulated in relevant Annexure –E) and successful commissioning of the work. The same will be passed and paid when the work get completed successfully.
- (15) **HINDRANCE FREE ALIGNMENT OF PIPELINE ETC:** RAIPUR MUNICIPAL CORPORATION will provide hindrance free alignment. The bidders should inspect the whole alignment and should make himself conversant with site conditions, strata, nallah crossings, road crossings, railway crossings, canal crossings etc completely. All permissions from Government/ Semi Government Authorities shall be taken by RAIPUR Municipal Corporation for above works.
- (16) **DEPTH OF EXCAVATION FOR LAYING OF PIPELINE:** The crown of the pipeline will be kept 1.0 m below the firm GL.
- (17) **ORDER OF PRIORITY :** Order of priority as given below shall prevail: -
Specifications as per NIT.
Specifications as per S.O.R.
Specifications mentioned in CPHEEO Manual 1999 (current Revision) for various water supply and treatment components.
Relevant IS Codes.
- (18) **STATUS OF ENVIRONMENTAL CLEARANCE:** Since this being a Water Supply Project involves neither displacement /rehabilitation of people nor any pollution of water body , hence no Environmental Clearance is required.
- (19) **SAMPLE OF CONSUMER WATER METER** of approved make as per the standard specifications is required to be submitted after award of Contract.
- (20) **VALVES WITH ACTUATORS:** The valves should be compatible with actuators as mentioned in Annexure-E.
- (21) **LAYOUT PLAN OF WATER TRANSMISSION AND DISTRIBUTION NETWORK:** Location of valves marked on the L-section will be prepared by the contractor for the approval of Engineer-in-Charge as mentioned in ANNEXURE-E.
- (22) **PERMISSION FOR INSTALLATION OF CONSUMER WATER METERS:** Municipal Corporation Raipur will provide the permission for fixing of consumer water meters.
- (23) **PREPARATION OF GIS BASED MAP:** Contractor has to prepare a entire layout plan of indicating the complete integrated water supply scheme including, raw water sump-cum pump house, 80 MLD WTP, and all OHSRs (existing and proposed) , (150 MLD WTP + 30 MLD form New 80 MLD WTP) 180 MLD WTP, clear water pumping station , all rising mains, distribution network (proposed) including all Bulk Flow meters, FVC, pressure gauges & valves etc on GIS platform .This will be put on the web site of the

Municipal Corporation and monthly updated indicating the progress of the progress achieved.

- (24) **PROCUREMENT OF PIPES & VALVES:** Contractor shall take written procurement clearance for the specified quantities of pipes, valves, specials etc from Engineer-in-Charge before taking procurement action.
- (25) **CONSUMER WATER CONNECTION:** (a) Length of pipe to be provided for each consumer water connection is 6m upto the property line. (b) Road breaking and its reinstatement will be carried by the contractor as per tender. (c) Reinstatement of floor/surface for provision of consumer meter connection will be done with PCC. (d) Number of Specials to be paid will be limited upto the property line of the consumer.
- (26) **PDMC:** The PDMC deployed by the Engineer-in-charge shall act as the representative of the Engineer-in-charge to the Contract. Unless specified otherwise, the PDMC shall be involved in testing of materials, supervision of works to ensure quality as per required (IS / Technical specifications) standards. Contractor shall provide support and assistance in all field works, checking of measurements, bills, work done (temporary / permanent) in the field, including all works to be carried out by the Engineer-in-charge. However, written approval of designs of surge control devices, drawings, additions, alterations, omissions, substitutions, approval for non-schedule items / rates as required shall be obtained from competent Authority of Municipal Corporation.
- (27) **INTERCONNECTIONS OF RISING MAINS:** The contractor is expected to visit the site of work and make his own assessment of quantum of work required to be carried out, Further before actual implementation of work the drawing of interconnections will have to be got approved from the Engineer-in-Charge. The interconnections of rising mains of all 47.5 MLD plant are to be shifted to rising main coming out of 80 MLD plant is also included. in the scope of work of this Contract.
- (28) **INTERIOR LIGHTING AND RECEPTACLES IN PUMP HOUSE & WTP:** Each panel shall be provided with a LED lighting fixture rated for 20 watt, 230V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The illumination lamp shall be operated by door switch or manual switch. Each panel section shall be provided with separate lighting. “
- (29) **RECYCLING OF WASTE WATER SYSTEM in THE PROPOSED 80 MLD WTP : Total maximum sludge volume including waste water = 5%**
1. **Maximum sludge volume from Clari-floculator = 2%**
 2. **Filter waste (washed water) to be directly pumped to inlet channel of plant**
 3. **Filter waste sump volume = complete waste of 3 beds wash**
 4. **Clari-floculator sludge to be re circulated through centrifuge only, bypassing thickener during high sludge content**
 5. **Decanted water from thickener may be collected in filter waste sump**
 6. **Water part from centrifuge should be diverted to raw water inlet channel of the plant**
 7. **The Clari-floculator sludge should be churned either by mechanical churner or by blower to protect from siltation**

Recycling of waste water and sludge of flocculator shall be designed to achieve zero discharge.

For by pass arrangement of the used wash water, it is proposed to be disposed off in nearby nalla through gravity. The wash water gutter invert level should therefore be fixed considering H.F.L. of nalla /natural drain so that drainage by gravity during flood can be possible.”

- (30) **12 MONTHS TRIAL RUN OF COMPLETE WORK AFTER COMPLETION OF WORK:** (a) The tender must be inclusive of operation of the plant for the twelve months trial run period free of charge

by contractors trained and qualified Engineers who should be completely familiar with the equipment supplied and erected and they shall train the Departmental Staff in operation & maintenance of the plant within that period. Detailed operation manual as well as the drawings of equipment supplied, should also be supplied by the contractor free of cost. The cost of electrical energy, Chlorine Gas, and pay to departmental staff for operation of the plant, WILL BE PAID by the Department during this period. Cost of chemical etc including complete O & M shall be borne by the contractor including replacement and warranty of any item component/spares. Performance Guarantee must be demonstrated by the test run for this period of twelve months.”

(b) Period of construction shall be reckoned from date of issue of work order to time of completion. Defect liabilities, tests, guarantee and trial run will be as per N.I.T.

After satisfactory completion of the complete work including testing, installation, commissioning the Engineer-in-charge will issue the Completion Certificate. After which 12 months of trial run at full load will be carried out. Any non-compliance in terms of running, delivery and performance of each component of the complete WORK will be maintained and recorded by the Engineer-in-Charge. Record of the incoming raw water quality (physical, chemical and biological parameters) and that of the treated water rendered by the WTP(both proposed 80 MLD and existing 150 MLD,80 MLD WTPs) shall be maintained.

Each day/part of the day when raw water Intake structure or the Water treatment Plant does not deliver as per the norms of Contract Agreement and CPHEEO Manual means that the trial run will be extended by that many days without any extra cost to RAIPUR Municipal Corporation.

(31) LIST OF SPARES TO BE MAINTAINED DURING O & M period of both proposed 80 MLD and existing 150 MLD,80 MLD WTPs

The contractor shall operate and maintain the water treatment plant including all the civil structures, electro-mechanical equipment, pipes, pipe specials, instrumentation provided by him in proposed 80 MLD Water Treatment Plant. He will maintain spares with stores for the proper upkeep of the WTP. List of spares is given below.

LIST OF SPARES: for 80MLD WTP

- (i) Flash Mixer
 - (a) Motor----1 no of each capacity of motor
 - (b) Bearing----1 set for each type of pump and motor
 - (c) Shaft----1 set for each type of pump of specified MOC
- (ii) Clariflocculators
 - (a) Motor Shaft--1 set for each type of motor
 - (b) Bearing---1 set for each type of pump and motor of specified MOC
- (iii) 2 No. Tonners of approved MAKE Chlorine Cylinder

For repairs and proper upkeep of the WTP in case any repair to any equipment is required, no extra payment will be paid to the contractor.

For non compliance of the water quality parameter a penalty of Rs. 5000/- for one event in a day shall be levied. Residual chlorine at outlet of clear water pump house \leq 2 ppm

(32) TESTING OF RAW AND TREATED WATER DURING 05 YEARS O & M BY THE CONTRACTOR:

“Daily the contractor has to get the raw water and treated water tested atleast three times at 8 hour interval for the parameters viz., turbidity, colour, taste, pH, TDS, Total hardness, residual chlorine conductivity, Alkalinity, Chlorides and coliform for proposed 80 MLD Water Treatment Plant.

For non-compliance of the water quality parameter a penalty of Rs. 5000/- for one event in a day shall be levied incase the residual chlorine at outlet of WTP is found less than 2 ppm or any of the above physico-chemical and biological parameters is found in the beyond acceptable range as specified in IS: 10500

(i)Residual chlorine at outlet of clear water pump house \leq 2 ppm

Every day at least 3 times daily raw water and treated water test reports of all the parameters as indicated shall be made available to Engineer in Charge.”

(33) GENERAL REQUIREMENTS FOR BUILDING WORKS: Unless otherwise specified, all the building works shall generally comply with the following Employer’s Requirements:

(a) All buildings shall have reinforced concrete framework.

(b)75 mm thick PCC Damp Proofing Course in M15 shall be provided to all building walls.

(34) TOPOGRAPHIC SURVEY: The contractor will carry out the Topographic survey work by using Total station of the entire site where the canal intake, raw water sump cum pump house, proposed WTP 80MLD, proposed OHSRs and proposed raw water and clear water rising main and proposed water distribution network are required to be constructed/laid.This is mandatory to confirm the levels and the lengths . Only after this exercise is carried out, contractor should prepare the detailed drawings, L-sections based on the design etc.

(35) HANDING OVER OF EXISTING 150 MLD,80 MLD Water Treatment Plant]:After the award of the Contract, the contractor shall operate and maintain THE EXISTING 150 MLD and 80 MLD WTP] in such a manner that the existing water supply to consumers is not disrupted at all.The contractor has to bear the expenses of chemicals and the operating staff deployed by him for this purpose . Chlorine gas and electricity tariff will be provided by the Municipal Corporation at no cost.

ANNEXURE ‘A’	Model Rules relating to labour, water supply and sanitation etc.
ANNEXURE ‘B’	Contractor’s Labour Regulations
ANNEXURE ‘C’	Statement showing the lead of materials
ANNEXURE ‘D’	Form of Income Tax clearance certificate
ANNEXURE ‘E-I’	Specification for Raw water pumps & clear water pumps
ANNEXURE ‘E-II’	Specification for construction of Water Treatment Plant.
ANNEXURE ‘E-III	Specifications of Rising Main & Distribution Network,House service connection Water meters etc
ANNEXURE ‘E-IV	Specifications for OHSRs
ANNEXURE ‘E-V	O &M of WTP,Raw water pump house ,clear water pump house,PLC SCADA,Automation
ANNEXURE ‘E-VII	PLC-SCADA,Automation system
ANNEXURE ‘E-VIII	Ancilaary Civil works
ANNEXURE ‘F’	Break -up schedule of payments
ANNEXURE ‘GI & GII’	Proforma of Bank Guarrenty
ANNEXURE ‘H’	Special Conditions of NIT
ANNEXURE ‘I’	Information & instructions to the bidders for online electronic government procurement system (e-gps).

ANNEXURE 'J'	Pre-Contract Integrity Pact
Appendix '1'	Qualification Information
Appendix '2'	Experience of similar nature of work
Appendix '3'	List of other construction work
Appendix '4'	Existing Commitments
Appendix '5'	Machinery available with the tenderer
Appendix '6'	Technical Personnel available with the tenderer
Appendix '7'	Financial report
Appendix '8'	Current claims and arbitration
Appendix '9'	List of plants and machinery required
Appendix '10'	List of plants and machinery to be deployed
Appendix '11'	List of personnel to be deployed
Appendix '12'	Contact persons
Appendix '13'	Affidavit

**Commissioner,
Municipal Corporation,
RAIPUR, Chhattisgarh**

NAGAR PALIK NIGAM RAIPUR

**RAIPUR AUGMENTATION OF WATER SUPPLY SCHEME (Under AMRUT MISSION)
Tender for a Lump - Sum Contract**

“We do hereby tender to execute the whole of the work described in the Drawing Nos.----- and according to the annexed specifications signed by ----- and dated ----- for the sum of Rs. ----- (Rupees -----) as given below:

Sr.No.	Particulars	Lump-Sum Cost(in Lakhs) In words as well as Figures
A	Lump Sum offer for construction of Augmentation of water supply Scheme at Raipur	Rs
B	Lump Sum offer for 5 years O&M of existing 80 & 150 MLD and proposed 80 MLD, WTP, all new RWPs and new CWPs and PLC SCADA automation , monitoring and Control system covering all existing and proposed RWPs, CWPs, WTPs, OHSRs, electromagenetic bulk flow meters and FCVs complete.	Rs

**Grand total ‘C’=A+B=Rs.....
(Rupees.....)**

and should this tender be accepted I/We do hereby agree and bind myself/ourselves to abide by and fulfil all the conditions annexed to the said specification or in default thereof to forfeit and pay to the RAIPUR Municipal corporation, the penalties of sums of money mentioned in the said conditions, viz.

Dated: _____ Tenderer`s Signature

Witness: _____ Address:

Address:

The above tender is hereby accepted by me on behalf of the RAIPUR Municipal corporation.

The _____/2017

Signature of the authority by whom the tender has been accepted.”

(Note: Figures given by the bidder in sub para –C shall be considered for evaluation purpose.)

SECURITIES

Name	Address	Occupation of Profession	Remarks

CONDITIONS OF CONTRACT

Definitions

- A.** The contract means the documents, forming the notice inviting tenders and tender documents submitted by the tenderer and the acceptance thereof including the formal agreement executed between the RAIPUR MUNICIPAL CORPORATION and the contractor.
- B.** In the contract the following expressions shall unless otherwise required by the context have the meanings hereby respectively assigned to them:-
- (a) The expression “works” or “work” shall unless thereby mean something either in the subject or context repugnant to such construction be construed and taken to mean the works or by virtue of the contract contracted to be executed whether temporary or permanent and whether original, altered, substituted or additional.
- (b) The “site” shall mean the land and/or other places on, into or through which work is to be executed under the contract or any adjacent land path or street through which work is to be executed under the contract or any adjacent land, path, or street which maybe allotted or used for the purpose of carrying out the contract.
- (c) The “Commissioner” means Commissioner of RAIPUR Municipal Corporation
- (d) The “Engineer-in-Charge” means the Executive Engineer who shall supervise and be in charge of the work and who shall sign the contract on behalf of the Commissioner.
- (e) “Municipal Corporation RAIPUR” shall mean the RAIPUR MUNICIPAL CORPORATION. Competent Authority means Commissioner of RAIPUR MUNICIPAL CORPORATION.
- (f) The term “Chief Engineer” means the Competent Authority from RAIPUR MUNICIPAL CORPORATION.
- (g) The term "Superintending Engineer" means the Superintending Engineer of the concerned RAIPUR MUNICIPAL CORPORATION / UADD
- (h) The term "Executive Engineer"/"Engineer-in-Charge"/"Divisional Officer" means the Executive Engineer of RAIPUR MUNICIPAL CORPORATION.
- (i) The term "Assistant Engineer" means the Assistant Engineer RAIPUR MUNICIPAL CORPORATION.
- (j) The word "Sub Engineer" shall mean "Section Officer" of the RAIPUR MUNICIPAL CORPORATION.

NOTE: “Words” importing the singular number include plural number and vice-versa,

CONDITIONS OF CONTRACT

1. The person(s) whose tender may be accepted (hereinafter called the contractor(s), their EMD shall be retained by RAIPUR MUNICIPAL CORPORATION as an initial security deposit and the remaining sum to make the security deposit to 5% (Five percents) shall be deducted from their RA Bills. The security deposit shall be released to the contractor after one year of successful completion of the

performance and defect liability period. The RAIPUR MUNICIPAL CORPORATION at any time can forfeit the security deposit if it seems to their opinion that the contractor is making any prejudice with the essence of the contract. The decision of the Commissioner in this regard shall be final and binding on the contractor.

2. The Contractor(s) is/are to provide every-thing of every sort and kind (with the exception noted in the schedule attached) which may be necessary and requisite for the due and proper execution of the several works included in the contract according to the true intent and meaning of the drawings and specifications taken together, which are to be signed by Executive Engineer/ Commissioner, Municipal corporation, RAIPUR. and the contractor(s) whether the same may or may not be particularly described in the specification or shown on the drawings, provided that the same are reasonably and obviously to be inferred there-from and in case of any discrepancy between the drawings and the specification the Executive Engineer/ Commissioner is to decide which shall be followed.
- 2 (a) The Contractor(s) is/are to set out the whole of the works in conjunction with an officer to be deputed by the Executive Engineer/ Commissioner and during the progress of the works to amend on the requisition of the Executive Engineer/ Commissioner any errors of which may arise therein and therein and provide all the necessary labour and materials for so doing. The contractor(s) is/are to provide all plant, labour and materials (with the exceptions noted in the schedule attached) which may be necessary and requisite for the works. All materials and workmanship are to be the best of their respective kinds. The contractor(s) is/are to leave to works in all respects clean and perfect at the completion thereof.

All inspection charges will be payable by the contractor

3. Complete copies of the drawings and specification signed by the Executive Engineer are to be furnished by him to the contractor(s) for his/their own use, and the same or copies thereof are to be kept on buildings incharge of the Contractor(s) agent who is to be constantly kept on the ground by the contractor(s) and to whom the instructions can be given by the Executive Engineer/ Commissioner. The Contractor(s) is/are not to sublet the works or any part there of without the consent in writing of the Executive Engineer/Commissioner.
4. The Executive Engineer/ COMMISSIONER is to have at all times access to the works which are to be entirely under his control. He may require the contractor(s) to dismiss any person in the Contractor(s) employ upon the works who may be incompetent or misconduct himself and contractor(s) is/are forthwith to comply with such requirements.
5. The Contractor(s) is/are not to vary or deviate from the drawings or specifications or execute any extra work of any kind whatsoever unless upon the authority of Executive Engineer to be sufficiently shown by any order in writing by any plan or drawings expressly given and signed by him as an extra or variation or by any subsequent written approval signed by him. In cases of daily labour all vouchers for the same are to be delivered to the Executive Engineer / Commissioner or the Officer-In-charge at least during the week following that in which the work may have been done and only such day work is to be allowed for as such as may have been authorized by the Executive Engineer/Commissioner. to be so done unless the work cannot from its character be properly measured and valued. The drawings in respect of which this contract is drawn up provide for a minimum depth of foundations for good soil. Any extra depth will not be measured as an extra when the foundation trenches have been opened up and will not be paid for in addition to the sum contracted for the completed work. The contractor has to ascertain the foundation strata in advance

and shall prepare the designs as per actual site conditions.

6. Any authority given by the Commissioner for any alterations or additions in or to works is not to vitiate the contract, but all additions, omission or variations made in carrying out the works are to be measured and valued and certified by the Executive Engineer /Commissioner and added to or deducted from the amount of the contract, as the case may be, at rates in force in the CGPWD/UADD/CGPHED Department. In such cases in which rates do not exist, the Municipal Corporation, will fix the rates to be paid.
7. All work and materials brought and left upon the ground by the Contractor(s) or his/their orders for the purpose of forming part of the works are to be considered to be the property of RAIPUR Municipal Corporation and the same are not to be removed or taken away by the Contractor(s) or any other without the special license and consent in writing of the Commissioner/ Executive Engineer of RAIPUR MUNICIPAL CORPORATION is not to be in any way answerable for any loss or damage which may happen to or in respect of any such work or materials either by the same being lost or stolen or injured by weather or otherwise.
8. The Commissioner has full power to require the removal from the premises of all materials which in his opinion are not in accordance with the specification and in case of default the Commissioner is to be at liberty to employ 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 Commissioner is also to have full power to require other proper materials to be substituted and in case of default the Commissioner may cause the same to be supplied and all costs which may attend such removal and substitution are to be borne by the contractor(s).
9. If in the opinion of the Executive/Commissioner any of the works are executed with improper materials or defective workmanship, the contractor(s) is/are when required by the Commissioner forthwith to re-execute the same and to substitute proper materials and workmanship and in case of default of the contractor (s) is so doing within a week the COMMISSIONER is to have full power to employ other persons to re-execute the work and the cost thereof shall be borne by the contractor(s).
10. Any defects, shrinkage or other faults which may appear within 12 months performance period, from the completion of the work arising out of defective or improper materials or workmanship are upon the direction of the COMMISSIONER/Executive Engineer to be amended and made good by the contractor(s) at his/their own cost unless the COMMISSIONER/Executive Engineer shall decide that he/they ought to be paid for the same and in case of default the Commissioner RAIPUR Municipal Corporation may recover from the contractor(s) the cost of making good the works.
11. From the commencement of the works to the completion of the same they are to be under the contractor's(s) charge. The contractor(s) is/are to be held responsible for and to make good all injuries, damages and repairs, occasioned or rendered necessary to the same by fire/ Natural Calamity or other causes and they are to hold the RAIPUR Municipal Corporation harmless from any claims for injuries to persons or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the contractor(s) or any one in his/their employ during the execution of the works
12. The COMMISSIONER is to have full power to send workmen upon the premises to execute fittings and other works not included in the contract for whose operation the contractor(s) is/are to afford every reasonable facility during ordinary working hours, provided that such operations shall be carried in such a manner as not to impede the progress of the work included in the contract but the

contractor(s) is/are not to be responsible for any damage which may happen to or be occasioned by any such fittings or other works.

13. The works comprised in this tender are to be commenced immediately upon receipt of the order of commencement given in writing by the COMMISSIONER when possession of the site can be had. The whole work including all such additions and variations as aforesaid (but excluding such if any as may have been postponed by an order from the COMMISSIONER) shall be completed in every respect within **30 months from the date of** issue of the aforesaid order and if from any cause whatever other than will full obstruction or default, on the part of COMMISSIONER or his staff and except as hereinafter provided the whole of such work shall not be finished to the satisfaction of the COMMISSIONER within the said period, the contractor(s) shall forfeit to the RAIPUR Municipal corporation from his/their security deposit by way of ascertained and liquated damages for each defaults and not by way of penalty the sum of **Rs. 125000/- (Rs. One lakh & twenty five thousand only)** per day for every completed day of such default provided that the entire amount of damages to be forfeited under the provisions of this clause shall not exceed ten percent on the estimated value of the whole work as shown in the tender.

Provided nevertheless that if the contractor to that effect from the COMMISSIONER himself which orders COMMISSIONER is the hereby e(s) shall be of the opinion that he is/they are entitled to any extension of time on account of the works being altered, varied or added to or on account of any delay by reason of any inclement whether or causes not under the control of the contractor(s) in consequence of orders empowered to give them in any or either of the such cases it shall by competent for the COMMISSIONER by an order in writing to extend the aforesaid period for final completion by such period or periods as he shall deem reasonable and the contractor(s) is/are to complete the works within such extended period or periods as aforesaid. Provided that the contractor(s) shall not be entitled to any extension of time unless he/they shall within 3 days after the happening of the event in respect of which he/they shall consider himself/themselves entitled to any extension give to the COMMISSIONER written notice of such claim to any extension of time and of the ground or grounds and of the amount thereof unless in any case the COMMISSIONER shall in his direction dispense with such notice and certify for an extension of time. Nevertheless and in case of any extension of time, the aforesaid provisions with amount for damages in defaults of due completion shall apply in case of non completion of the works within the extended time. Provided that the contractor(s) shall not be entitled to any extension of time in respect of the extra work involved in the extra depth of foundation mentioned in clause 5.

14. If the contractor(s) shall become bankrupt or compound with or make any assignment for the benefit of his/their creditors or shall suspend or delay the performance of his/their part of the contract (Except on account of causes mentioned in clause 13 or in consequence of not having proper instructions for which the contractor(s) shall have duly applied.) The COMMISSIONER may give to the contractor (s) or his/their assignee or trustee, as the case may be, notice requiring the work to be proceeded with and in case of default on the part of the contractor(s) or his/their assignee or trustee for a period of 7 days, it shall be lawful for the COMMISSIONER to enter upon and take possession of the works and employ any other person or persons to carry on and complete the same and to authorise his/them to use the plant, materials and property of the contractor(s) upon the works and the costs and the charges incurred in any way in carrying on and completing the said works are to be paid to the COMMISSIONER by the Contractor(s). The COMMISSIONER shall be the final authority to determine the amount spent to complete the unfinished work. The certificate of COMMISSIONER as to the value of the balance work done shall be final and conclusive against the contractor.

15. The Contractor(s) shall be paid on the completion of each calender month commencing from the Date of issue of work order a sum of 90% of total value of work done since the last payment according to the certificate of the Executive Engineer when the works shall be completed the contractor(s) is/are to be entitled to receive one moiety of the amount remaining due according to the best estimate of the same that can be made and the contractor(s) is/are to be entitled to receive the balance of all moneys due or payable to him/them under or by virtue of the contract within twelve months from the completion of the works. Provided always that no final or other certificate is to cover or relieve the contractor(s) from his/their liability under the provision of clause 10 whether or not the same be notified by the COMMISSIONER at the time or subsequently to the granting of any such certificate.
16. A certificate of the COMMISSIONER or an award of the referee hereinafter referred to, as the case may be showing the final balance due or payable to the contractor(s) is to be conclusive evidence of the works having been duly completed and the contractor(s) is/are entitled to receive payment of the final balance, but without prejudice to the liability of the contractor(s) provision of clause 10.
17. Provided always that in case any question, dispute of difference shall arise between the COMMISSIONER and the contractor(s) as to what additions if any, ought in fairness to be made to the amount of the contact by reason of the works being delayed through no fault of the contractor(s) or by reason or on account of any directions or requisitions of the COMMISSIONER involving increased cost to the contractor(s) beyond the cost properly attending the carrying out of the contract according to the true intent and meaning of the signed drawings and specification, or as to the works having been duly completed or as to the construction of these presents or as to any other matter or thing arising under or out of this contact, except as to matter left during the progress of the works to the sole decision or requisition of the COMMISSIONER under clauses No.1,4,8 and 9 or in the case the contractor(s) shall be dissatisfied with any certificate of the COMMISSIONER under clause 6 or under the provision in clause 13 or in case he shall with hold or not give any certificate to which he/they may be entitled, or as to the right of the contractor(s) to receive any compensation or as to the amount of such compensation payable to him/them under clause 18, then such question, dispute or difference or such certificate of the valve or matter which should be certified as the case may be, is to be from time to time submitted to the arbitration of a tribunal composed of one arbitrator nominated by the contractor(s) and one arbitrator nominated by the RAIPUR MUNICIPAL CORPORATION. In the event of a disagreement between the arbitrators on any matter of matters, such matter or matters shall be referred to an umpire to be nominated by the Director, UADD and the award of such arbitrators or the umpire is to be final and where necessary to be equivalent to a certificate of the Director, UADD and the contractor(s) is/are to be paid accordingly.
18. If at any time before or after the commencement of the work, Commissioner RAIPUR MUNICIPAL CORPORATION shall for any reason whatsoever:-
 - 18.1 Cause Alterations, omissions or Variation in the drawings and specification involving any curtailment of the works as originally completed; OR
 - 18.2 Not required the whole of work as specified in the tender to be carried out,

The contractor(s) shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he/they might have derived from the execution of the work in full as specified in the tender but which he/they did not derive in consequence of the curtailment of the works by reason of alterations, omissions or variations or in consequence of the full amount of the work not having been carried out.

But the contractors shall be entitled to compensation for any loss sustained by him/them by reason of his/their having purchased or procured any materials or entered into any engagements or made any advances to labour or taken any preliminary or incidental measure on account of or with a view to execution of the works or the performance of the contracts.

19. Death or permanent invalidity of the contractor-If the contractor is an individual or a proprietary concern, partnership concern, dies during the currency of the contract or becomes permanently incapacitated, where the surviving partners are only minors the contract shall be closed without levying any damages/ compensation as provided for in clause 3 of the contract agreement. However, if the competent authority is satisfied about the competence of the surviving, then the competent authority shall enter into a fresh agreement for the remaining work strictly on the same terms and conditions, under which the contract was awarded.

20. Penalty for Breach of Contract- On the breach of any term or condition of this contract by the contractor, the RAIPUR MUNICIPAL CORPORATION shall be entitled to forfeit the security deposit or the balance thereof that may at the time be remaining, and to realize and retain the same as damages and compensation for the said breach but without prejudice to the right of the RAIPUR MUNICIPAL CORPORATION to recover further sums due or which may become due to the contractor by RAIPUR MUNICIPAL CORPORATION or otherwise howsoever.

21. From the commencement of the work to the completion of the same they are to be under the contractor's charge. The contractor(s) is/are to be held responsible for and to make good all injuries, damages and repairs, occasioned by or rendered necessary to the same by the fire/ natural calamity or any other causes and they are to hold the corporation harmless from any claims for injuries to persons or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the contractor(s) or anyone in his/their employ during the execution of the works.

Dated:

Signature of the Contractor

Dated:

**Commissioner
Municipal Corporation
RAIPUR, Chhattisgarh**

Annexure- "A":Model Rules relating to Labour, Water Supply and Sanitation in Labour Camps

NOTE:

These model rules are intended primarily for labour camps which are not of a permanent nature. They lay down the minimum desirable standard which should be adhered to standards in permanent or semi permanent labour camps should not obviously be lower than for temporary camps.

LOCATION:

The camp should be located in elevated and well drained ground in the locality. Labour huts to be constructed for one family of 5 persons each. The layout to be shown in the prescribed sketch.

HUTTING:

The huts to be built of local materials. Each hut should provide at least 20 sqm. of living space.

SANITARY FACILITIES:

Latrines and urinals shall be provided at least 15 mtrs. away from the nearest quarters separately for men and women and specially so marked in the following scale.

LATRINES:

Pit provided at the rate of 10 user of families per seat. Separate are required as the privacy can also be user for this purpose.

DRINKING WATER:

Adequate arrangements shall be made for the supply of drinking water. If practicable filtered and chlorinated supplies shall be arranged when supply is from intermittent sources over head storage tank shall be provided with a capacity of five liters a per son per day. Where the supply is to be made from a well it shall conform to the sanitary standard laid down in the report of the rural sanitation committee. The well should be at least 30 meters. away from any latrine or other source of pollution. If possible the and pump should be installed for drawing the water from well. the well should be effectively disinfected one every month and the quality of the water should be got tested at the Public Health Institution between each work of disinfecting.

BATHING AND WASHING:

Separate bathing and washing plan shall be provided for men and women for every 25 persons in the camp. There shall be one gap and space of 2 sq. for washing and bathing Proper drainage for waste water should be provided.

WASTE DISPOSAL:

Dustbin shall be provided at suitable places in camp and the residence shall be directed to throw all rubbish into those dustbins. The dustbin shall be provided with cover. The contents shall be removed every day and disposed off by trenching.

MEDICAL FACILITIES:

a) Every camp where 1000 or more persons reside shall be provided with whole time doctor and dispensary. If there are women in the camp a whole time Nurse shall be employed.

b) Every camp where less than 1000 but more than 250 persons resides shall be provided with a dispensary and a part time, Nurse/Midwife. If there are less than 250 persons in any camp a first aid kit shall be maintained in charge of whole time persons trained in first side. All the medical facilities mentioned above shall be for the all residents in the camp, including a dependent of workers, if any, free of costs. For each labour camp there should be qualified sanitary inspector and sweepers should be provided in the following scales :-

For camps with strength over 200 but not exceeding 500 persons - One sweeper for every 75 persons above the first 200 for which 3 sweepers will be provided.

For camps with strength over 500 persons - One sweeper for every 100 persons above first 500 for which 6 sweepers should be provided.

Annexure- "B": Contractors Labour Regulations

The contractor shall pay not less than fair wage to labours engaged by him in the work:

EXPLANATION:

- A. "FAIR WAGES" means whether for time of piece work as notified on the date of inviting tenders and where such wages have not been so notified the wages prescribed by the competent authority for division in which the work is done.

The contractor shall, notwithstanding the provision of any contract to the contrary, cause to be paid a fair to labours indirectly engaged on the work including any labour engaged by his sub-contractor in connection with the said work as if labourers had been immediately employed by him.

In respect of all labour directly or indirectly employed on the works or the performance of his contract, the contractor shall comply with or cause to be complied with the labour Act. Enforce.

The Executive Engineer/Assistant Engineer shall have the right to deduct from the money due to the contractor any sum required or estimated to be required for making good, the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for the benefit of the workers non payment of the wages or of deductions made from his or their wages which are not justified by their terms of contract or non-observance of regulations.

The contractor shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity form his sub-contractor.

The Regulations aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this conduct.

The contractor shall obtain a valid license under the contract (Regulation & Abolition) Act, in force and rule made there under by the competent authority from time to time before commencement of work and continue to have a valid license until the completion of the work.

Any failure to fulfill this requirement shall attract the penal provisions of this contract arising out of the resulted non execution of the work assigned to the contractor.

Special Additional Condition:-

- Cess@1% (one percent only) shall be deducted at source, from every bill of contractor by Executive Engineer under "Building and other Construction for workers welfare, cess Act-1996"

It is mandatory for the contractor(s) to get him self/them selves registered with "Chhattisgarh Building and other Construction Welfare Board" for work amounting to Rs. 10.00 Lacs (Ten Lacs) and above and enclose a true copy of such registration certificate within one month of award of contract.

Annexure-"C": Form of Income Tax Clearance Certificate-Deleted

ANNEXURE – “D”

Statement showing the Lead of Materials

S.No.	Description	Lead
1.
2.
3.
4.
5.

Note - This statement is only for guidance of the contractor. The tenderer should satisfy himself regarding the availability of the required quality and quantity of materials.

SPECIAL CONDITIONS OF CONTRACT

1. The Addresses are : (i) “Employer” : The Commissioner Municipal Corporation, RAIPUR
Attention:
- (2) Tax will be deducted at source as per prevailing Income Tax Rules
- (3) The risk insurance coverage shall be as follows
 - a) Third party vehicle liability insurance as required under India’s Motor Vehicle Act, 1988 by the Contractor or its personnelSub Contractor or their personnel foe the period of contract.
 - b) Third Party liabilities insurance, with a minimum contract of equal to amount of contract.
 - c) Professional liabilities insurance with a minimum coverage equal to amount of contract.
 - d) Employer’s liabilities & workers compensation insurance in respect of the Personnel of the Contractor, in accordance with the relevant provisions of the Applicable Laws of India, as well as with respect to such personnel any such life, health, accident, travel or other insurance as may be applicable
 - e) Any other laws / rule applicable in India.
- (4) The arbitration proceedings shall take place in RAIPUR, Chattisgarh.
- (5) The performance Securities amount is 5% of the contract value

Binding Signature of
Commissioner, Municipal Corporation, RAIPUR

.....

Binding Signature of
CONTRACTOR

.....

(On behalf of)

ANNEXURE - "E-I"

1.0 SCOPE, SPECIFICATIONS FOR PUMPS, INCLUDING ALL ACCESSORIES

- 1.1 Replacement of VT raw water pumps (4W+2S) in intake well of existing 150 MLD including electric panel and all connections including 12 months trial run & 5 years of O&M. O&M will start after completion of 12 months Trial run.
- i. Removing and Shifting (4W+2S) VT pumps from existing 150 MLD Intake well and replacing them in 80 MLD Intake well again after removing existing pumps installed in 80 MLD intake well. These old worn out pumps including electric panel and accessories complete will be handed over to RMC Raipur and receipt obtained.
- 1.2 Replacement of clear water pumps in
- i. In (150+30) MLD clear water pump House of (4W+2S) nos of discharge 2046 cum/hr at head 65 m including all accessories and electric panel and all connections including 12 months trial run & 5 years of O&M.
 - ii. In existing 80 MLD clear water pump house of (4 nos new + 2 nos Existing Pumps) HSC pumps of discharge 995 cum/hr at head 45 m including all accessories and electric panel and all connections including 12 months trial run & 5 years of O&M. Pumps already existing there will be handed over to RMC Raipur and receipt obtained.

1.3 PUMP HOUSE AND EQUIPMENT:

- i. Provision of Dismantling of Existing Pumping Machinery & Installation of same including all electrical equipment, Panel, Breaker cable etc in a planned manner (To be approved by Engineer -in-Charge) including suction and delivery side valves, pipes & special, shifting of all these items out side the pump house up to the store and including all civil works as directed by Engineer -in-Charge for followings:
 - a. 6 Nos VT pump of 150 MLD Intake to be taken out and to be installed in existing 80 MLD Intake.
 - b. 6 Nos, VT Pumps of 80 MLD Intake well to be taken out.
 - c. 6 Nos. HSC pumps to be taken out from existing 150 MLD WTP and to be replaced by new compatible pumping machinery
 - d. 4 Nos. HSC pumps to taken out from existing 80 MLD WTP and to be replaced by new compatible machinery
- ii. Supply, fixing of 6 Nos Water lubricated Verticle Turbine Pumps each 2705 cum/hr discharge @45 m head (4W+2S) with HT motor, Foundation, Pipes, with specials, Dismanteling joints, Sluice valve, reflux valve, Auto Transformer Starter, H.T. Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit brakers, single phasing preventer water level guard, capacitor etc, Cable (XLPE Armoured cable), Earthing, Pressure gauging, Tools, Spares and lifting arrangement(for 02 Years), Lighting/lighting arrestor in pump house, EOT Crane (Capacity -7 Ton) etc complete including installation and commissioning with 12 months trial run
- iii. Supply installation, testing and commissioning of 6 Nos (4W+2S) Horizontal Split Case Centrifugal Pumps, (Impeller Stainless steel & Stainless Steel Shaft) suitable for pumping Clear water of capacity and minimum combined efficiency 75 % coupled with flexible coupling to TEFC Squirrel cage Induction HT motor (Degree of protection IP 44) complete with discharge each 2046 cum/hr @ 65 m head with Base Frame, foundation bolts etc. all as required & directed. (Pumps with higher efficiency shall be preferred) and also including foundation, Pipes, with specials, Dismanteling joints, Sluice valve, reflux valve, Auto

Transformer Starter,H.T Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit breakers, single phasing preventer water level guard, capacitor etc,Cable (XLPE Armoured cable),Earthing,Pressure gauges,Tools, Spares and lifting arrangement for 02 years,Lighting/lighting arrestor in pump house,EOT Crane (Capacity -7 Ton) complete and s as directed

- iv. Supply installation, testing and commissioning of 4 Nos Horizontal Split Case Centrifugal Pumps, (Impeller Stainless steel & Stainless Steel Shaft) suitable for pumping Clear water of capacity and minimum combined efficiency 75% coupled with flexible coupling to TEFC Squirrel cage Induction HT motor (Degree of protection IP 44) complete with discharge each 995 cum/hr @ 45 m head with Base Frame, foundation bolts etc. all as required & directed. (Pumps with higher efficiency shall be preferred) and also including foundation, Pipes, with specials,Dismanteling joints,Sluice valve, reflux valve,Auto Transformer Starter,H.T Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit breakers, single phasing preventer water level guard, capacitor etc,required cable (XLPE Armoured cable), Earthing,Pressure gauges,Tools, Spares and lifting arrangement for 02 years,Lighting/lighting arrestor in pump house,EOT Crane (Capacity -7 Ton) complete and s as directed
- v. Supply installation, testing and commissioning of 6 nos (4W+2S) Horizontal Split Case Centrifugal Pumps, (Impeller Stainless steel & Stainless Steel Shaft) suitable for pumping Clear water of capacity and minimum combined efficiency 75% coupled with flexible coupling to TEFC Squirrel cage LT Induction motor (Degree of protection IP 44) complete with , Base Frame, foundation bolts etc. all as required & directed. (Pumps with higher efficiency shall be preferred). Each 620 Cu.m/hr discharge @ 60 m head and including Foundations, Pipes, with specials, Dismanteling joints, Sluice valve, reflux valve, Star Delt Starter, L.T Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit breakers, single phasing preventer water level guard, capacitor etc., Cable (XLPE Armoured cable), Earthing of all current carrying equipments as per IS, Pressure gauging, Tools, Spares(for 02 years) and lifting arrangement, Lighting/lightening arrestor in pump house, EOT Crane(capacity- 5 Ton), and
- vi. Installation, Testing, Commissioning and shifting of old Transformer, Cable and Pole etc. From Existing 47.5 MLD WTP to Prop. 80 MLD WTP site. And construction of 60 cm high plinth of 3mx 3m size and construction of chain link fencing at elast 2m high with a steel gate 2mx 1.2 m
The equipment mentioned is required to be provided and installed for the Augmentation and reorganization of water Supply Scheme for RAIPUR.The ambient temperature to be adopted for the design of the equipment shall be 45⁰.

1.4 SPECIAL CONDITIONS FOR WORK

1. Work is for complete design, supply, installation & commissioning of all items, as per detail specification given
2. Electrification work shall be done as per I.E. Rules only.
3. Electrification work shall be done by “A” class contractor, whose certificate to be produced before commissioning of work.
4. Contractor will have to submit drawing for work which shall be as per electricity rules and will have to get approved by this office within 30 days of awarding of work.
5. Contractor will have to submit drawing for sub-station which shall be as per electricity rules and will have to get approved by this office and safety electrical inspection authority within 30 days of awarding of work.

6. Contractor/firm shall also get permission for commencing the sub-station by safety electrical inspection authority of Govt.
7. Contractor/firm shall offer their prices on basis of specification given as per Annexure – “E” only.
8. This office shall only accept items of makes specified in the tender documents as per Annexure “T”. All other items whose makes has not been specified should be as per IS specification.
9. Contractor/ firm shall have to submit manufacturers test certificate for items like, Pumps, Motors, Valves, Panel, Transformer and ACB.
10. Contractor would be provided with desired certificate for consumption of items as per Annexure “E- 1” for this project.
11. Pumps, Motors, Valves, Transformers, LT Panel will have to be inspected by DGS&D/RITES/SG&S at manufacturers’ works, inspection charges to be born by tenderer.

**Commissioner,
Municipal Corporation
RAIPUR, Chhattisgarh**

1.4.1 SCOPE OF MISC. AND CIVIL WORKS:

All the works like foundation laying, grouting, R.C.C. work for chairs of valves, manifolds, thrust blocks and painting etc. As described in detail in the following para's (nos. 1.3 to 1.11) will have to be inclusive of all such items. The required material, labour and machinery for such works are to be arranged by the contractor at his end.

1.4.2 FOUNDATION WORKS:

The surfaces of foundations shall be dressed to bring the top surface to the required level, prior to the placement of equipment/equipment bases on the foundations. All the equipment bases and structural steel base plates shall be grouted and finished as per these specifications unless otherwise recommended by the equipment manufacturer.

The concrete foundation surfaces shall be properly prepared by chipping, grinding as required to bring the top of such foundation to the required level to. Provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned.

1.4.3 GROUTING MIX:

The grouting mixture shall be composed of Portland cement, sand and water. The Portland cement to be used shall conform to IS 269 or equivalent, sand shall conform to relevant applicable is or equivalent. The grout proportions for flat bases where the grouting space does not exceed 25 mm shall be 50 kg. of cement 75 kg. of sand. Only the required quantity of water shall be added so as to make the mix must workable and the mix shall not show excess water on stop when it is being puddle in place. For thicker grout beds upto 65 mm, the amount of sand shall be increased to 105 kg. per bag of cement. Bases which are hollow and are to be filled full of grouting shall be filled to a level of 26 mm, above the outside rim with a mortar mix in the volumetric proportions of one part of cement. 1.5 part sand and 1.5 part 6 mm, hard gravel by volume. An acceptable plasticizer may be added to the grout mixes in a proportion recommended by the manufacturer of plasticisers. All such grouts shall be thoroughly mixed and shall be used immediately after mixing.

1.4.4 PLACING OF GROUT:

Before actually placing the grout a low dam shall be set around the base at a distance that permit pouring and manipulation of the grout. The height of such dam shall be at least 25mm above the bottom of the base. Suitable size and number of chairs shall be introduced under the base before placing the grout so that such chairs can be moved back and forth to push the grout into every part of the space under the base.

1.4.5 FINISHING OF THE EDGES OF THE GROUT:

The poured grout should be allowed to stand undisturbed until it is well set immediately thereafter, the dam shall be removed and grout which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement-sand mortar pressed firmly to bond with the body of the grout and smoothed with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.

1.4.6 CHECKING OF EQUIPMENT AFTER GROUTING:

After the grout is set and cured, the contractor shall check and verify the alignment of equipment, alignment of shafts and rotating machinery, the stops of the bearing pedestals, centering of rotors with respect of their sealing bores couplings, etc, as applicable and the like items to ensure that no displacement has taken place during grouting. The values recorded prior to grouting shall be used during such post grouting check-up and verifications. Such pre and post grout records of alignment details shall be maintained by the contractor in manner acceptable to the Engineer.

1.4.7 SHAFT ALIGNMENT:

All the shafts of rotating equipment shall be properly aligned to those of the matching equipment to as perfect an-accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

1.4.8 DOWELING:

All the drive motors and other equipment shall be suitably doweled after alignment of shafts with tapered machined doweling as per the direction of the Engineer.

1.4.9 PAINTING:

All exposed metal part of the equipment including pumping, structures, railings, etc., wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches with the shop primer paint used after thoroughly cleaning all such parts of all dust, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or sand blasting, and the same being inspected and approved by the engineer for painting. Afterwards the above parts shall be finished with two coats of alloyed resin machinery enamel paints. The quality of the finish paint shall be as per the standards of relevant i.e. or equivalent and to be of the colour as approved by the engineer.

1.4.10 COLOUR CODE FOR PIPE SERVICES:

All pipe services wherever applicable are to be painted in accordance with the manufactures' standard colour scheme by the Contractor.

1.5 DETAILED ITEM – WISE SPECIFICATIONS VERTICAL TURBINE PUMPS

1.5.1 GENERAL:

For mounting. These components shall be from pump manufacturers only. The complete assembly consisting of steel base frames, sole plate and bottom pieces shall be stress relieved after fabrication and before machining. Test certificate from manufacturer regarding stress relieving with observation sheets from column pipe, discharge head, base frame, motor stool etc., shall be furnished. All necessary details regarding pump and motor mounting shall be furnished well in advance by the contractor for prior approval and to ensure necessary pockets in civil works. Work of erection pumps, motors including laying under this section, specifications of vertical turbine pumps are outlined. The Vertical turbine pumps shall generally conform to IS 1710 of 1972. The specifications given in this section are for the following type of V.T. pumps.

- V.T. Pumps-self water lubricated-surface discharge type.
- V.T. Pumps-self water lubricated-sub surface discharge type.
- V.T. Pumps-forced water lubricated-surface discharge type.
- V.T. Pumps-forced water lubricated-sub surface discharge type.

1.5.2 PUMP DUTIES:

1.5.3 DUTY POINT DISCHARGE:

The pump shall have to give a discharge at normal water level conditions at duty head and shall give corresponding higher discharge for the lesser heads.

1.5.4 DUTY POINT PUMP HEAD:

Duty point pump heads for pumps, as corresponding to normal W.L. shall be designed by the bidders. No loss of head what-so-ever in entry, strainer, bell mouth, bowl assembly, column pipes and discharge tee is accounted for in the calculations of pump head. The bidder/manufacturer shall have to account for these

losses while designing the pumps. However, head loss delivery pipe, valves fittings, rising mains and velocity head beyond discharge flange on discharge head/pumps casing are to be included. Thrust bearing loss may be declare separately by the manufacturer.

1.5.5 DUTY POINT EFFICIENCIES:

The Tenderer should evaluate the above efficiencies and specify the same in their offer along with calculations. The curves for both types of efficiencies viz., pump efficiency and overall efficiency for entire starting from shut off the static head should be invariably submitted along with the offer.

1.5.6 HEAD RANGE AND PARALLEL OPERATIONS:

The pumps will satisfy the head requirement as per the system resistance curves, while operating in solo and in any combination as per design requirement. The pumps should be suitable for operation in head range. The system resistance curves of the pumps shall be submitted by the bidders.

1.5.7 POWER MARGIN:

The pumps shall be capable of operating in the range without being overloaded at any point and keeping a margin of at least 5% of power in the motor pump over entire operating range. Requirement of power at shut off should not exceed power requirement at duty point. The pump should be capable of starting against fully closed Butterfly valve without being overloaded at any point upto valve fully open.

1.5.8 PUMP CHARACTERISTICS:

The pump characteristics shall be of stable nature and such that the efficiency is fairly steady for the water level variations as mentioned in the foregoing clauses. The maximum efficiency point will be nearer to the duty point and fairly constant for larger range on either side. The pumps should run smoothly from lowest head to shut off point, without cavitations and vibration (within H.L.S. limitations for vibrations). The variation in the efficiencies for any point of operation in the entire operating range should be minimum.

1.5.9 NPSH CONDITIONS (NET POSITIVE SUCTION HEAD CONDITIONS):

NPSH required by pumps offered by the Tenderer should be lesser by at least 0.5 meters than N.P.S.H.A. at duty point and shall not exceed the N.P.S.H. available at any point of operation in the range, with solo and parallel operations. The Tenderer shall take following values of the corresponding parameters for the purpose of calculation of N.P.S.H.A. at the site.

- i) Atmospheric : 9.6 Meter column of water
- ii) Vapour pressure of water : 0.6674 Meters (at 37.80 C Normal temperature) column f water.

1.5.10 SPEED:

Pump speed should be decided by the tenderers based on optimum and cost economic consideration.

1.5.11 SOLID HANDLING CAPACITY:

The pumps shall be suitable for pumping of raw river water containing silt coarse sand and gravel / suspended solids upto 20 mm size. Tenderer to get water analysis done and suitable preventive special alloy coating needs to be provided to the impellers and casings to avoid any d amage due to abrasive material in raw water.

1.5.12 CLASS OF OPERATION:

The pumps shall be suitable for non stop continuous 24 hours operation without interruption.

1.5.13 DEFINITIONS OF EFFICIENCES:

For all purpose of this contract, the various efficiencies will have the same meaning and effect as defined in the IS 1710-1972 (page 5) which are reproduced below.

I) BOWL EFFICIENCY:

The ratio of bowl assembly output to bowl assembly input expressed as percentage.

II) PUMP EFFICIENCY:

The ratio of pump output to pump input expressed as percentage.

III) OVERALL EFFICIENCY:

The ratio of pump output to driver input expressed as percentage.

1.6 CONSTRUCTION FEATURES FOR V.T. PUMPS:

The pump shall vertical, spindle suspended and non-pullout type. Number of stages should be decided by the tenderers. The pumps shall comprise of Bowl Assembly, line shaft enclosing tubes, line shaft bearings, line shaft bearing holders, discharge head thrust bearings, sole plates, base frames, flexible coupling etc.

A) The pump shall be self water lubricated type or

B) The pump shall be forced water lubricated type as the case may be

- 1.6.1 The pump bowl/bowls shall be flanged with machined mating faces. The bowl shall be flange joined to the discharge nozzle or suction nozzle. Bowl wearing rings be of replaceable type. The casing shall be provided with water lubricated bearings.
- 1.6.2 A Ni-CI bell mouth shall be fitted to suction nozzle to reduce inlet velocity to 1.5 mtrs/sec. Maximum. The suction strainer shall be of galvanized MS and sufficiently strong to stand the suction pressure. Area of opening shall not be less than 2.5 times bell mouth area.
- 1.6.3 Impellers shall be enclosed type, cast in one piece and balanced both statistically and dynamically. The impellers shall be provided with wearing ring on it. The interior surfaces and passages shall be smoothly finished to obtain the highest efficiency and shall be designed to ensure smooth operation free from any cavitation or vibrations. As raw water is being pumped, balancing holes/ devices will not be accepted for balancing the hydraulic thrust.
- 1.6.4 The pump height (i.e., impellers) should be adjustable from the top of pump head. There should be a sufficient vertical clearance between the bowl and impeller to accommodate for the line shaft elongation due to hydraulic thrust, while in operation.
- 1.6.5 The impeller shaft will not overhang at the bottom and will be rotating in bearing support at its bottom.
- 1.6.6 The line shaft shall be solid type and will be designed to take all types of loads such as torsion, tensile and dynamic etc. Impeller shaft will have muffled coupling arrangements. The line shafts bearing shall be water lubricated type with cutlass rubber, grooved to facilitate lubrication. Line shaft bearing shall be provided at suitable intervals to ensure that first critical speed is at least 25% more than rotative speed. Suitable steel sleeves be provided to line shafts. (e.d) The line shaft protection tubes shall be provided for forced water lubrication to line shaft bearings. The line shaft protection tubes should be of heavy duty seamless steel tubes and shall withstand all mechanical and hydraulic forces exerted on it with an allowance for corrosion and wearing.
- 1.6.7 The column pipe shall be of extra heavy weight, electrical fusion welded (EFW) single longitudinal joint, or electrical resistance welded (ERW) pipes with both ends flanged, machined on surfaces, edges and spigotted to facilitate the alignment. The flanges shall have grooves to accommodate the rubber rings.

- 1.6.8 The discharge head/motor stool shall be of full diameter, flanged at ends, flanged surfaces and Tee ends machined, fabricated out of MS in smooth 90° bend so as to have minimum loss of head in and stress relieved before machining. The pump discharge head shall be fabricated and suitably reinforced to withstand all types of static, dynamic loads, hydraulic thrust, torsional loads imposed by the pump, motor and to limit vibrations. The pump discharge head/motor stool shall house thrust bearings with cooling arrangement and contain cast iron stuffing box in which the pump top shaft shall be sealed. A sufficient opening should be provided so as to have an easy access and workability on stuffing box. Non reverse rotation ratchet arrangement is to be provided either in pump or in motor so as to prevent the pump from rotating in reverse direction.
- 1.6.9 The column assembly shall be in standard lengths as far as possible.
- 1.6.10 The clearance between bell mouth, strainer and sump floor and also nearing walls should be such that the vortex free operation is obtained. Any changes in this clearance if required other than those specified shall be clearly mentioned in the offer, with reasoning thereof.
- 1.6.11 The pump shall be subsurface discharge type with discharge-head with integrated or separate motor stools suitable for mounting in the R.C.C. floor of pump house. The construction should be such that the pump discharge head with thrust bearings, motor stool along with the motor shall be resting on the pump floor only.
- 1.6.12 Steel sole plates of adequate thickness shall be provided under the pump discharge head/pump head/motor stool, together with all necessary anchor bolts, nuts and washers to provide precise horizontal and vertical alignment. The sole plate shall be fixed on steel based frames to be anchored in R.C.C. floors. The surfaces of base frame, sole plate and base plate shall be smoothly and snugly fitted so that no vibration shall occur. The fastening of base frame to sole plate and sole plate to base of pump/motor shall be through nut bolts or headed studs. The opening in the sole plates and the base frame shall be of sufficient diameter to pass the complete bowl assembly including suction bell and strainer. The erection and dismantling of both the pumps and motors shall be possible from the motor floor, with EOT / HOT crane available in the motor hall. The motor or the pump discharge head shall not be rested either on the pump floor or motor floor while erecting or dismantling on places other than respective base frames/sole plates. The above components should always be carried from or to the service bays directly, while assembling, or dismantling. The contractor will be responsible to get design from the pump manufacturer and approved from KBJNL. The steel base frames fabricated from plates together with machined bottom pieces, sole plates, all anchoring arrangement, support etc., for pump and mong of foundation, grouting, shaft alignment, doweling and painting etc., shall be done by the contractor at his own cost as per general and miscellaneous specifications mentioned earlier.
- 1.6.13 The thrust bearing shall be anti friction heavy duty type. The bearing shall be designed to accommodate all possible loads under normal operations or shut of condition and shall be suitable for reverse rotation upto at least 1.5 times the normal forward speed. The bearing shall be oil lubricated type and shall be provided with oil level gauge and temperature measuring and sensing system and cooling system as given below.
- One no. temperature probe suitable for dial type thermometer with dial temperature.
 - One no. 3 wire platinum element having DC resistance f 100 ohms at 00 C suitable for use with adigital temperature, scanner as specified in electrical section.
 - The cooling water supply for the pump thrust bearing if required shall be taken from a adequate tapping from the pump discharge head or line shaft bearing lubrication (forced water). Necessary valves, strainers and non-flow sensors and annunciation system on panel board shall be provided for this cooling system. The life of thrust bearings shall not be less than 40000 hours of operation.

1.7 FORCED WATER LUBRICATION AND COOLING SYSTEM:

The forced water lubrication system for transmission bearing and supply of cooling water to pump thrust bearing and for motor cooling shall be generally as mentioned below.

- Set of manual type Pressure filters along with differential pressure switches, pressure gauge built in valves etc., are to be provided to clean stream of water from main header containing fine, un-dissolved solids like sand, dust, abrasives etc. The raw water should be made to enter into the inlet of Pressure filter at sufficient pressure. The contaminant should be separated and should pass downwards and ultimately discharging out of the drain of the Pressure filter.
- The clean and solids free water free from the outlet of filter should be used for the thrust bearing cooling and lubrication of line shaft/transmission rubber bearings of the V.T. Pumps and for cooling of vertical motors.

The system shall comprise of following:

- One set of manual Pressure filter of adequate size for each pump shall be provided having sufficient design capacity of V.T. Pump lubrication and cooling to thrust bearing and motor cooling.
 - Booster pump sets complete with motor, base plate, switches and starter etc. (One working + One stand by) suitable for group of 8 or less V.T. pumps sets shall be provided having adequate capacity in discharge and head with sufficient margin.
 - Suction pipe for Booster pumps with valves etc., for raw water to be taken off from the R.C.C.storage tank being provided for the purpose by the Contractor.
 - All Pumping valves, gauges press switches, Solenoid valves etc., shall be provided as per schematic drawing.
 - Electrical interlocks with suitable sensors must invariable be provided for forced water lubrication system and cooling system. The arrangement should trip the main pump motor in the even of failure of water supply from booster line to either of line shaft lubrication system thrust bearing cooling or motor cooling. The arrangement for tripping the main pump motor should be such as to allow contains time lay for the stand by booster to take over.
 - Automation with all relays, sensors, switch gears and solenoid valves etc., shall be provided so that if any Booster pumps trips or fails to deliver water the stand-bye set should start automatically and feed V.T. Pumps sets the lubrication and cooling system and stop the defective Booster pumps.
- 1.7.1 The water storage tank provided to initial start could be made the only source of water for feeding the booster pumps. These tanks could be continuously fed with water from the delivery system so as to keep the water level more or less constant. So, that the tank could feed the booster pump on a continuous basis. To avoid head load on pressure filtration system water to be drawn from the storage tanks at a level not lower than the middle level of the tank.
- 1.7.2 A. A suitable arrangement to take out the entrapped air in the pump column discharge tee shall be provided with pipe fitted in the tapping at suitable place in the pump, with valve, etc., complete the make the system work satisfactorily.
- 1.7.3 Suitable topping appropriate place shall be provided for mounting a delivery pressure gauge. The pressure gauge shall be Bourdon type and shall be provided with piping U type and tabulating socket etc. This pressure gauge shall be provided and located at operating level i.e., motor floor level. Gauge range shall be twice the head to be measured. Drain cocks should be placed immediately below the gauged so that frequent tests could be made to determine whether pipe connections of the gauge are filled with water. The bourdon type gauge shall be fixed in such a way that no strain is placed on its case so that readings are not affected. Gauge shall be calibrated prior to after the tests and shall be fixed in upright position.
- 1.7.4 In case of emergency i.e. failure of Booster pumps of filtration system, necessary system shall be installed by the contractor for supply of raw water for lubrication of Pumps and motor by necessary tapping from pump delivery line, by passing the regular cooling/lubrication system.

1.8 MATERIALS OF CONSTRUCTION FOR V.T. PUMPS:

Bell mouth, pump bowls, suction casing And discharge nozzle	Ni-CI conforming to IS 210 grade 20
Impellers shaft for V.T. Pumps and Booster Pumps	Stainless steel AISI SI 410
Column pipes	Mild steel IS 2062 EFW/ERW pipes
Line shaft protection tubes	Seamless MS
Flexible coupling	Forged steel conforming to IS 3495
Wearing rings for V.T. Pumps and Booster pumps	Gun metal/stainless steel as Appropriate
Column flanges	Mild steel IS 2062
Nut bolts and washers upto bottom of Discharges lead	Stainless steel AIST ST 304/316
Line shaft Stainless Line Shaft coupling	Steel AISI-410
Line shaft bearing	Stainless steel AISI – 410
Discharge head	Cutlass rubber
Pump shaft bearing	Cutlass rubber
BOWL drawing	Ni-CI Conforming IS 210 or Mild Steel fabricated IS 2062
Strainer	Gun Metal
Casing of Booster Pumps	Ni-CI or galvanised steel
Pressure filters	Ni-CI conforming to IS 210 grade 20
Body and flanges	MS fabricated
Sealing material	CAF

1.9 PRESSURE FILTER:

Design Duty	50 Micron
Degree of filtration	
End connections	2I NB 150
Fluid	Water
Viscosity	1 cp
Flow rate	Adequate with sufficient margin
Design pressure	Adequate
Pressure drop	0.2 kg/cm ² (Clean condition)
Hydrants Pressure	1.5 Times of design pressure
Applicable standard	IS 2825

1.10 PUMPS STARTING/CLOSING LOGICS AND INTERLOCKS:

(A) LOGIC OF PUMPS STARTING:

After single push button command, following operations shall take place in sequence.

- i) Taped water lubrication system/pre-lubrication starts.
- ii) After a time delay, the main pump motor will start and capacitor cubicle circuit will be ON.
- iii) The delivery valve start opening.

(B) LOGIC OF PUMP CLOSING:

The delivery valves will be closed.

After closing of valves completely, the main pump motor will STOP and capacitors cubicle circuit will be OFF. Forced water lubrication and cooling system will be closed.

(C) INTERLOCKS:

- i) V.T. Pumps will not start if lubrication system and cooling has not started functioning.
- ii) V.T. Pumps will not start unless valve opening command is passed on.

1.10.1 TESTING AND INSPECTION FOR V.T. PUMPS:

All the nos. of vertical turbine pumps proposed shall be inspected and tested at the manufacturing works and site as below in the presence of Engineer's representatives.

1.10.2 HYDROSTATIC TEST / DYNAMIC BALANCING / DYE PENETRATION TEST FOR V.T.PUMPS:

- a) All pumps bowl assemblies shall be subjected to Hydrostatic test at manufacturer's works. The test pressure shall be either One and One Half times the shut off head developed by pump level assembly or twice the rated head, whichever is greater and applied for standard time.
- b) All pumps discharge heads and columns upto 10% shall be subjected to hydrostatic test pressure as specified at (a) above.
- c) Dynamic balancing test of impellers and impeller shafts together shall be arranged at manufacturer's works, which will be witnessed by engineers (as per IS 1940-1973 II)
- d) Dye penetration test for impellers shall be arranged at manufacturer's works, which will be witnessed by the engineer.

1.10.3 PERFORMANCE TEST AT FACTORY FOR V.T. PUMPS:

All pumps shall be subjected to performance test as IS 1710 of 1972 at manufacturer's works at full load and full speed by shifting one of electric motors for respective pumps to be supplied under this contract as primer mover. Performance testing shall include determination of head, discharge, power demand and efficiency over a range of cutoff to shut off head. Site conditions for minimum no positive suction head shall be simulated as near as possible for testing purpose. The tenderer shall furnish the facility available agency and place for conducting above test. The following values of parameters applicable for the site may be considered for calculation for VPSH by the contractor. Atmospheric pressure 9.60 meters column of water Vapor pressure of water (at 37.80 C normal temp.) 0.6674 meters column of water

1.10.4 OTHER INSPECTIONS AT FACTORY FOR V.T. PUMPS:

Contractor shall arrange for following inspections at manufacturer's works.

- i. Inspection for critical dimensions to components viz. dia, of line shaft, dia and wall thickness of column pipe, flange thickness of column pipe, thickness of sole plate etc.
- ii. Inspection for verification of metallurgy of various components by reviewing metallurgical tests carried out by the manufacturer.
- iii. Inspection for machining or finish quality and undue wear of fast moving parts after trial runs by stripping down the machine.
- iv. Inspection for verification of test observations and reports for stress relieving components, specified earlier in detailed specifications.
- v. X Ray test for impeller shafts shall be arranged at Manufacturer's works, which will be witnessed by Engineer.

1.10.5 TEST REPORT AND OTHER DOCUMENTS FOR V.T. PUMPS:

Contractor shall furnish to the Engineer the following documents before dispatch of material.

- 1) Test reports for chemical analysis of materials of construction for major components like impellers, pump shaft, line shafts bowl assembly etc.
- 2) Pump performance test reports with sample calculations and actual pump performance curves and pump performance test acceptance report.
- 3) Other test and inspection reports as above.

- 4) Final construction drawings of the pump.
- 5) Operation, maintenance and spare parts manual for pumps.

1.11 NON-RETURN VALVES/DUAL PLATE CHECKS VALVE:

1.11.1 GENERAL:

Each pump will be provided with one Non Return Valve in its delivery pipe. The non-return valves shall be all flanges type single door type Multi door (well proven type, free acting quick opening giving non-sigma closure etc., and with low head loss characteristics conforming to IS 5312. The valves shall be equivalent to IS 1538 1976/BS 4504.

1.11.2 MATERIALS OF CONSTRUCTION:

Body, cover, door, hinges	Cast Steel, IS : 210, FG-220
Hinge, pins, door pins,	Stainless Steel, SS:304
Suspension pins	
Disc facing	Leaded in Bronze IS 318
Seating in body	Leaded in Bronze IS 318
Bearing bushes, Body rings	Leaded in Bronze IS 318
Door faces	GR LTB 2
Bolts and nuts	Carbon Steel

1.11.3 TESTING

The valves shall be subjected to seat and body test in accordance with IS 5312 at the manufacturer's work vide table below. These tests shall be carried out at manufacturer's work in presence of Engineer or his representative, before delivery test certificate shall be furnished in triplicate. The valve rating, seat test pressure and body test pressure shall be decided by the tenderers and shall be furnished along with bid.

Valve Rating	Seat Test Pressure	Body Test Pressure
PN-1.6	20.0 Kg/cm ²	30.0 Kg/cm ²

The closing period of NRV should be mentioned by the manufacturer. Also the velocity range in which NRV open and closes should also be mentioned by manufacture. The NRV should be tested for closing and opening characteristics at contractor's cost. And any modification in NRV if required after testing to suit the anti-surge device should be carried out at contractor's cost.

1.12 BUTTERFLY VALVES:

1.12.1 GENERAL:

Each pump shall be provided with a butterfly valve in the delivery pipe. The butterfly valve shall be flanged water works pattern, eccentrically pivoted and shall be electrically actuated. The actuators shall suitable for opening and closing against the maximum head released under operating conditions and any necessary spur or other gearing and likes etc., shall be incorporated. The actuator motors shall be complete with limit switches, interlock switches for remote control and also contacts for close, open, in operation and percentage opening position indications. The actuators shall be suitable for operation with DOL starting on 415 V. 3 phase, 50 HZ AC power supply. Necessary arrangement with hand wheels shall be provided for emergency manual operation with suitable interlocking mechanism to prevent the actuator operations when the valve is being operated manually and vice versa. The actuator shall be located at motor floor and so also the manual operation of valve shall be from motor floor. The valves shall generally conform to BS5155. The closing time for electrical actuator shall be from 2 to 3 minutes. The actuator shall incorporate Banklash hammer blow feature.

Body / Disc	CI / Cast steel
Shaft	Stainless Steel (BS 970 431 S29)
Clamping Ring Segment	Stainless Steel (ASTMA 479 Type 304/A 35 ICF 8)
Bearing	Stainless Steel Banked PTFE
Rubber seal	Precision moulded nitrite rubber ring
Ring	(shore hardness 55 to 65)
Hardware	Stainless Steel
Used inside Inside portion of the valve	shall be painted by black paint conforming to IS 158

1.12.2 LOCAL OPERATIONS SWITCH:

Local operation switches near the valves should invariably be provided for operation of the valves.

1.12.3 TESTING:

The valves shall be subjected to seat and body test in accordance with BS 5155 at the manufacturer's works vide table below. This test shall be carried out in presence of engineer or his representative before delivery test certificates shall be furnished in triplicate.

Valve Rating	Seat Test Pressure	Body Test Pressure
PN-1.6	20.0 Kg/cm ²	30.0 Kg/cm ²

1.13 SLUICE VALVES:

The specifications under this section cover the design, performance, manufacture and construction features, delivery, erection and testing etc., of Sluice Valves with hand wheel to be supplied under this tender. One sluice valve shall be provided in the suction pipe of each pump. The valve shall be double flanged, water works pattern, inside screw with non-rising spindle. The valve shall be suitable for working pressure 10 Kg/cm², 16 Kg/cm². The valve shall have suitable size hand wheel with arrow marked for open and close. The material of construction shall be of cast iron with Stainless steel spindle of grade specified in IS 2906 and 780.

Body / Bonnet / Wedge / Gland / Hand Wheel,	Cast Iron, IS:210, FG:220
Body / Seat Ring / Wedge Seat Ring	SS: AISI: 304
Wedge Nuts	LTB-2, IS:318
Spindle	SS: AISI:410
Bolt Nuts	Carbon Steel IS: 1363-1967
Packing	Asbestos IS: 4687
Gasket	Rubber: IS:638-1979, Type-B

1.14 TESTING:

The valves shall be subjected to seat and body test in accordance with BS 5155 at the manufacturer's work vide table below. This test shall be carried out in presence of Engineer or his representative before delivery test certificates shall be furnished in triplicate. The valve rating seat test pressure and body test pressure shall be decided by the bidders and shall be furnished along with bid.

1.15 DOUBLE KINETIC AIR VALVES:

1.15.1 GENERAL:

Kinetic Air Valve for vertical turbine pump set shall be provided and installed on the delivery pipe coming out from each vertical turbine pump. The valves shall be provided at locations shown in the drawing Kinetic Air Valve shall be of two orifice type, the small orifice releasing air from pipe carrying water under pressure under normal working condition while the large orifice shall admit or release air when the pipe is being emptied or filled. The air valve shall be designed to operate satisfactorily at normal working pressure of the

system. Each air valve shall be provided with an isolating sluice valve and having cast iron hand wheels for manual operations. Sluice valve shall be in conformation with IS 780 with gun metal single (Non rising type.)

1.15.2 MATERIALS OF CONSTRUCTION:

Float chamber bowl	Grey cast iron conforming to IS 210 [1978]
And cover	Grade FG 200/220
Small Orifice Float	Stainless steel
Orifice	SS, AISI 304
Valve Seat, Nut	Loaded in Bronze

1.16 DELIVERY PIPES/MANIFOLD:

The scope of work includes:

- i) Design of delivery pipes, manifold with respect to following aspects.
 - a) Selection of diameter with wall thickness and number of rows of pipes to carry required quantity of water up to delivery with head loss calculations and total head requirement.
 - b) Velocity of flow.
 - c) Operating pressure, maximum gauge pressure and designed test pressure of system.
 - d) Stability of pipe system.
 - e) Protection against corrosion.
- ii) Supply, installation, jointing of delivery pipe from each pump to manifold including necessary butterfly valve, non-return valve and air valve including rubber expansion joints.
- iii) Fabrication and installation of MS manifold out of MS pipe of sufficient diameter with required number of inlets and outlets with flanges drafted end inspection manhole of suitable diameter with blank flanges with gaskets. Wall thickness of MS manifold shall be as per D/t ratio of 120.
- iv) Construction and installation of MS rising mains of suitable type diameter with required number of rows from manifold upto delivery chamber with anchor blocks saddles as required. Entire process right from design to commissioning shall be carried out as per relevant IS Standard.

The contractor shall provide at his cost all the material required such as tapers, distance pieces, bends, nut bolts gaskets. The work of joining delivery pipelines to the respective manifolds for turbulence free smooth flow is included in this tender. Flanged joints shall be adopted for valves and but welding joints of flanged joints in jointing of delivery pipe. Concrete saddles for valves and pipe work inside pump house shall be provided by the contractor as per design and drawings furnished by him and approved by Engineer. The scope should include necessary excavation foundation with anchor supports concrete thrust blocks, outside the pump house for all delivery pipes/manifold rising mains.

1.16.1 MATERIAL OF CONSTRUCTION:

- 1.16.2 All the pipes and specials shall be fabricated out of steel plates confirming IS 2062. The fabrication of pipe should generally confirm IS 1582-1966. The fasteners required for delivery pipe connections shall be of carbon steel. The flange thickness shall be as per BS-1504.
- 1.16.3 The interior of the pipe work and specials shall be provided with cement mortar (1:1.5) inner lining and 15mm thick external CM 1:3 concrete guniting of minimum 25mm thickness as per IS 1916:1989.

1.16.4 SURGE ANALYSIS AND PROTECTION:

This shall be calculated as per standard procedure necessary have to be provided a appropriate by them or the rising main for dampening and elimination of the surge effect. This is included in the scope of the work.

- i) Water hammer in pump discharge line caused by power balance.
- ii) Due to sudden failure of single pump where multiple pumps are in parallel open them
- iii) Due to variation in discharge concerned by month wise more than a pulling of.

The design criteria for the surge protection for a pumping down are started margin alignment down surge or up surge for the critical design condition of power failure. The strength of the delivery piping and valves in the house shall be so designed as to withstand level with pres sure due to single pump piping since the surge protection for using mams can not take care of such pump ripping condition. Design of using mams and valves etc. i.e., Type of wall thickness and diameter shall be based on above surge analysis.

1.16.5 TESTING:

1. Contractor to submit manufactures test certificates in respect of MS /pipe materials.
2. Contractor to conduct radiography test on welded joint if any at manufacturing stage and also at site during jointing. Test reports shall be submitted to employer.
3. Contractor to arrange hydraulic pressure testing in sections of delivery pipe, manifold, rising mains and again tested after installation and jointing/welding at site to the designer test pressure for a minimum of 24 hours. Any loss of pressure due to leakage noticed shall be rectified by the contractor Re-test shall be conducted to the satisfaction of Engineer-in-charge. All the above test certificates shall be part of handing over document.

1.17 DISMANTLING JOINTS:

A dismantling joint, Butterfly valve size shall be provided in delivery pipe lint of each pump. The dismantling joint shall be placed between pump and non return valves and shall be fabricated from M.S. plates designed to withstand the 1.5 times of working pressure. However plate thickness for barrels shall not be less than 10 mm. The design of the joint shall ensure that no forces are transmitted to the pump foundation and the flanges of dismantling joints are held rigid during normal working. For dismantling it should be possible to side flanges at one end by at least 20 mm to enable dismantling and refitting. General arrangement drawing shall be got approved from the engineer-in-charge before actual fabrication of the joint.

1.18 MOTORS AND ALLIED ELECTRICAL INSTALLATIONS

1.18.1 H.T. MOTORS FOR V.T.PUMPS:

1.18.2 GENERAL:

- 1.18.3 The vertical solid shaft squired cage TEFC type induction motors shall be suitable for operation on 3.3 KV, 3 phase, 50 Hz, AC supply and suitable for direct coupling with pumps stated under the detailed specification here before. The motors shall generally be as per the latest revision of IS 325 and 4722 and other relevant ISS. The motor shall have minimum power facing of 0.866 at duty point or without capacitor as far possible.
- 1.18.4 The motors shall be capable to meet the power requirement of the pump in the complete range of its operation without being overloaded at any point and keeping a margin of at least 5% over entire operating range. The Tenderers shall design the KW requirement and provide motors of suitable capacity. However all the motors shall have the same capacity and shall be similar in all respects. The motor should be capable to meet the requirement of pump under various conditions of operation as described in item no.1 for pumps.

2.0 ELECTRICAL TECHNICAL SPECIFICATION:

Motor shall be capable of delivering rated out put with:

- (A) Terminal voltage differing from its rated value by not more than 10% or
- (B) The frequency differing from its rated value by not more than 5% or
- (C) Any combination of (a) and (b) for continuous, duty operation.

2.1 Method of Starting:

Soft starters of FCMA Type or equivalent shall be provided, limiting the starting current to less than three times of FLC.shall be provided.

The motor shall also be suitable for frequent start/stop operations as per the system requirements.

- 2.1.1 Motors, when started with the drive imposing its full starting torque, under the specified supply voltage variation, shall be capable of withstanding at least two successive starts from cold condition and one start from hot condition, without damage to the winding. The motor shall have good starting torque and

- withstand to high starting current and it shall also have high pull-out torque with good overload capacity (210%). The motor shall be capable of taking overload as per IS 325.
- 2.1.2 The HT motor winding shall be provided with the insulation conforming to I' class. Maximum temperature of winding shall be kept well below the maximum temperature limit specified for class B' insulation.
- 2.1.3 The motor construction shall be suitable for easy dismantling and re-assemble at site with the help of simple overhead crane. The motors shall be of core pack construction attached to the stator frame to facilitate easy removal and replacement of the winding for maintenance purpose. The overhang for the winding at both the ends of the core shall be accessible for visual inspection, without resorting to major dismantling. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in hot, humid tropical climate.
- 2.1.4 Motor frames shall be rigid fabricated steel, they shall be suitably annealed to eliminate any residual stresses introduced during the process of fabrication and machining. The dimensions shall be in accordance with IS 325 TEFC type and the enclosure shall be TEFC type. The degree of protection for TEFC enclosure shall be IP55. Inspection window shall be kept for inspection and cleaning, winding, overhead, bearing grow force. However, they shall be blinded by their light blanking plates fitted with bolts force and holes shall be provided at equal distance along peripheries top for inspection of air gap. Stator lamination shall be made from suitable grade sheet steel varnished on either side and they shall be adequately designed to avoid overheating during starting and running conditions, stipulated above. Rotor short circuiting end rings shall be such that it is free to move with expansion of the bars without distortion. The connections of the bars to end rings shall be made by brazing.
- 2.1.5 Locked rotor withstand time under hot condition at 110% voltage shall be more than starting time at minimum permissible voltage by at least two seconds
- 2.1.6 Suitable insulation shall be provided on the shaft/bearing housing to prevent short current. The insulation provided shall be such that it shall retain its dielectric properties even after, its handling for number of times during dismantling and reassemble. Bearing assembly shall be such that it prevents dust and water from getting into the bearing. Further, the bearing lubricant shall not find access to the motor windings. Each bearing shall be provided with 1 number, 3 wire, platinum elements, having a DC resistance of 100 ohms at 00 C for bearing temperature detection. The bearing shall operate continuously at any speed corresponding to the pump operation range without injury. It shall operate safely at over speed at which the motor is designed for the duration which is not less than twice the over speed duration of the motor.
- 2.1.7 Separate terminal boxes shall be provided for main terminals for the motor and for Resistance Temperature Detectors (R.T.D) and for space heaters. The terminal box for the main and neutral terminals of the motor shall be segregated type suitable for 3 core, designed XLPEAL cable.
- 2.1.8 6 nos. 3 wire platinum element, embedded resistance type Temperature Detectors (RTD) for stator winding, each having a DS resistance of 100 ohms at 00 C shall be embedded in stator winding at locations where highest temperature may be expected.
- 2.1.9 Motors shall have space heaters suitable for 240 volts single p hase 50 Hz AC supply. Space heaters shall have adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation on insulation during shut down periods.
- 2.1.10 Motors shall be preferably of low 'Height to Width Ratio' to have greatest stability and low vibration limits. Motors stools of suitable size shall be supplied free of cost with motor. Motors overall size should be

such that it could be easily accommodated in the Pump House, being constructed as per tender drawings, with sufficient space for ease of operation. The tenderer shall furnish along with their offer, the details of efficiency, total losses and power at different loads etc., required in form of guaranteed performance and technical particulars.

2.1.11 The arrangement for supply clear cooling water to motor radiators and thrust bearing from Pressure Filter through necessary valves, piping, flanges, non flow indications, relays etc., shall be done by contractor at no extra cost.

2.1.12 The tenderers shall offer energy saving motors having high optimum efficiency. The tenderer shall furnish the calculations to prove how efficiency optimization has been achieved on cost of motor and corresponding saving in energy loss. He shall indicate how his motors compare with provision of following NEMA standards and their latest issue. No MG-10-1977 Energy management guide for and use of poly-phase motors.
No MG-1-1978 values of nominal efficiency and corresponding minimum efficiency for induction motor. No MG-1-12-53 Efficiency labelling standards. The Tenderer shall furnish, along with their offer the details of efficiency, total losses and power at different load etc., required in the form of Guaranteed performance and Technical particulars of Schedule.

2.2 ERECTION:

The work of erection of motors and its alignment with the pump including laying of foundations, grouting, doweling and painting etc., shall be done by the contractor at his own cost as per general and miscellaneous specifications mentioned.

2.2.1 Emergency stop switches near the motors should be provided for switching off motors in case of emergency.

2.3 TESTING:

One motor shall be type tested and all motors shall be routine tested at the supplier's works in the presence of engineer or his representative. In addition to the above shop tests and site tests should also be conducted on motors. The scheduler for part I, part II, part III and part IV for each of the above tests i.e., type tests, routine tests, shop tests and site tests should be followed as below.

2.3.1 TYPE TEST ON MOTORS PART I:

- 1) No load running of motor and reading of voltage, current, power input and speed.
- 2) Reduced voltage, running of tests at no load to check the ability of motor to run upto full speed on no load in each direction of rotations with 1/1, 732 of rated line voltage applied to the stator terminal.
- 3) Locked rotor readings of voltage, current, power input and values of torque of motors (Note: This test may please be made at a reduced voltage)
- 4) Full load reading of voltage, current, power input and speed.
- 5) Temperature rise test.
- 6) Momentary overload test.
- 7) Insulation resistant test (both before and after the high voltage test)
- 8) Vibration test.
- 9) High voltage test.
- 10) Test to determine losses and efficiencies.

2.3.2 ROUTINE TEST ON MOTORS-PART II:

1. Insulation resistance test
 - i) High voltage test
 - ii) No load running of motor and reading of current in three phases and voltage.

- iii) Locked rotor reading of voltage, current and power input at suitable reduced voltage.
- iv) Reduced voltage running up test at no load to check the ability of motor to run upto full speed on NO load in each direction of rotation with 1/1, 7321 of the rated line voltage applied to the stator terminal.

2.3.3 SHOP TESTS ON MOTORS-PART III:

1. Line out of motor and pump shafts including and fixing of coupling bolts and checking of bearing faces.
2. Over run test.
3. Vibration test.
4. Motor frame dimensional check and general appearance check.
5. General appearance of main shaft and dimension of the same.
6. Insulation resistance dielectric and coil resistance test of poles.
7. Match mark check test will be made only where applicable.
8. Dimensional check and general appearance check after assembly of complete motor and assembly of pump with motor.
9. Efficiency test.
10. Measurement of air gap length.
11. High voltage test.
12. Tests to determine losses and efficiency.
13. Heat run test to determine the temperature rise of various parts including windings, bearings etc., of the motor when the machine is in operation continuously at the rated and overload output.
14. Dielectric test of motor windings.

2.3.4 SITE TEST ON MOTORS PART-IV:

1. Measurement of resistance of windings.
2. Insulation resistance test.
3. High voltage test.
4. Measurement of air gap.
5. No load test.
6. Over run test. The motor and pump is to run continuously for 72 hours at full load and temperature of various parts including windings bearings etc., are to be observed. This test is to be carried out on each pump separately and measurements of discharges at rated head is to be measured.
7. Losses and efficiency of pump set are to be carried out on any two motors selected by the Engineer-in-charge.
8. Measurement of insulation resistance of windings.
9. Alignment of pump and motor and pump shaft.
10. Vibration test.

2.4 415 Volts, INDUCTION MOTOR:

For Horizontal split case centrifugal pump Horizontal shaft, squirrel cage, TEFC. Induction Motor suitable for operation on 415 Volts 3 phase 50 Hz. A.C. supply and suitable for direct coupling with centrifugal pumps stated under detail specifications here before.

- Motor shall be generally as per IS-325 and IS-44722 and latest, amendments. Motor shall be suitable for supply characteristic such as voltage, frequency and fault levels of system. Motor should have rating to meet 5% over load during entire range of operational conditions. Tenderer should design and provide Motor of suitable H.P. capacity to fulfil requirement of site condition.
- Motor shall be provided class B' insulation. Motor should be continuously rated as per IS 325.
- Motor should be dynamically balance reducing the vibration to minimise to ensure smooth running, quiet operation and maximum bearing life.
- Motor construction shall be such that it can be easily dismantled and reassembled by chain pulley clock.

- All motors shall be routine tested and one motor shall be type tested at suppliers work in presence of customers representative as per IS 325.

In addition to above para no. 9.1.2. to 9.4 of this section are applicable for induction motor for horizontal split case pump.

3.0 CAPACITOR CUBICLES:

- 3.1 Each motor shall be provided with the bank of capacitors to improve the power factor of motors to 0.95. However, care shall be taken that KVAR of capacitor shall not exceed magnetizing KVAR of the motor, in that case the corrected power factor may be less than 0.95, the capacitors shall be provided in separate expanded metal housing with top completely covered with MS sheets. The capacitors shall be mounted on rigid framed structure. The bushings required for supporting interconnection of capacitors and HRC fuses shall be as per IS 2834 but shall also meet the requirement as per BSS 1950 of 1965 wherever these are applicable. The tenderer should ensure that power factor of the system does not fall below 0.90 lag during off load and/or monsoon period. The Tenderer should make necessary arrangements for connecting the required capacity KVAR capacitors bank in the circuit with load break switches, fuse units etc., during off load and/or monsoon period.
- 3.2 The capacitors shall be provided with earth terminals. The earth fault relay is included under HT Panel. The one no of CBCT to detect the earth fault required for each fault relay shall be provided.
- 3.3 Each capacitors cubicle will comprise of following.
- I. Bank of capacitors of suitable KVAR rating for each motor to improve the P.F. of motor to 0.95.
 - II. HRC fuses suitable for operating voltage
 - III. Earthing terminals
 - IV. Switching device to isolate individual bank of capacitors.

3.4 EMERGENCY STOP SWITCHES:

Emergency stop switches near the capacitors should be provided for switching off the unit in case of emergency.

- 3.5 Number of capacitor cubicles may have separate A.C.B / Vacuum contact breaker, which connect them in line circuit.

Note: These capacitors can be put OV especially when there will be low power factor of the system, in rainy season or when the motor will be idle.

1. Capacitors shall be protected against over current by means of suitable Breakers with adjustable over current relays, which are adjusted to interrupt the circuit. When the current exceeds the permissible limits specified in 5.3 of IS 2834-1964.
2. Suitable discharge device may be provided across the second axis of the current transformers used for over current protection to afford necessary protection against transient over voltage during switching. Suitable discharge device shall be provided to discharge the capacitors.
3. The protection against internal fault of a capacitor bank should be provided by suitable means to isolate automatically a faulty unit.

3.6 L.T. CAPACITOR CUBICLE:

1. These capacitors will be suitable for operation on 440 V three phase AC and to improve power factor of Butterfly Valve actuator motor, Booster pump motors to 0.95 and other L.T. Auxiliary loads e.g. lighting, Air-conditioning, Ventilation, Sump Pump, Vacuum Pumps etc.
2. These capacitors should be provided with HRC switch fuse unit for each bank.
3. These will be mounted near L.T. Panel.
4. Every capacitor should have discharging resistance to reduce the voltage to 50 V within 60 seconds when capacitor is taken out of circuit.
5. Capacitor winding shall be free from oxidation and protected from humidity.

6. Capacitors should have minimum dielectric loss, self heating property and should not short between the phases throughout its life. It should have negligible temperature rise for better performance with longer life.

3.7 TESTING:

The Capacitor will be tested in manufacturer's works as per IS 2834-1964 in presence of the Engineer-in-Charge or his representative.

4.0 SWITCH GEAR PANNEL (MAIN PANNEL):

Main panel shall be of sheet steel dust and vermin proof indoor floor mounting type HT panel with Bus Bars suitable for 3.3 KV system voltage completely assembled, wired, tested and painted with rustproof paint conforming to relevant IS. The panel shall comprise of following incoming breakers.

The degree of protection should be IP-44 as per IS.

4.1 INCOMING BREAKER SHALL CONSIST OF FOLLOWING:

- i) Vacuum circuit breaker; draw out type suitable for 3.3 KV voltages three phase, 50 Hz. AC with motor charged spring closing mechanism and facility for remoter operation. Surge suppression arrangement iv VCB is essential.
- ii) Three nos. double core current transformers of ratio rated cap/1.1A. one core for metering class 1 accuracy 30 VA burden and the other core for protection Class 5 P-10 15 VA burden.
- iii) Three numbers single core current transformers of rated CAP/1 amps / Class -p 5 accuracy with suitable knee point voltage to be used for differential protection of transformers. The requirement of knee point voltage shall be subject to prior approval.
- iv) Three numbers single phase potential transformers to be star/Star connected with ratio rated voltage/ 1.7321 (110 V/1. 7321) Class-I accuracy and rated burden 150 V.A.
- v) Trip neutral, close, circuit breaker control switch.
- vi) Indication lamps, red/ green / amber for circuit beaker _ON / OFF / auto trip indication rated for 110 volts DC.
- vii) White indication lamp for trip circuit healthy indication suitable for 110 volts DC.
- viii) 96 sq. mm ammeter of suitable scale with 3 way and ON/OFF selector switch.
- ix) 96 sq. mm voltmeter of suitable scale with 3 way and ON/OFF selector switch.
- x) High speed tripping relay.
- xi) Static type pole inverse definite minimum time lag (IDMTL) relay with two element one for over current protection having setting range 50 to 200% on IDMTL unit and other element for earth fault protection with setting range 20 to 80% on IDMTL unit with common instantaneous setting range of 500 to 2000%.
- xii) Cable termination arrangement with cable end box suitable for terminating XIDE cablecoming from transformer.
- xiii) DC fail relay.
- xiv) Auxiliary relays, AC and DC fuses etc., as required.
- xv) Remote / Local selector switch with locking arrangement.
- xvi) (MWH) Mega Watt Hour meter suitable for 3 phase, 3 wire unbalanced load.
- xvii)(RRVAH) Reactive Kilo Volt Ampere Hours suitable for 3 phase, 3 wire Maddeded load.
- xviii) Power factor meter showing the power factor of system (0.50 Lag to 0.50 Lead).
- xix) Time delay relay.
- xx) Single pore instantaneous under voltage relay.
- xxi) Frequency indicator having range of 45 Hz to 60 Hz.
- xxii) Counter showing no. of trappings made by breaker.
- xxiii) Phase sequence indicators.

4.2 OUTGOING FEEDERS FOR MOTORS:

Each feeder to have the following:

- i) Minimum chitchat breaker draw out type suitable for installation with minimum rupturing capacity.
- ii) 3 nos. double core current transformers of suitable rating on primary side and 121 amp. On secondary side, one core for metering Class-1 accuracy 20 V.A burden, one core for protection Class-5 P 10 accuracy with 15 VA burden.
- iii) 3 Nos. single phase PT with ratio (system voltage/1, 7321) / ((110 V/1, 7321) Class –I accuracy and 150 VA burden.
- iv) Under voltage relay with time lag arrangement.
- v) Trip, neutral, close, circuit breaker control switch.
- vi) Indicating lamps Red / green / Amber for circuit breaker On / Off / Auto Trip indication rated 110 volts DC.
- vii) Indicating lamp for trip circuit healthy indication suitable for 110 Volts D.C.
- viii) Indication for valve actuator motor operation for following position.
 1. Valve fully open
 2. Valve partially open
 3. Valve fully closed.
- ix) Indication and annunciation for following.
 1. Low water level in sump
 2. High water level in sump
 3. Capacitor earth fault.
- x) 96 sq.mm Ammeter shall be with suitable scale with 3 way ON/OFF selector switch.
- xi) High speed tripping relay.
- xii) Protection relays with flange for following.
CIMN make English, Electric or equivalent comprehensive motor protection relay (relay subject to approval by Dept.) having following protection.
 - a. Thermal overload
 - b. Instantaneous earth fault
 - c. Instantaneous unbalance
 - d. Stalling protectionIn addition to above following relays for fault shall be provided :
 - a. Earth fault relays for capacitor earth fault.
 - b. High/Low water level in sum with sensing element.
- xiii) Disconnecting links for disconnection of cable of capacitors.
- xiv) Cable termination arrangement with cable end box suitable for terminating cables as per cable Schedule (for motor and for capacitor)
- xv) Remote/ local, selector switch with locking arrangement.
- xvi) Remote switch gear panel/local selector switch with locking arrangement for valve motors.
- xvii) Auxiliary relays, terminals, AC and DC fuses etc., as required.
- xviii) Time delay relay.
- xix) Forced water lubrication pump start/stop switches with indication lamps.
 - xx) Hour motor one for each motor panel and square panel operating on 230/110 V.A. C/D.C.supply.
- xxi) Butter fly valve operation switches OPEN/CLOSE with indication lamps indicting valve positions of fully open/ Fully close / Partly open / Operating.

4.3 Outgoing feeder for connection Aux. Transformer comprising of following.

- i) Air circuit breaker / Vacuum circuit breaker draw out type suitable for installation with a minimum rupturing capacity.

- ii) Three sets of single core C.Ts of suitable rating on primary side and I AMP on secondary side for metering Class-I accuracy and 20 V.A burden.
- iii) Three sets of single core C.Ts. of suitable rating on primary side and I AMP on secondary side for protection Class-5, P-10 accuracy and 15 V.A burden.
- iv) Trip, neutral, close, circuit breaker control switch.
- v) Indication lamps Red / Green / Amber for circuit breaker On / Off / Auto trip indication rate for 110 volts DC.
- vi) One indication lamp for trip circuit healthy indication suitable for 110 volts DC.
- vii) Indication for following:
 - 1. Buchholtz relay operated
 - 2. Over current earth relay operated.
- viii) 96 sq. mm Ammeter having suitable scale with 3 way and ON/OFF selector switch.
- ix) High speed tripping relay for IDMT and buchholtz.
- x) Static type triple pole IDMT relay with two elements one for over current protection having setting range 50 to 200% in IDMTL unit and one element for earth fault protection with setting range 20 to 80% on IDMTL unit with common instantaneous setting ranges of 500 to 2000%.
- xi) Cable termination arrangement with cable end box suitable for terminating cable as mentioned in cable scheduled.
- xii) Auxiliary relays, terminals, AC and DC fuses etc., as required.
- xiii) Remote/ Local control switch.

4.4 ANNUNCIATION:

- 1) 1 No. buzzer suitable for operation on 110 volts DC.
- 2) 1 No. Bel suitable for operation on 230 volts AC

Note: The bell and Buzzer will operate in parallel with corresponding Annunciation of Remote Control panel.

5.0 AIR CIRCUIT BREAKERS / VACCUM CIRCUIT BREAKERS:

I. Each Breaker shall have following accessories:

- i. Operation counters to register number of Breakers operations.
- ii. Mechanical operating device for manual closing and tripping of breaker.
- iii. Device for manual charging of closing spring.
- iv. Mechanically operated Red 'Trip' shrouded push button.

II. There should be locking facility in SERVICE, TEST and ISOLA TED position.

III. In TEST position, the Breaker / ACB will be tested without energizing the power circuit.

IV. It should not be possible to plug in a closed Breaker or to draw out a Breaker / ACB in closed position.

V. It should not be possible to operate Breaker / ACB unless it is fully plugged IN, TEST or fully isolated position.

VI. Through the Breakers are to be suitable for electrical operation, provision of manual charging, closing and tripping shall be made.

VII. All Breaker / ACB of identical current ratings shall be interchangeable.

VIII. Charging motor and closing coil shall operate between 85 to 110 percent of 110 volts DC supply and trip coil between 70 to 110 percent of 110 volts DC supply. Suitable thermal Protection shall be provided for charging motor.

5.1 BUS BARS AND SUPPORTS:

Bus Bars shall be of Electrolytic Aluminum and of ample size. It shall be adequately supported non-hygroscopes, non-combustible, fibber glass reinforced, plastic insulator. The Bus Bars up to incoming of Breakers and also up to the outgoing terminals, including all joints, shall be fully insulated with heart

shrinkable PVC sleeves. They shall be uniform and continues throughout the length of Switch Board. The Bus Bars shall be extendable on both sides.

5.2 BUS COUPLER PANEL:

3.3 KV, VCB 2000 Amps rating, 25 KA SC rating for 1Second with O/C, E/F relay with extension Bus bars, Earth bus extension to Ammeter , Voltmeter with S/switch with CT etc complete housed in the sheet metal cubicle.

5.3 CONTROL WIRING:

All control wiring shall be of adequate capacity and all outgoing circuits shall be wired upto terminal blocks for external connections. Wires shall be properly colour coded and ferruled to distinguish different circuits. They shall be neatly routed through PVC channels of adequate size. All control wiring shall be carried out with 1.1 KV, grade, 2.5 sq. mm. PVC insulated wires.

5.4 PANELS:

The panel shall be indoor, free standing type, fully compartmentalized and properly ventilated. It shall be totally enclosed, dust and vermin proof. It shall be possible to extend the assembly on either side. It shall be made out of at least 10 SWG sheet steel suitably reinforced to provide flat level surface, resistant to vibration and rigid during transportation and installation. Door and removable covers may be of 14 SWG sheet, Breaker compartment shall have front hinged door with lock and key

6.0 L.T. DISTRIBUTION PANEL:

6.1 One sheet steel totally enclosed dust and vermin proof L.T. panel board suitable for indoor floor mounting with requisite capacity aluminum bus bar and neutral of half the rating for operation on 433 V. 3 phase, 50 Hz. A.C. System completely assembled, wired, tested and painted with rust proof paint for controlling L.T. supply to different auxiliaries of pump house. Each panel shall consist of following items well installed and connected to suitable size of bus bars provided in the panel.

7.0 PROVIDING TOOL SETS AND SPARES:

- 7.1 The contractor shall provide a set of recommended spares for 5 years operation & maintenance period of the plant. These spares shall be suitable for the equipment provided under this contract and form the original Manufacturers only.
- 7.2 The contractor shall provide one set of tools required for operation, maintenance, repairs and over hauls of the complete plant during its five (5) years O&M period.

8.0 TESTING TRIALS, COMMISSIONING AND OPERATION – 1 JOB:

8.1 TRIAL OPERATION:

The plant in the pump house shall be on trial operation during which period all necessary, adjustments shall be made while operating over the full load range enabling the plants to be made ready for performance and guarantee test.

8.2 The duration of trial operation of the complete equipment shall be fourteen (14) days out of when at least seventy two (72) hours shall be continuous operation of full load or any other duration on higher side as may be agreed to between this Engineer and contractor. The trial operation shall be considered successful provided that each item of the equipment can operate continuously at the specified operating characteristics for the period of trial operation.

- 8.3 Minor Interruptions not exceeding four (4) hours at a time caused during the continuous operation shall not affect the total duration of trial operation. However, if in the opinion of the Engineer, the interruptions are long, the trial operation shall be prolonged for the period equal to that of interruption.
- 8.4 A trial operation report comprising observations and recordings of various parameters to be measured in respect of above trial operations shall be prepared by the contractor. This report besides recording the details. Of the various observations during trial run shall also include the dates of start and finish of the trial operations and shall be signed by the representatives of both the parties. The report shall have sheets recording all the details of interruptions occurred adjustments made and any major repairs done during the trial operation. Based on the observations necessary modification / repair to the plant shall be carried out by the contractor to the full satisfaction of the Engineer to enable the latter to accord permission to carry out performance and guarantee tests on the plant. However minor defects which do not endanger the safe operation of the equipment, shall be considered as reasons for withholding the aforesaid permission.

9.0 COMMISSIONING AND OPERATION:

The commissioning and operation period generally will be 90 days and will follow the trial operation of individual set of pumping equipment unless otherwise specially agreed. During the commissioning and operation period, the contractor shall depute his personnel; full time to operate, maintain and repair the equipment. Only water and electricity shall be provided by the corporation. During this period the corporations personnel who shall continuously work with the contractors personnel shall be adequately trained by the contractor's personnel to take full responsibility of operating, maintaining, repairing etc., of the equipment and plant.

10.0 PERFORMANCE AND GUARANTEE TEST:

1. The final test as to the performance and guarantee shall be conducted at site by the contractor as per IS 1937. The contractors commissioning and start up engineers shall make equipment ready for such test and assist the corporation in conducting the test free of cost such test will be commenced after the successful completion of operation of 75 days or 1000 hours, whichever is more.
2. These tests shall be binding on both the parties of the contract to determine compliance of the equipment with the performance guarantee. The acceptance of tee tests will be subject to provision made.
3. Un-measurable parameters shall be taken into account in a reasonable manner by the engineer for the requirement of these tests. The test will be conducted on the completed installations without any special modifications for test purpose. No separate allowances or deviations from specified conditions in test procedures shall be allowed while evaluating the performance.
4. Any special equipment tools and tackle required for the successful completion of the performance and guarantee tests shall be provided by the contractor free of cost.
5. The guarantee performance figures of the equipment shall be provided by the contractor during these performance and guarantee tests. Should the results of these tests show any decrease from the guarantee values. The contractor shall modify the equipment as required to enable it to meet the guarantees in such case performance and guarantee test shall be repeated within one month from the date. Equipment is ready for the test and all cost of modifications including labor, materials and the cost of additional testing to prove that the equipment to meet the guaranty shall be borne by the contractor.

DETAILED SPECIFICATION OF RAW WATER PUMPSET

1 VERTICAL TURBINE PUMPS:-

The pumping capacity and length of column assembly of each pump is as as per engineering practices

SPECIFICATION FOR RAW WATER VERTICAL TURBINE PUMPS.

1.1. **General Design Consideration :**

The pumps shall be vertical turbine wet pit type non pull out design with multi stage bowl assembly, directly coupled through vertical hollow shaft motor without speed reduction gear. These pumps are to be installed in the jack well cum pump house in Raw Water Pumping Station to pump the turbid water. Pumps shall be designed so as to have a maximum flow capacity of not less than 120% of the rated flow capacity. The pumps shall be designed so as to have a stable non over loading characteristic. The shut off head should not exceed 120% of duty point head on higher side and 80 % on lower side.

The impeller adjustment shall be designed in such a way that impellers run free in any installed condition in spite of the extension of line shaft caused by hydraulic down-thrust and the weight of shafts and impellers.

1.2 **General specifications:-**

The pumps shall be complete with bowl assembly, column pipe, sub floor discharge head, line shaft, foundation plate/sole plate, basket strainer, motor foot stool and all other necessary accessories. The pumps should generally comply with the requirements of following standards.

- i) I.S. 1710 - Vertical turbine pumps for raw water.
- ii) I.S. 5120 - Technical requirement of rotor dynamic Special purpose pumps.

1.3. **Impeller shaft :** -

The impeller shaft shall be of stainless steel with renewable stainless steel sleeves at bearing portion. The impeller shaft shall be guided by bearings provided in each bowl. The butting faces of the shaft shall be machined square to the axis and the shaft shall be chamfered on the edges. The shaft shall have a surface finish of 0.75 micron as per I.S. 3073-1967.

1.4. **Impellers :**

The impeller may be of closed type made of CF8M material statistically and dynamically balanced. The impeller shall be free of any casting defect and shall be properly machined. All the water passages shall be smooth finished and coated. The impellers shall be fastened with shaft thrust collar and keys.

1.5. **Bowls :**

The bowls shall be made of cast iron smoothly finished and free from any casting defects. The bowls shall be capable of withstanding hydrostatic pressure equal to twice the pressure at rated capacity or 1.5 times of the shut off head whichever is greater. The bowls shall be equipped with replaceable seal rings on the suction side of impellers in case of closed impellers. The water passage in the bowls shall be smooth.

1.6. **Line shafts :**

The line shaft shall be made of SS410 and shall be finished with inter changeable section, have a length of .75 m , 1.5 m or 3 m. The butting faces of shafts shall be machined square to shafts axis and the shafts ends shall be chamfered on the edges. To ensure the correct alignment of shafts, they shall be straight within 0.125 mm for 3 m length total dial indicator reading. The shaft shall not have the surface roughness more than 0.75 micron as per IS 3073-1967. The shaft coupling shall be designed with a minimum factor of safety two for shafts and shall have left hand or right hand threads depending on the direction of rotation of pump to tighten during the pump operation. The outside diameter of the coupling shall be concentric with the bore and with a small transverse hole in the middle. The shaft shall have the adequate strength to withstand all the forces at $\pm 20\%$ of the critical speed of shaft.

1.7 **Column pipe**

The columns pipe shall be manufactured from the Heavy series of mild steel tube conforming to relevant Indian Standard Specifications. The column pipes shall be flanged and bolted and shall be complete with nuts and bolts the length of column section shall depend upon the design of sump well cum pump house and the installation. However, for handling, the length of each column pipe shall not exceed 1.50 m.

- 1.8 **Line shaft Bearings**
The bearing shall be designed to be for proper lubrication. The line shaft bearing shall be of cut less rubber.
- 1.09 **Discharge head :**
The discharge head should be sufficiently strong to support the weight of the pump having outlet size as given in **Annexure “E-1”**.
- 1.10 **Motor Foot Stool**
The motor foot stool shall be of fabricated mild steel and shall be designed to take care of all the static and dynamic loads on it.
- 1.13 **Sole Plate**
Each pump shall be provided with a heavy structural steel sole plate. Sole plate shall be provided and grouted with foundation. The sole plate shall be designed to permit removal of entire pump without disturbing sole plate.
- 1.14 **BOLTS NUTS & WASHERS**
All bolts, nuts and washers shall be of superior quality and should be made of high tensile mild steel conforming to relevant Indian Standard Specifications.

TESTING

The department can depute the Engineer-In-Charge of work to witness inspection for routine test at manufacturer's place with respect to their characteristic and performance.

FIELD TEST

The field test shall be carried out as per IS: 1520-1972 & 5120-1965.

GUARANTEED PERFORMANCE & TECHNICAL PARTICULARS:-

The contractor shall submit the details of guaranteed performance & technical particulars as desired in the Performa enclosed vide schedule's with the tender along with the preliminary out line drawing indicating principal dimensions & weight of pumping equipments and cross-section drawing indicating the assembly of pumps & major parts thereof with materials of constructions and special features. Complete descriptive and illustrated literature on the equipment and accessories offered.

COATING

Drinking water approved coating shall be applied to liquid flow passage of pump.

Coating should be anti-erosion, anti-corrosion, cathodic protection, anti-galvanic action, energy efficient and Hydrofobic in nature.

Components to be coated of VT Pump – Internal of pump bowl and bell mouth.

Coating Specifications – DFT 1.00 mm tolerance minus 100 microns. compound, cured by the addition of organic compound.

Intermediate coat – A heavy built glass flake costing based on low reactivity,

Bisphenol „A Polyester resin pre accelerated, A two pack resin system sing organic peroxide.

Top coat – A cold cured highly modified chemically resistant, two pack resin system filled with stabilizing enforcement to reduce cold flow characteristics. The coating should have good gloss with waxy appearance when cured and surface roughness of minimum 0.09 microns.

2. PRESSURE INDICATION DEVICES

Each pump shall be provided with pressure gauges along with siphon tube and cork of best quality. The pressure gauges should be of Aluminum casting body with glycerin field. The dial size shall be of 100mm.

3. SPECIFICATIONS FOR 415-V INDUCTION VERTICAL HOLLOW SHAFT MOTORS

3.1 TYPE:

The VHS motor shall be Induction type suitable to operate on 415 V, 3 phases, 50 cycles A.C. supply directly coupled to turbine pump having nominal speed of 1500 RPM generally conforming to IS: 325 of H.P as specified in **annexure "E-1"** or as per clause 3.3 which ever is higher.

3.2 VARIATION IN SUPPLY VOLTAGE

The motors shall be capable of delivering rated out put and rated power factor with following variations:-

Voltage = $\pm 10\%$

Frequency = $\pm 5\%$

Combined = As per IS 325

3.3 RATED CAPACITY:

The minimum conditions rated capacity of motors shall be such that it meets the power requirements of pumps in the complete range of its operation. It shall also provide on additional power requirement on the motor. By 10% at the duty point of operation or 5% of maximum power drawn by pump or as specified , which ever is higher.

3.4 ACCELERATION CHARACTERISTICS:

The acceleration characteristics of motor shall be matched with the driven equipment so that acceleration is obtained without over heating of motor.

3.5 METHOD OF STARTING:

The motors shall be designed for star/delta starting at full voltage with starting current not exceeding four times the rated full load current. The motor shall also be designed for a minimum pull out torque of 200%.

3.6 NUMBER OF START:

Motor when started with the drive imposing its full starting torque under the specified supply voltage variation shall be capable of withstanding at least one successive starts from hot condition two start from cold condition without damage to the winding.

3.7 CLASS OF INSULATION:

The motor winding shall be provided with insulation conforming to thermal class "F". The maximum temperature rise of the winding shall not exceed the limits specified for class "F" insulation of the winding shall not exceed the limits specified as per class "F" insulation. The insulation shall be given tropical and fungicidal treatment for successful operation of motor in hot humid tropical climate. It shall be of thermos setting type and shall remain unaffected by heat. The coils shall be highly uniform with uniform insulation strength and uniform dielectric losses.

3.8 MOTOR CONSTRUCTION:

The motor construction shall be suitable for easy dismantling and reassemble at site with the help of simple overhead crane. The motor shall be of core pack construction attached to the stator frame to facilitate easy removal and replacement of the winding for maintenance purpose. The overhead for winding at both ends of the core shall be accessible for usual inspection without resorting to major dismantling.

3.9 MOTOR FRAME:

Motor frames shall be of rigid fabricated steel they shall be suitably annealed to eliminate any residual stresses introduced during process of fabrication and machining

- 3.10 STATOR LAMINATIONS:-
Stator laminations shall be made from suitable grade sheet steel varnished on higher side and shall be adequately designed to over heating during starting and running conditions stipulated above.
- 3.11 ROTOR SHORT CIRCUITING RINGS:
Rotor short circuiting and rings shall be such that it is free to move with expansion of bars without distortion. The connections of the bars to the end rings shall be made by brazing.
- 3.12 LOCKING ROTOR WITH STAND TIME:-
Locked rotor with stand time under hot conditions at 110% voltage shall be more than starting time at minimum permissible voltage by at least two seconds.
- 3.13 TYPE OF ENCLOSURE & DEGREE OF PROTECTION.
The degree of protection provided by the enclosures of motor shall conform to IS:4691. The enclosure for the motors shall be TEFC (IP 44).
- 3.14 SHAFT INSULATION:
Suitable insulation shall be provided on shaft/bearing housing to prevent shaft current. The insulation provided shall be such that it shall retain its dielectric properties even after its handled for number of times during dismantling and reassemble.
- 3.15 BEARING ASSEMBLY:
Bearing assembly shall be such that it prevents dust getting to the bearing. Further, bearing lubricant shall not find access to the motor winding. The bearing assembly shall be provided with proper lubricating nipples.
- 3.16 EARTHING:-
The motor body shall have two separate earthing terminals for earthing in compliance with I.E. Rules.
- 3.17 DIMENSIONS OF MOTORS:-
Motors shall be properly dimensioned to have greater stability and low vibration limit.
- 3.18 TESTING:-
All the motors shall be routine tested at manufacturer's workshop and test certificate shall be provided with motors.
- 3.19 Variable Frequency Drives (VFD)

3.19.1 General

AC induction motor shall be coupled with a Frequency drive of rating commensurate with the rated motor. The Frequency drives shall be of Current Source Inverter Pulse Width Modulated (CSIPWM) with latest version, which performs precise speed and torque control of standard squirrel cage motors with optimum efficiency. Each drive must have a soft starting feature and a bypass arrangement for DOL starting of motors. All frequency drives shall be suitable for data connectivity with PLC/SCADA system and shall have suitable communication port and protocol. The drives must be easily programmable. The drives shall be provided with surge protection, programmable lockable code. The Frequency drive shall have following characteristics:

- Accurate open loop torque control
- Torque step rise time typically less than 5 ms
- Speed control inaccuracy typically 0.1% to 0.5% of nominal speed
- 150% overload capacity for 60 second

Total Harmonic distortion shall comply with the provisions of IEEE 519. Necessary metering, self-diagnostic arrangement (including display and alarm facilities) shall be provided for local/ remote monitoring.

3.19.2 Technical Parameters

Main connection

Voltage	:	3 phase, 415 +/- 10 % permitted tolerance
Frequency	:	45 to 65 Hz, maximum rate of change 17%/s
Imbalance	:	Max. +/- 3% of nominal phase to phase input voltage
Fundamental Power factor	:	0.97 (at nominal load)

Motor connection

Voltage	:	3 phase, from 0 to applied incoming supply voltage, 3-phase symmetrical
Output Frequency	:	0 to 250 Hz
Frequency Resolution	:	0.01 Hz
Continuous Current	:	1.0 * I _{2N} (normal use)
Short Term Overload	:	I _{2max} = 1.1 * I _{2N}
Capacity (1min./10min)	:	
Field Weakening point	:	8 to 300 Hz
Acceleration Time	:	0 to 1800 sec
Deceleration Time	:	0 to 1800 sec
Efficiency	:	Min. 97% at nominal power level

Environment limits

Ambient temperature	:	0 to 45 deg. Cent.
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General Standard Control Connections or as per Process Requirement

- 3 programmable differential analogue inputs (1 voltage signal, 2 current signals)
- 7 programmable digital inputs
- 2 programmables analogues outputs (current signal)
- 3 programmable digital outputs (from C relays)
- Optional analogue and digital extension modules can be added as well as a wide range of field bus adapters.

Protection

- Over current
- Short circuit at start-up
- Input phase loss
- Output phase loss
- Motor overload
- Earth fault
- Overvoltage
- Undervoltage
- Over temperature
- Motor stall

Application macros

The features a selection of built-in, pre-programmed application macros for configuration of inputs, outputs, signal processing and other parameters. It shall have interfacing facilities to communicate data to SCADA system. These include:

- FACTORY SETTING for basic industrial applications
- HAND/AUTO CONTROL for local and remote operation
- PID CONTROL for closed loop processes
- TORQUE CONTROL for process where torque control is required.
- SEQUENTIAL CONTROL for processes where torque control is required.
- USER MACRO 1 and 2 for user's own parameter setting
- Comprehensive testing and diagnostic function

3.19.3 Tests

Each unit of Variable frequency drive shall be tested at the manufacturer's work. Test result must satisfy the efficiencies on various loads and at different frequency levels against their quoted values during bidding.

DETAILED SPECIFICATION OF CLEAR WATER PUMPSET

Horizontal Split Casing Centrifugal Pumps

1.1 GENERAL DESIGN CONDITIONS:-

The pumps shall Horizontal split casing type of Single Stage Centrifugal type. The pumps shall be designed to operate satisfactory while handling positive or negative suction as specified lift from all caused, 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 pumps,

Pumps shall be designed so as to have a maximum flow capacity of not less than 120% of the rated flow capacity. The pumps shall be designed so as to have a stable non over loading characteristic. The shut off head should not exceed 120% of duty point head on higher side and 80 % on lower side.

The pump should be designed for minimum efficiency as per Engineering practices at duty point.

1.2 MATERIAL OF CONSTRUCTION OF PUMP.

1.2A PUMP CASING:-

The casing shall be Cast Iron ensuring smoothness of hydraulic passages resulting in high efficiency. The delivery flange is vertical.

1.2B IMPELLERS:-

The impeller shall be enclosed type. It is hydraulically balanced by its inherent design. The impeller is statically and dynamically balanced. The material of impellers shall be of CF8M and casing ring should be of BR BSEN-1982-CC 480K (BS1400-CT 1).

1.2C PUMP SHAFT:-

The pump shaft shall be manufactured from high tensile carbon steel and provided with sleeves.

1.2D Facilities for gland drainage shall be provided and gland lubrication shall be suitably arranged by means of providing connections from the discharge volute of the pump casing.

1.2E **BOLTS NUTS & WASHERS:-**

All bolts, nuts and washers shall be of superior quality and should be made of high tensile mild steel conforming to relevant Indian Standard Specifications.

TESTING:-

The department can depute the Engineer-In-Charge of work to witness inspection for routine test at manufacturer's place with respect to their characteristic and performance.

2. **PUMP COUPLING:-**

This shall be of flexible pin type equipped with a suitable coupling guard.

3. **BASE PLATE.**

Each pump shall be provided with a heavy structural base plate & foundation bolts. Base plate shall be provided and grouted with foundation and shall be designed to permit removal of entire pump without disturbing base plate.

4. **Specifications for 415-V Induction Motors**

4.1 **TYPE**

The motor shall be Induction type suitable to operate on 415 V, 3 phase, 50 cycle A.C. supply directly coupled to pump having nominal speed of 1500 RPM Generally conforming to IS:325 of H.P as per engineering practices or as per clause 4.3 which ever is higher.

4.2 **VARIATION IN SUPPLY VOLTAGE**

The motors shall be capable of delivering rated out put and rated power factor with following variations:-

Voltage	=	± 10%
Frequency	=	± 5%
Combined	=	As per IS 325

4.3 **RATED CAPACITY:**

The minimum conditions rated capacity of motors shall be such that it meets the power requirements of pumps in the complete range of its operation. It shall also provide on additional power requirement on the motor. By 10% at the duty point of operation or 5% of maximum power drawn by pump or as per engineering practices, which ever is higher among the three options.

4.4 **ACCELERATION CHARACTERISTICS:**

The acceleration characteristics of motor shall be matched with the driven equipment so that acceleration is obtained without over heating of motor.

4.5 METHOD OF STARTING:

The motors shall be designed for star/delta starting at full voltage with starting current not exceeding four times the rated full load current. The motor shall also be designed for a minimum pull out torque of 200%.

4.6 NUMBER OF START:

Motor when started with the drive imposing its full starting torque under the specified supply voltage variation shall be capable of withstanding at least one successive starts from hot condition two start from cold condition without damage to the winding.

4.7 CLASS OF INSULATION:

The motor winding shall be provided with insulation conforming to thermal class "F". The maximum temperature rise of the winding shall not exceed the limits specified for class "F" insulation of the winding shall not exceed the limits specified as per class "F" insulation. It shall be of thermos setting type and shall remain unaffected by heat. The coils shall be highly uniform with uniform insulation strength and uniform dielectric losses.

4.8 MOTOR CONSTRUCTION:

The motor construction shall be suitable for easy dismantling and reassemble at site with the help of simple over head crane. The motor shall be of core pack construction attached to the stator frame to facilitate easy removal and replacement of the winding for maintenance purpose. The over head for winding at both ends of the core shall be accessible for usual inspection without resorting to major dismantling.

4.9 MOTOR FRAME:

Motor frames shall be of rigid fabricated steel they shall be suitably annealed to eliminate any residual stresses introduced during process of fabrication and machining

4.10 STATOR LAMINATIONS:-

Stator laminations shall be made from suitable grade sheet steel varnished on higher side and shall be adequately designed to over heating during starting and running conditions stipulated above.

4.11 ROTOR SHORT CIRCUITING RINGS:

Rotor short circuiting and rings shall be such that it is free to move with expansion of bars without distortion. The connections of the bars to the end rings shall be made by brazing.

4.12 LOCKING ROTOR WITH STAND TIME:-

Locked rotor with stand time under hot conditions at 110% voltage shall be more than starting time at minimum permissible voltage by at least two seconds.

4.13 TYPE OF ENCLOSURE & DEGREE OF PROTECTION.

The degree of protection provided by the enclosures of motor shall conform to IS:4691. The enclosure for the motors shall be Screen protected Drip Proof (IP 21)

4.14 SHAFT INSULATION:

Suitable insulation shall be provided on shaft/bearing housing to prevent shaft current. The insulation provided shall be such that it shall retain its dielectric properties even after it's handled for number of times during dismantling and reassemble.

4.15 BEARING ASSEMBLY:

Bearing assembly shall be such that it prevents dust getting to the bearing. Further, bearing lubricant shall not find access to the motor winding. The bearing assembly shall be provided with proper lubricating nipples.

4.16 EARTHING:-

The motor body shall have two separate earthing terminals for earthing in compliance with I.E. Rules.

4.17 DIMENSIONS OF MOTORS:-

Motors shall be properly dimensioned to have greater stability and low vibration limit.

4.18 TESTING:-

All the motors shall be routine tested at manufacturer's workshop and test certificate shall be provided with motors.

Detailed Specification Common to Raw & Clear Water Pumpset

5. ACTUATOR BASED SLUICE VALVES:

1. DESIGN REQUIREMENT:

- A. Sluice valves shall be ISI mark and conforming to IS 14846-2000, additionally, they should also meet specific requirement as stated.
- B. Spindle, thrust collar and operating arrangement including hand wheel should be designed in such a way that one adult male is able to operate the valve against full differential pressure by exerting no more than 16 kgf effort (Pull and push) on the hand wheel.

2. FEATURES OF CONSTRUCTION:

- a. Valves shall have inside screw, non rising spindle.
- b. Valves shall be with appropriate bushing arrangement for replacement of packing without leakage (300 NB and above)
- c.
- d. Valves 300 mm dia & above shall be provided with an antifriction device/ ball thrust bearing arrangement to minimize friction between spindle collar and casting. These should be housed away from wet chamber and should have facility for periodic greasing.
- e. Valves of size 350 mm dia and above shall be provided with enclosed, grease packed spur/ worm gear box.

- f. Valves 450 mm dia and above shall be provided with a drain and air plug.
- g. Valves shall be fitted with gunmetal channel and shoe arrangement in case these are electrically operated, the clearance being controlled between 2 to 3 mm throughout the door travel. The channels should be fixed from inside. Puncturing the body for fixing of channels is not allowed.
- h. All valve doors when fully closed, would ensure door faces are riding on body seat ring by at least 50% of the width of seat ring and there is sufficient room for wear travel.
- i. All face and seat rings will be force/press fitted and additionally riveted (300 NB & above) to the recess in the CI casting.
- j. Nominal size of the valve shall be cast on the body of the valve:

DATA

– Rating (Kg/sq.mm)	:	PN 1.6
– Drilling	:	IS 1538 Table 4 & 6

3. SHOP TESTING:

HYDRO TEST

– Seat leakage	:	16 Kg/cm ² (5 min) – for PN 1.6
– Back seat leakage	:	8 Kg/cm ² (2 min) – for PN 1.6
– Body	:	24 Kg/cm ² (5 min) – for PN 1.6

5. NON RETURN VALVES:

- 1. The valves shall be I S I mark and conforming to IS 5312 Part 1 (Single Door Type) for sizes 80 to 600 mm dia and IS 5312 Part II (Multi Door Type) for sizes above 600 mm dia.
- 2. The valve shall be suitable for mounting on a horizontal pipeline and flow direction shall be clearly embossed on the valve body.
- 3. Valves shall have in built quick closing non-slam characteristics achieved by suitable disposition of weight on door and the hydraulic passage. No spring loaded/ spring return action or external dampening arrangement is acceptable.
- 4. Valves of multi door type shall be additionally provided with a supporting foot.
- 5. All faces and seat rings will be force/press fitted and additionally riveted (300 NB & above) to the recess in the CI casting.

DATA:

1. Size	:	
2. Rating (Kg/sq.cm)	:	PN 1.6
3. Drilling	:	IS 1538 Table 4 & 6
4. Accessories	:	
By-Pass Arrangement	:	Required

SHOP TESTING :

B) HYDRO-TEST

Seal Leakage : 16 Kg/cm² (5 min) – For PN 1.6
Body : 24 Kg/cm² (5 min) – For PN 1.6

- Each pump shall be provided with Non Return valve to be provided on delivery side of size as per engineering practices
- On manifold pipe line one numbers of Non Return valve is to be provided of size as per engineering practices

6. Electrically Actuated Butterfly Valves:

1. DESIGN REQUIREMENT:

- A. Butterfly valves shall be I S I mark and conforming to BS 5155 and must also meet the following requirement.
- B. Cone-sphere eccentric design.
- C. Generously designed disc, shaft and cotter pins, ensure that actual working stress at designed pressure never exceeds 40% of the yield strength of material.
- D. Gear box must be generously designed and must be rated for at least 25% more than the torque required to crack open the valve at designed pressure. Also, one adult male is able to operate the valve against full differential pressure by exerting not more than 10 kgf pull and push on the hand wheel.
- E. Valves should be drop tight and designed for flow in either direction.

2. FEATURES OF CONSTRUCTION:

- A. Valve shall be U – section wafer long/ double flanged short body type.
- B. Valves to have two stub shaft, extending at least 2 times their dia, within a robust housing on either side fitted with PTFE bearing.
- C. The valve seat on the body should be integral with it to preclude any leakage from beneath the ring/ “O” ring when the disc is closed.
- D. The synthetic rubber seal ring should be of ample proportion, “T” shaped and must be fastened to the disc by a one piece retaining ring in such a way that the seal ring does not become loose in service.
- E. In addition to providing end of travel stops in the gear box, an integral stopper in the body be provided to prevent over travel of disc during closure.
- F. Gear box must be self locking type, with a continuous indicator. Traveling nut and screw type of gear boxes are not acceptable.
- G. Nominal size of the valve must be cast on the valve body.

DATA

– Rating (Kg/sq.mm) : PN 1.6
– Drilling : IS 1538 Table 4 & 6

3. SHOP TESTING:

– Seat leakage : 16 Kg/cm² (5 min) – for PN 1.6
– Body : 24 Kg/cm² (5 min) – for PN 1.6

- Each pump shall be provided with BUTTERFLY valve to be provided on delivery side of size as per engineering practices

7. FLOW METER

On manifold pipe line one numbers of flow meter will have to be installed having of size as specified in annexure EI, flow meter shall be electro magnetic type having additional display in pump house also through cable.

8. SUCTION & DELIVERY PIPES

Providing, laying & jointing of D/F, M.S. Delivery pipes of lengths as per site requirement and size of pipe shall be as per engineering practices,

9. ENLARGER

Each pump shall be provided with M.S. D/F Concentric Enlarger of size as per engineering practices

10. DISMANTLING JOINT

Each pump delivery pipe line and one number on manifold pipe line shall be fitted with D/F dismantling joint of size as per engineering practices. The dismantling joint shall be designed in such manner so that gap is created in pipe line for easy removing of pump, valves, pipes etc., for maintenance.

11. COMMON MANIFOLD PIPES

All the pumps delivery pipeline shall be connected to common manifold pipe which is to be provided as per size as per engineering practices

12. CABLES

Providing, and laying of be I S I mark LT Cable for 415 Volts, of Aluminum conductor of 3½ core, having PVC Insulated, color code, wrapped with appropriate filler and care binder and single layer galvanized steel wire armoring for multi-core and overall PVC Jacket. Cable shall be laying, fitted with Lugs, Gland, etc., as required from Transformer to Panel and panel to motor.

1 x 3½ core x of size as as per engineering practices

13. A) CONTROL PANEL BOARDS: (Applicable For Raw Water Vertical Turbine Pump & Horizontal Split Casing Pump For WTP)

The LT A.C. Switch Board shall be of 440 Volts, 3 Phase and neutral, 50 Hz. Distribution board, indoor type, sheet clad by 1.5mm thick CRC sheet over M.S. Channel structure frame, floor mounted free standing type, cubical pattern, dust & vermin proof, and shall comprise of following.

PANEL FOR DISTRIBUTION AND MOTOR CONTROL

1 No of Incoming feeders each comprising of:-

- 1 No. 800 Amp ACB for VT/1000 for HSC
- 1 No. of 96sq.mm flush type ampere meter with selector switch.
- 1 No. of 96sq.mm flush type volt meter with selector switch.
- 1 Set. of Indication Lamps for all three phase, ON/OFF, Auto Trip.
- 1 Set. of CT's for protection and metering.
- 1 No. of over current and earth fault protection.

- The bus bar shall be suitable for full load of Ampere of ACB of incomer.
- 1 No Bus coupler between incoming feeder comprising of 1 No. 800/1000 Amp ACB with interlocking arrangement both electrical and mechanical.

Outgoing feeder comprising of:

- 4 No. of 630 Amps ACB.
- 4 No. Auto Trasformer Starters with AC 3 duty Contractor's etc. Complete.
- 2 No. each of 125/62 Amps Switch Fuse Unit with HRC Fuses for auxiliary loads.
- 4 Set. of Ampere Meter for motor with selector switch.
- 4 Set. of single phase preventer for Auto Transformer Starter.
- 2 Set. of Capacitor 130 KVAR for V.T. and 2 sets of 165 KVAR for HSC Pump
- 4 Nos. Of motor protection relay
- 4 Nos. Of RDOL starters for actuator motors.

The bus bar shall be suitable for 3 phase, 4 wire and shall be of suitable ratings. The bus bars shall be with colored insulated sleeves. The supports shall be suitably spaced to give mechanical rigidity for with standing stress due to system fault. The panel compartments shall have adequate space for termination of incoming and outgoing feeder cables equipped with gland, lugs etc. The contractor should submit the drawing of LT panel and switch gear data be provided and get approval before supply at site.

PANEL ROOM FOR DISTRIBUTION AND MOTOR CONTROL at Each Installing site of PUMPS

1 No of Incoming feeders each comprising of:-

- 1 No. 100 Amp. MCCB for incomer
- 3 No. 100 Amp. MCCB for outgoing
- 3 No. of 96sq.mm flush type ampere meter with selector switch.
- 1 No. of 96sq.mm flush type volt meter with selector switch.
- 1 Set. of Indication Lamps for all three phase, ON/OFF, Auto Trip.
- 1 Set. of CT's for protection and metering.
- 1 No. of over current and earth fault protection.
- The bus bar shall be suitable for full load of Ampere of MCCB of incomer.
- 3 No. Star Delta Starters of required rating.
- 2 No. of 32 Amps Switch Fuse Unit with HRC Fuses for auxiliary loads.
- 3 Set. of single phase preventer.
- 3 Set. of required Capacitor with switches

The contractor should submit the drawing of LT panel and switch gear data be provided and get approval before supply at site.

DETAILED SPECIFICATION FOR VARIOUS ITEMS FOR SUB- STATION.

1. TRANSFORMER:

Voltage ration : 11/0.415 Kv
Vector group : Dyn-II and all the transformers shall be filled with mineral oil and ONAN cooling type suitable for outdoor installation and for parallel operation.

- ❖ Each transformer shall be capable of operation continuously at its rated output without exceeding the limits of temperature rise as given below over the ambient temperature of 50°C.

a. In Oil by thermometers. : 45°C
b. In winding by resistance : 55°C

- ❖ The loading of the transformer shall conform to IS:6600/1972.
- ❖ The transformers shall be so designed as to capable of withstanding without injury to the thermal mechanical effect of short circuits at the terminals of any winding for a period as specified in IS:2026.
- ❖ The transformer shall be capable of continuous operation at the rated output under the following conditions.

a. Voltage variation : $\pm 7.5\%$ of rated voltage.
b. Frequency variation : $\pm 3\%$ of rated frequency.
c. Combined voltage and frequency variation : 10%

- ❖ The transformer shall be free from any abnormal noise and vibration and have noise level below the limits prescribed in the relevant standards.
- ❖ The transformer shall be capable of running in parallel.

CONSTRUCTIONAL FEATURES:

TANK:

1. The tank shall be of welded construction and fabricated from sheet steel or adequate thickness. All seams shall be properly welded to withstand requisite impact during short circuit without distortion. The tank wall shall be reinforced by stiffener of structural steel for general rigidity. The tank shall have sufficient strength to withstand without deformation (i) mechanical stock during transportation and (ii) all filling by vacuum.
2. The tank cover shall be bolted on to the tank with weather proof, hut oil resistant, resilient gasket in between for compete oil tightness. If gasket is compressible, metallic stops shall be provided to prevent over compression. Bushing, cover of access holders and other devices shall be designed to prevent any leakage of water into and oil from the tank. The cover shall also be provided with 2 Nos. grounding pads for earthing.
3. Oil sampling taps shall be provided with value at top and bottom to collect sample of oil from the tank for testing.
4. To facilitate the oil filtration by streamline filter suitable inlet and outlet taps with valve sat the bottom and at the top of the tank diagonally opposite corners shall be provided. The value at the bottom may be used as drain valve.

5. Thermometer pocket for top oil temperature measurement by mercury thermometer shall be provided.
6. The transformer tank shall be fitted with a double diaphragm type of explosion relief vent at the top having equalizer pipe connection from conservator.

CORE AND COILS:

The transformer will be of core type, the core design shall be built up with inter lived high grade non-grain. Low loss, high permeability grain oriented cold rolled silicon steel laminations properly treated for core material. The coils shall be manufactured from electrolytic copper of suitable grade, and should be properly insulated varnished and stacked.

All insulation material shall be of proven design. Coils shall be also insulated that impulse and power frequency voltage stresses are minimum. Insulating level of graded insulation shall conform to the relevant standard of IS:2026 Part-III, 1977.

Coil assembly shall be suitable supported between adjacent sections by insulation spacers and barriers. Bracing and other insulation used in assembly of the winding shall be arranged to ensure a free circulation of the oil and reduce the hot spot of the winding.

All leads from the winding to the terminal board and bushing shall be rigidly supported to prevent injury from vibration or short circuit stresses. Guide tube shall be soused where practicable.

The core and coil assembly shall be securely fixed in position, so that no shifting or deformation occur during movement of transformer or under short circuit stresses.

TAPINGS:

Off load tap changer is to be provided on the high voltage winding. The steps shall be of 1.25% variation required is $\pm 7.5\%$ Winding including tapping arrangement shall be designed to maintain the electromagnetic balance between HV and LV winding at all voltage ratios.

CONSERVATOR TANK:

Conservator tank shall be provided with dial type level indicator visible from ground level and fitted with low oil level alarm contact. Plain oil level gauge shall also be provided.

Transformer oil shall comply with IS:335-1972.

TEMPERATURE INDICATOR:

1 No. Dial type temperature indicator shall be provided in the transformer.

TERMINAL ARRANGEMENT.

Since the cables shall be provided for connection with LV systems of transformer, hence the cable terminal boxes shall be provided for the connections to have a closed connections.

TRANSFORMER BUSHING:

All bushing shall conform to the requirements of the latest revision of relevant IS:2099-1973 & 3347. Bushings shall be so located to provide at least minimum permissible electrical clearance and between phase and ground as per the relevant standard.

TRANSFORMER ACCESSORIES:

Transformer shall be equipped with fitting and accessories as listed below complying with IS:3639/1966.

Oil conservator with filter cap and drain plug for each transformer.

Silicagel breather with connecting pipe and oil seal.

Explosion relief vent with double diaphragm and equalizer pipe connection to conservator air space.

Air release plugs.

Direct reading plain oil level gauge – 1 No. for each transformer.

Drain valve with threaded adopter.

Oil sampling valves (top and bottom)

Filter valves with threaded adopter (top & bottom)

Cover lifting eyes.

Jacking pads, handling and lifting lugs.

Skids.

Radiator – These shall be tank (wall) mounted type.

Rating plate and terminal marking plate.

Termination arrangement for cable connection at sides LV.

Neutral bushing.

Off circuit tap charger.

Clamping device with nuts and bolts for clamping the transformer on foundation rails.

Temperature meter.

2. CABLES:

Providing, and laying of be I S I mark LT Cable of 1100 Volts, of Aluminium conductor of 3 -1/2 core, having PVC Insulated, colour code, wrapped with appropriate filler and core binder and single layer galvanized steel wire armoring for multi-core and overall PVC Jacket. Cable is required from Transformer to Incomer panel.

3 LT PANEL BOARD:

The LT AC Switch board shall be 440 volts 3 phase and neutral, 50 Hz., distribution board, outdoor type, wall/floor mounted comprising of following:

1. 1 Nos. Incoming feeder **each** incoming feeder comprising of:
 - (a) 1 Nos. Three pole MCCB of amperes rating with in-built magnetic thermal release, under voltage release and shunt trip release.
 - (b) 1 Nos. suitable CTs for protection & metering.

The bus bar shall be suitable for 3 phase 4 wire and shall be of amps of MCCB as per rated per phase and 100 amps for neutral. Nominal current density in bus bars shall not exceed 1.5 amps per mm². The bus bars shall be with colored insulated sleeves. The supports shall be suitably spaced to give mechanical rigidity for withstanding stress due to system fault level of 40 KA for 1 second. The bus bar chambers shall be of adequate size to house the stated air insulated bus bars. Panel compartments shall have adequate space for termination of incoming and outgoing feeder cables equipped with compression glands etc.

All MCCB units shall be front operated handle type.

4. LIGHTING ARRESTOR

Each Sub-Station shall be provided with 25 kV. of L/A.

The lightning arresters (Surge Diverters) shall be single pole, station type, suitable for use in solidly earthed system i.e. 33 kV side short circuit level is considered upto 1500 MAV. The lightning arrester will comply with IEC 99.5 and IS 3070. All ferrous parts shall be hot dip galvanized. It should act as a by pass for the lightning

surge and also to limit and squash the flow of follow current from the system after the surge has passed. Its rating should be 33 kV, 50 Hz., heavy duty, long duration discharge class with 8/20 wave shape, 10,000 Amp and also be of pressure relief class.

8 33 kV PIN INSULATOR.

These shall be used in Sub-Station as per requirement.

9 33 kV DISC INSULATOR

These shall be used in Sub-Station as per requirement.

10 HARDWARE FOR ACSR CONDUCTOR.

Miscellaneous hardware material required to draw ACSR conductor from electricity board line to L/A to DO to AB Switch to Transformer.

11 Earthing:- Material :-G.I. PLATE

Supply & fixing of G.I. Plate of size 600 x 600 x 6mm or as per design for additional earthing of Transformer, panel etc.

G.I. STRIP

Supply & fixing of G.I. Strip of size 25 x 5mm from earthing pit to various points of earthing connection of all electrical equipments.

G.I. PIPES

Supply & fixing of G.I. 50mm from earthing pit to various points of earthing connection of all electrical equipments.

HARDWARE FOR EARTHING

Miscellaneous hardware material such as Galvanized Nut-Bolts, Funnels, Coal/ Charcoal, Salt etc. required to complete the earthing arrangement.

MAIN HOLE COVER

Main Hole Cover of size 300 x 300mm for earthing pits chamber protection.

12 D.P. STRUCTURE for each sub station i/e for Raw water and Clear water

- 2 Pole Structure for incomer line fabricated out of RS joint of the size 200 x 100 mm of 9 to 11 M. length.
- 6 Pole Structure for distribution of line to 1 Nos. of transformers fabricated out of RS joint of the size 200 x 100 mm of 9 to 11 M length.
- 100 x 50 x 5mm MS channels of required length for installation of various equipment like LA/ Pin Insulator/ Disk Insulator/ DO Sets/ AB Switch, CT's, PT's, etc.
- MS Flats, MS Angles of 50 x 50 x 6mm, etc. for miscellaneous cross support, horizontal and vertical support etc.

13 FENCING

The boundaries of sub-station shall be fenced with help of M.S. Angles, flats, gate, as per requirement.

VERTICALS

The vertical posts of 2.5 M height above G.L. shall be legged by 50 x 50 x 5mm size angle fixed at a

distance of 2 M and every corner shall be provided with diagonal struts of 50 x 50 x 5mm angle.

WIRE MESH

The boundary shall be covered by G.I. Wire Mesh of 3mm thick netting size 100 x 100mm of height 2.5 M

FASTENING FLAT

The wire mesh will be fastened with the supports by M.S. Flats of 25 x 3mm size for vertical & horizontal support as required.

HARDWARE

The standard make nut-bolts, G.I. Wire, Washers, etc., shall be provided for fixing of wire mesh.

One Iron Gate of 3.5 M. wide & height of 1.5 M. shall be provided.

14 METALLING

50mm thick metal shall be covered uniformly over the entire surface of sub-station, the metal shall be hard, tough, resistance to abrasion and weathering action, nonporous drainable, and rough surfaces for proper interlocking.

15 LIGHTING

Sub-Station yard shall be properly lighted with help of street lighting poles of height 8.5 M. fitted with 250 Watts Sodium Vapor lamps with hardwires & ON/OFF switch control.

16 CABLES FOR LIGHTING

2.5sq.mm x 4 core copper armored cable shall be used.

17. CIVIL WORK FOR ERECTION AND COMMISSIONING OF ENTIRE JOB

Transformer platform made of CC M-20 Mix, Foundation work and other mechanical mixed CC M-20 work.

Construction of wall for partition between two transformers.

Construction of earth pit chamber as per I.E. Rules.

Trenches for cable from transformer to panel room with filling by sand.

18 ACCESSORIES

Rubber Hand Gloves.

Ball Pin Hammer with Wooden Handle.

Screw Driver 8" & 12"

Shock Treatment Chart.

Danger Notice Board.

Fire Stand with Fire Bucket in sub-station.

Insulated Player.

Fire extinguisher 4.5 Kg.

D.O. Operating rod 33 kV fibre H.D.

Discharge rod with accessories fibre.

Helmet H.D.

19 Work of erection (as per IE rules) of entire sub station equipments and allied works.

20 Work of drawing preparation, commissioning along with obtain of charging permission from electrical inspector as per IE rules.

DETAILED SPECIFICATIONS FOR RAW & CLEAR WATER PUMPSET

14. CIVIL WORK FOR ERECTION AND COMMISSIONING OF ENTIRE JOB.

Foundation as per site condition of pump set, valves support, etc with help of 1:2:4 Cement Concrete. 1 Job.

Installation of all above supplied items as per rules along with earthing of all electrical equipments as per IE rules. 1 Job.

15. ACCESSORIES:

Rubber Hand Gloves.	1 Nos.
Shock Treatment Chart.	2 Nos.
Danger Notice Board.	2 Nos.
10mm Thick 1 Mtr. wide rubber matting.	2 Set.
Fire extinguisher 4.5 Kg.	1 Nos.
Ring spanners of size 6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22, 21x23, 24x27, 25x28, 30x32.	1 Set.
Double ended spanners of size 6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22, 21x23, 24x27, 25x28, 30x32.	1 Set.
Adjustable spanner phosphates finish of size 305 mm lengths.	1 Nos.
Combination pliers of length 185 mm.	1 Nos.
Long Nose pliers of length 170mm.	1 Nos.
Screw Drivers Blade length 75 mm and blade dia 3 mm.	1 Nos.
Screw Drivers Blade length 100 mm and blade dia 4 mm.	1 Nos.
Screw Drivers Blade length 150 mm and blade dia 3.5 mm.	1 Nos.
Screw Drivers with Neon Bulb Overall length 125 mm.	1 Nos.
Meco make Tong Tester.	1 Nos.
Heavy duty Steel Almirah of 5 feet height for storage of above tools.	1 Nos.

16

Spares.

Panel Spares.

- | | |
|--------------------------------------|--------|
| a. Indicating Lamps. Red/Green/Amber | 6 Set. |
| b. Selector switch for Ampere Meter. | 1 Nos. |
| c. Ampere Meter of 96 x 96 size. | 2 Nos. |
| d. Selector switch for Volt Meter. | 1 Nos. |
| e. Volt Meter of 96 x 96 size. | 2 Nos. |
| f. Fuse of 32 Amp for Main SFU. | 12Nos. |

17. MOUNTING & SETTING ELECTRIC ACTUATOR VALVE

Note: Before wiring and limit switch setting, please study the Instruction Manual(s) supplied by the Electric Actuator manufacturer. Initial trials of the Electric Actuators are taken at our factory, with their mounting on with the valves. For safe transport of the Electric Actuators, the contractor shall dispatch the Electric Actuators along with the valves, but in separate case(s). Therefore, assembly of the Electric Actuators with the valves, followed by its due setting is necessary at site. Setting of the Electric Actuator includes electrical wiring & limit switch setting.

1. Actuator Mounting & Setting

1.1 Mount the electric actuator on Valve Stool / Gearbox actuator adapters flange (as appropriate) and fasten the actuator with fasteners provided.

1.1.1 Mounting of the actuator having E-base (Bore with Key-way)

- a. Ensure key is fitted on valve keyed spindle / gear box pinion shaft.
- b. Engage the Valve Spindle keyed end (in case of direct mounted actuators without intermediate gear box on valve) / Gear Box pinion shaft in the drive sleeve of the electric actuator.
- c. Match the tapped holes on actuator base with Stool provided on valve / actuator adapter flange on the gear box.
- d. Fasten the actuator base & the stool on valve / actuator adapter flange with the fasteners provided.

1.1.2 Direct Mounting of the actuator having A-base (Thrust type base with threaded sleeve, on Rising Spindle type Sluice / Gate Valve) When the Electric Actuator is to be directly mounted on the Rising Spindle type Sluice Valve / Gate Valve, follow the steps as below:

- a. Engage the Manual Operation lever of electric actuator.
- b. Bring the actuator base having internal threads in drive sleeve, near to the valve spindle threads, and take guide of valve spindle threads into the internal threads provided in actuator drive sleeve. Hold the actuator for its balancing and rotate the actuator hand wheel in 'ANTI CLOCKWISE' direction, so that the valve spindle goes on engaging into the actuator drive sleeve and the actuator moves towards the mounting flange provided on the valve. Continue this till the base of actuator matches the actuator mounting flange provided on the valve.
- c. Match the tapped holes on the actuator base with the holes provided on the stool / actuator adapter flange provided on the gear box and fasten the same with the fasteners provided.

Page 2 of 4

- c. Continue to rotate actuator hand wheel in ANTICLOCKWISE direction, so that valve spindle rises and open the valve.

- 1.2 Rotate the actuator hand wheel to partly open the valve, so that its disc / wedge / gate reaches intermediate position.

- 1.3 Carry out electric terminal wiring of the actuator, as per the information / instructions given in the individual Electric Actuator manual, by the Actuator manufacturer.

- 1.4 Ensure that the proper earthing is made for the actuator body.

- 1.5 Read the actuator & its motor name plate details carefully.

- 1.6 Supply the rated power to the actuator to receiving terminals of the actuator.

1.7 Checking correctness of phase of power supply: Operate the switch 'OPEN' and the valve should start Opening. (In Electric mode of operation, the 'Manual' operation lever in the actuator automatically disengages.) In case after switching on the "OPEN" button, if the valve starts Closing, switch-off the incoming power supply immediately. Interchange two of three phases of the incoming power supply. Again switch on the 'OPEN' button, and ensure that the valve starts Opening. This test is to set correct Direction of Rotation of the actuator, to Open / Close the valve w.r.t. the sequence of the supplied power phases. Note: During this test, DO NOT fully open or fully close the valve with electric actuator.

1.8 Setting of Actuator Travel Limit Switches in 'OPEN' and 'CLOSE' positions: Note: This is very important setting for the Actuator Operated Valves and the setting must be done very carefully and correctly for avoiding any trouble / damages of valve / actuator.

1.8.1 Once again switch on 'OPEN' button of the actuator. Cut-off the power supply as the valve disc / wedge / gate is near to OPEN position. Engage the Manual Operation Lever in the actuator and fully Open the valve using the

hand wheel provided on the actuator. Set the 'OPEN' travel limit switch in the actuator at the valve 'Open' position.
1.8.2 Press the 'CLOSE' button on the actuator. The Manual operation lever will again disengage, and valve will start Closing. When the valve disc / wedge / gate nears the 'Close' position, switch off the actuator. Close the valve fully using the hand wheel provided on the actuator, after engaging the Manual Operation lever. Set the 'CLOSE' travel limit switch in the actuator at the valve 'CLOSE' position.

Page 3 of 4

This completes the Travel Limit Switch setting of the actuators.

1.9 It is strongly recommended that electric operated valve should be opened or closed with use of Open or Close Travel Limit Switches only. Torque Limit switches provided in the actuators are to be used as stand by in case the valve requires excessive torque at open / close / intermediate position. In such case, the torque limit switches will stop the valve.

2. OPERATION OF THE VALVE WITH ELECTRIC ACTUATOR

2.1 When the actuator is supplied with correct sequence of phases of the power, the valve will Open / Close corresponding to the appropriate switch operation.

2.2 The travel limit switches in the actuator will stop the motor at the end of the valve travel.

2.3 In case the movement of valve disc / wedge / gate is mechanically obstructed by any other reason, the torque limit switch will operate and stop the valve to safeguard the motor and driving mechanism against damage.

2.4 The valve can also be operated 'Manually' by engaging the manual operation lever provided in the actuator. As soon as the actuator is operated electrically, the hand wheel will get automatically disengaged.

2.5 In case the motor operation stops due to operation of torque switch or during the manual operation the hand wheel stops before the indicator shows that the disc / wedge / gate has reached its full extent of travel; do not use extension levers on the hand wheel. In such case, inspect the valve and gearbox internally to remove such obstruction or identify & remove cause of stoppage of travel.

2.6 Normally the electric actuators supplied for the valves are meant for short time on-off duty. Actuator motor is rated for 15 minutes operation time maximum and 60 starts per hour.

(At 50 MLD Clear Water P/ House)

S.No	Particulars.	Qty.
	DESIGN, SUPPLY, FIXING, COMMISSIONING, TRIAL RUN OF FOLLOWING AS PER DETAILED SPECIFICATIONS GIVEN ON ANNEXURE "E"	
1.	Centrifugal pump for 620 cum/hr at 60 M total head with suction lift of 1.5 meter as per detail specification along with Coupling, Coupling guard, Base Plate & Foundation bolts for above pump along with Electric Motor 3 phase, 415 volts, foot-mounted type SPDP as per detail specification. Pump efficiency minimum 60% at duty point. Along with vacuum pump set of 5 HP as per detailed specifications.	6 Set.
2	Sluice valve of PN 1.6 size 400 mm for suction side of pump as per detail specification.	6 Nos.
3	Sluice valve of PN 1.6 size 400mm for delivery side of pump as per detail specification.	6 Nos.
5	Butterfly valve of PN 1.6 size 400 mm for delivery side of pump as per detail specification.	6 Nos.
6	Non-Return valve of PN 1.6 size 400 mm for delivery side of pump as per detail specification.	6 Nos.
7	Non-Return valve of PN 1.6 size 900 mm for common manifold pipe line as per detail	1 Nos.

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

	specification.	
9	Pressure gauge of dial size 100mm, 0-10 kg/cm ²	6 Nos.
10	D/F Flow meter of electromagnetic type for installation on manifold pipe as per detail specification.	1 Nos.
11	M.S. D/F Pipe for suction as per site requirement of 400 mm size along with hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	850 Kg
12	M.S. D/F 450mm Bend of 90/45Deg for suction side.	6 Nos.
13	DI Dismantling Joint of 400 mm for suction side of pump as per detail specification.	6 Nos.
14	M.S. D/F Pipe for delivery of 400 mm size along with hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	200 Kg
15	M.S./C.I./DI D/F 400 x as per suction size of pump eccentric enlarger for suction side.	111 Kg
16	M.S./C.I./DI. D/F 400 x as per delivery size of pump concentric enlarger for delivery side.	111 Kg
17	M.S. D/F 900mm Bend of 90° for jointing to common main fold and pump outlet.	1 Nos.
18	M.S./DI D/F Pipe for common manifold of 900mm size and of following lengths along with hardware like Nut, Bolts , Wicers & Rubber Sheet complete for joining pipes, valves, etc.	1500 Kg
19	3½ core x 300 sq.mm Aluminum Armored cable including accessories like lugs, glands. For connection of Transformer MCCB panel to Motor Panel.	200 Mtr.
20	3 core x 185 sq.mm Runs Aluminum Armored cable from starter to motor including accessories like lugs, gland. for panel to Motor.	100 Mtr.
21	MOTOR CONTROL PANEL:	
	This panel shall be as per detail specification.	1 Set
	Main panel as per detailed specification with incoming, and outgoing as per detailed specifications, with 4 Star delta starter etc.	
22	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Strip 50 x 6 mm, Complete hardware of earthing like coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete, as per IE Rule.	3 Nos.
23.	ACCESSORIES:	
	Rubber Hand Gloves (11kv grade).	1 Set.
	Shock Treatment Chart.	2 Nos.
	Danger Notice Board.	2 Nos.
	10mm Thick 1 M. wide rubber matting (11kv grade).	2 Nos.
	Fire extinguisher 4.5 Kg.	1 Set.
	Ring spanners of size 6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22, 21x23, 24x27, 25x28, 30x32.	1 Set.
	Double ended spanners of size 6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22, 21x23, 24x27, 25x28, 30x32.	1 Set.
	Adjustable spanner phosphates finish of size 305 mm lengths.	1 Nos.
	Combination pliers of length 185 mm.	1 Nos.
	Long Nose pliers of length 170mm.	1 Nos.
	Screw Drivers Blade length 75 mm and blade dia 3 mm.	1 Nos.
	Screw Drivers Blade length 100 mm and blade dia 4 mm.	1 Nos.
	Screw Drivers Blade length 150 mm and blade dia 3.5 mm.	1 Nos.
	Screw Drivers with Neon Bulb Overall length 125 mm.	1 Nos.
	Meco make Tong Tester.	1 Nos.

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

	Heavy duty Steel Almirah of 5 feet height for storage of above tools.	1 Nos.
24	Spares.	
	Panel Spares.	
	Indicating Lamps. Red/Green/Amber	6 Set.
	Selector switch for Ampere Meter.	1 Nos.
	Ampere Meter of 96 x 96 size.	2 Nos.
	Selector switch for Volt Meter.	1 Nos.
	Volt Meter of 96 x 96 size.	2 Nos.
	Fuse for Main SFU.	12Nos.
	Installation and commissioning of all above items including painting, trial and testing	1 job
	TOTAL	

ANNEXURE - "E-2"-

I. Scope of work & Specifications for Water Treatment Plant 80MLD based on Lamella

Clarifier & Recirculation of Used Back Wash Water inclusive of all civil works, providing & installation of all Mechanical & Electrical Equipment including PLC-SCADA, automation, monitoring & Control system including 12 months trial runs followed by 5 years O&M trial run including replacement and warranty.

II. Construction of Recirculation system including Sludge Sump, Thickeners, Thickener feed pumps, Thickened Sludge sump, Centrifuges, Centrifuge feed pumps, Supernatant and Centrate collection sump and recycle pumps, DWPE dosing system, centrifuge building, etc. for 230 MLD (150 + 80) existing WTPs with 12 months of trail run followed by 05 years of O & M including replacement and guarantee.

1.1 Construction of 80 MLD WTP (lamella clarifier Type)- with recirculation of sludge & waste water including PLC-SCADA, automation, monitoring & Control system including 12 months trial runs followed by 5 years O&M

1.1.1 Scope: Proposed WTP of Capacity 80 MLD will be constructing in the existing WTP complex. 30 MLD capacity for demand of newly added seven villages and 50 MLD will be additional considering 47.7 MLD existing WTP will be defunct after commissioning of this project. Lamella clarifier is proposed in new WTP. WTP will consist of following units. All unit sizes calculated are tentative. Successful bidder for the project will do the detailed design and will provide general arrangement and unit sizes.

- a. Cascade Aerator
- b. Flash Mixer
- c. Clarifloculator /Lamella Clarifier / Plate Settler
- d. Rapid Sand filters-conventional/high rate
- e. Clear Water reservoir and High Lift Pump House
- f. Chlorination
- g. Sludge Thickener
- h. Centrifuge / Belt Filter

including trial run period of 12 months etc & 05 years of Operation & Maintenance including replacement & warranty complete and as instructed by Engineer in Charge

1.2 Construction of Recirculation system including Sludge Sump, Thickeners, Thickener feed pumps, Thickened Sludge sump, Centrifuges, Centrifuge feed pumps, Supernatant and Concentrate collection sump and recycle pumps, DWPE dosing system, centrifuge building, etc. for 230 MLD (150 + 80) existing WTPs including trial run period of 12 months etc & 05 years of Operation & Maintenance including replacement & warranty complete and as instructed by Engineer in Charge

1.3 General conditions

1.3.1.1 All specifications to be as per CPHEEO manual

1.3.1.2 No extra payment for dewatering required for natural, artificial or manmade reason or rock excavation will be payable for any depth or for repetitive work.

1.3.1.3 The bearing capacity of the foundation shall be checked by suitable testing of SBC conforming to IS code by the firm/contractor for which a test certificate will have to be submitted by the firm/contractor to the RMC, Before submitting the design.

1.3.1.4 The prices should be firm inclusive of all taxes, handling, storage, transportation, wages, watch and ward etc. at the site of work.

1.3.1.5 Payment shall be made as per breakup schedule given in Price Schedule. The bank charges and interest on delay in payment if any will not be paid by the department.

1.3.1.6 All Switches, cables, starters, electrical fixtures/equipment shall be of best available standard made

- such as L & T, Siemens, GEC, Philips etc.
- 1.3.1.7 Weather proof Exterior painting on exterior & Acrylic Emulsion in two coats on inside walls of the Intake well (238 MLD shall be provided
 - 1.3.1.8 Surplus excavation earth should be filled and leveled in the area as per the direction of Engineer-in-charge and in no case disposed off near the site .
 - 1.3.1.9 The pump house should have adequate space for free movement after installation of all pump, machinery, pipes and accessories.
 - 1.3.1.10 Anti termite treatment to entire structure below ground level shall be provided.
 - 1.3.1.11 The firms/contractors are directed to submit the detail designs, plan and elevation of complete structure showing the dimensions of all components and other details as per the specifications attached here Detailed physical survey, sanitary survey, Geotechnical (Plate Load test) investigation including trial bores for soil investigation / structural design & BOQ for WTP. complete as directed by the Engineer-in-charge.
 - 1.3.1.12 Preparation of general arrangement drawing, layout of site, on proper scale as directed by the department.
 - 1.3.1.13 Architectural/ Structural drawing having following items
 - 1.3.1.14 Layout plan. Elevation, cross-section i/c details of 80 MLD WTP
 - 1.3.1.15 Preparation of BOQ on prevailing schedule of rates, architectural drawing / structural drawing for technical vetting. The designs and drawings shall be got approved by Engineer in Charge through PDMC. Complete set of drawing and estimate will be submitted in 6 sets.

The Contract on turn-key basis comprises all necessary site investigations, functional planning, supply of Plant, general design, detailed design, manufacture, supply, delivery to site, installation, construction, testing and commissioning of all works required for the Water Treatment Plant of capacity **80 MLD (considering 22 hours pumping)** including all associated mechanical and electrical plants, equipments and services, civil and building works, pipe lines and appurtenances from the raw water inlet upto clear water reservoir and pump house. The designs and drawings shall be got approved from Engineer in charge through PDMC. The successful bidder shall first submit the General arrangement drawing accomodating all the existing units and submit the same for the approval of PDMC. After this he shall submit the hydraulic design and after due approval only he shall prepare the structural designs and architectural drawings and get it approved from competent authority through PDMC.

Water Treatment Plant capable of delivering 80 MLD of filtered water comprising of Civil works, providing and fixing of electrical, mechanical equipment including testing & satisfactory trial run for 12 months, with a guarantee for entire work for 12 months or 2 consecutive rainy seasons which ever is more with a provision of over loading of filter beds with 25% except inlet and outlet control arrangements which should be designed to permit a 100% overload for emergent occasions. This work shall comprise of the following items:-

The principal requirement is a spacious and convenient layout. The structure should represent a pleasing appearance with aesthetic features forming a balance between function and form. The interiors of the structure shall be eye appealing and in keeping with the objectives of the plant viz., production of pure and wholesome water.

While designing and constructing, it should be ensured that all materials, design, construction and fabrication details for different units including doors and windows conform to the IS-specifications and codes of practice wherever available and in their absence, to the established standards.

The scope of work includes but shall not be limited to the provision of the following :-

- Study of available data with department and if required collection of additional field data's and site investigations.
- Planning and design of most economical type of treatment plant to generate 80 Mld wholesome water conforming to relevant IS Code in 22 hours, with due consideration of future expansion.
- The detailed design including hydraulic and structural design, development and preparation of detailed plant working drawings, diagrams and cable schedules and detailed structural steel fabrication drawings, preparation of design reports, manufacture and testing at places of manufacture, transport, delivery, erection, building-in, setting to work, commissioning, testing of all plant required for the Water Treatment Works,

The contract is including but not limited to pipelines, pumping installations, blowers, compressors, machinery, apparatus, station pipe work, lifting, handling ,ventilation equipments, electrical equipments, instrumentation, control, compatible PLC / SCADA interfacing lighting systems, earthing, fire safety and lightning protection systems, materials, articles, fittings and accessories, ancillary works of all kind and nature required for installations of the highest possible operative standards and for compliance with the standards prescribed in the Specification and with the particulars and guarantees entered by the Contractor in the schedules.

Treatment Process

The Water Treatment Plant will be based on Lamella clarification followed by rapid gravity sand media filtration.It will consist of following treatment units:

- Cascade aerator
- Inlet Chamber and inlet channel
- Measuring flume and flow measuring equipment(Ultra Magnetic Flow Meter)
- Chemical house and chemical feeding equipments including automatic valve operation system with audio visual annunciation at the central control panel
- Flash Mixer
- Lamella Clarifier (Minimum Two No. Units of total 80 MLD capacity)
- Rapid Sand gravity filters
- Disinfections arrangements
- Laboratory and Laboratory equipments
- Clear water sump well and pump house
- Used Back Wash Water Recirculation arrangement

The plant should have arrangements for flow measurement, chemical dosing, chemical mixing, mechanical flocculation and clarification, filtration by rapid sand gravity filters, disinfections by pre and post chlorination, chemical storage and Laboratory with Laboratory equipment.

The plant should be capable of treating the raw water to get the filtered and chlorinated water 80 MLD in 22 hours excluding wash water requirement per day. It should also be possible to overload the by 25% .The design calculations with 25% overloading shall also be submitted.

Filtered water standards:

The filtered water should be generally in conformity with the standards specified in IS 10,500(2012). The

tenderers shall be required to give guarantee for the performance standards, which should be satisfied by filtered water effluent, when the plant is working at the maximum rate of filtration samples for this purpose, shall be collected at filtered water outlet prior to chlorination and get tested at such laboratory as may be specified by the Executive Engineer and results of such tests shall be final and binding on both the parties.

The Executive Engineer shall decide the manner and frequency of sampling of raw water and filtered water.

Performance Standards:

The filters performance standards as specified in “Manual of water supply and Treatment 1999” para 2.2.9 shall have to be achieved.

Acid Reaction:

The Filter water shall not have an acid reaction in any circumstances and shall contain not less than 10-PPM alkalinity, measured in terms of calcium carbonate.

The P^H value of the filter effluent shall be between 7.0 and 7.5. The chemical characteristics of the filtered water shall be in confirmation to standards.

Guarantee for the Equipment:

All the mechanical equipment and appurtenances supplied and erected by the tenderers shall be covered by a guarantee for satisfactory working for a minimum period of 12 months or 2 consecutive rainy season which ever is more,. From the date of satisfactory commissioning of the plant.The tenderer at his own cost, such replacement being arranged by tenderer as expeditiously as may be directed by the Executive Engineer shall replace any defective parts detected during this guarantee period.

The tenderer shall supply and deliver a full set of spares for working of the plant, continuously for 2 years. These spares price shall be quoted separately with full details for the parts offered.

Testing and Inspection:

All pipes and other castings subjected to pressures, shall be hydraulically tested to 2 times the designed pressures as directed by the Executive Engineer.

The entire work during manufacturing and erection, shall be subjected to inspections by the departmental staff (i.e. Executive Engineer or his nominees) for which adequate facilities, shall be extended by the tenderers at his cost.

Completion Drawings:

The tenderer shall furnish on completion of the work and handing over the same to the Department, three sets of white print plans mounted on cloth, showing the working detail of the several components, units of the plant and equipments, including civil works (i.e. building etc.) installed and erected, together with a descriptive specification for the daily working, operation and maintenance and also a list of spares along with the plant. The original cloth tracings of the above completion plans, shall also be handed over to the Department for record. A section of filter media together with its density, sizes, depth and specifications, shall be enclosed in triplicate duly attested.

Standards for purified water:

The purified water shall meet the standards as mentioned in IS 10,500(2012).

Treatment:

The treatment should comprise of the following process:

- 4.01 Alum dosing and flocculation
- 4.02 Coagulation and settling
- 4.03 Filtration by Rapid Gravity filters
- 4.04 Disinfection using gaseous chlorine

CASCADE AERATOR –The cascade aerator shall be provided with minimum four steps and space provided shall be not less than $0.030\text{m}^3/\text{m}^2/\text{hr}$

MEASURING FLUME AND EQUIPMENT: -

Design: The flume shall be designed for a flow of 80 MLD (with a provision of 100% over loading) with free board of not less than 30 cm. The measuring flume shall have a side chamber for float. The flume shall be open channel type working on the principles of parshall flume. The flow indicator (meter) shall be provided inside the gallery or within permanent structure and not in open area.

Construction: The entire construction shall be R.C.C. M-30 and shall be perfectly water tight and suitably supported on R.C.C. columns.

Accessibility: The walkway of 1.20-meter width with G.I. Pipe railing as per specification given in item number 6.20 shall be provided.

Electrical and Mechanical Equipments: The Ultra Magnetic Flow Meter should be provided near the flume to indicate the flow. The flow indicator shall have a capacity of measuring a maximum flow including 25% overloading at ultimate flow. The weir plate will have brass edges, which shall be graduated to read in liters per hour. The weir shall operate with clear free fall condition. It shall be ensured that the weir plates do not get submerged due to afflux. The dial of indicator shall be properly lighted. Necessary arrangements for proper desilting of stilling chamber shall be to be provided.

(1) INLET CHAMBER :

It shall be provided to collect the raw water from cascade aerator. It shall be designed for designed Capacity. It shall be in R.C.C. minimum grade M-30. The chamber shall serve the purpose of dissipating the kinetic energy of incoming water and also provide necessary static head for flow through treatment plant, during normal and emergent loading condition. The residual head at the end of pumping main will be minimum 5 m, which may be kept, is consideration during the design.

(2) INLET CHANNEL:

It shall be designed for 100 % over loading of designed capacity with flow measuring arrangement Parshall Flume type with dial type flow indicator. The raw water channel shall be constructed in minimum grade R.C.C. M-30 concrete supported on columns at minimum 2.00 mts, center to center in R.C.C. minimum grade M-25. A puddle collar shall be provided to receive water.

(3) FLOW MEASURING ARRANGEMENT:

The flume shall be designed for 100 % overloading of a designed flow with free board of not less than 30cm. The measuring flume shall have a side chamber for float. The flume shall be open channel type. The

entire construction shall be in R.C.C. and shall be perfectly water tight and suitably supported in R.,C.C. columns. The walkway of 1.0-meter width with **SS 304** pipe railing as per specification given shall be provided. The Ultra Ultra Magnetic flow Meter flow indicator shall be provided near the flume to indicate the flow. This will also fitted with a sensor to transmit the flow rate to PLC –SCADA Automation system The flow indicator shall have a capacity of measuring a maximum flow of 50 MLD including 50% overloading. The weir plate will have brass edges which shall be graduated to read in liters per hour. The weir shall operate with clear free fall condition. It shall be ensured that the weir plates do not get submerged due to afflux.

CHEMICAL HOUSE AND CHEMICAL FEEDING EQUIPMENTS:

DESIGN:

The building shall be constructed in two floors. To facilitate proper transportation of alum into the chemical house (at ground floor) a ramp shall be provided at the entrance, which shall have a 2.5 M wide steel rolling shutters.

In the first floor there shall be adequate numbers of alum solution tanks, automatic alum dosing equipments and a weighing machine of steel yard type platform for weighing alum up to 5 M.T. A chain pulley block of 2 M.T. Capacity with complete chain and bucket shall also be provided at the first floor to lift alum from the ground floor, Sophisticated lifting arrangement will be preferred. An opening of 2 M x 1.5 M shall be provided in the slab for lifting alum , with proper railings as specified in item no 6.2 Maximum dose of the alum shall be 8 grains/gallon and maximum strength of solution shall be 10%. The capacity of tanks shall be such as to hold 8 hours requirement at maximum demand with 0.30 m depth extra for free board. Minimum 2 alum solution tanks should be provided.

LIME DOSING TANKS:

For lime dosing 2 tanks of 8 hours capacity with lime dosing equipment capable of administering lime dose of 0.7 grains/gallon with 10% strength are to be included in the L.S. offer. A suitable space for storing chemicals like Alum & lime of 50 sqm should be provided.

The height of alum stack should not be taken more than 2 m with 30% open space for passage. The other specification of alum store shall be as per para 6.3.3.2 of manual. As an optional item the tenderers are advised to quote for variable rate proportioning feeder including all accessories. The alum solution tanks shall be constructed in R.C.C. M-30. The inner walls of alum tanks shall be painted from inside with 3 coats of Chloro rubber paint. The other specifications of alum solution tanks shall be in accordance with para 6.3.1.1. of manual.

CONSTRUCTION:

The entire construction of Alum store and chemical house shall be in R.C.C. M-30 columns and beams with second class brick panellings of thickness not less than 20 cm in 1:3 cement mortar in external and internal walls. The clear height of the chemical house at ground floor and first floor shall not be less than 4.0M. The floor of the store shall be of kota stone.

MECHANICAL AND OTHER EQUIPMENTS:

A dissolving tray of R.C.C. M-30 with holes or slots shall be provided on tanks for placing the alum cakes. The alum solution tanks shall be fed with pure water by means of G.I. Pipes medium class and valves of adequate size from wash water tank. The solution tank shall be provided with brass gauge plate level indicator. The alum mixing paddles shall be of alloy resistant to mix the alum of enough section & size. There shall be paddles at least at two places, driven by a Central shaft. It shall be driven by electric motor, through worm gear. Necessary wash out arrangements shall be provided. The solution dose shall be drawn in to a constant head stainless steel dosing tank and fed in to a raw water just where it leaves the measuring notch. The dose of the alum solution should be capable of being set and varied manually. The dosing and feeding equipments shall be provided with 100% stand by. The alum solution shall be fed by gravity only. The alum solution tank shall be lined by 6 mm thick H.D.P.E. sheets at bottom and sides. Each alum solution tank should have a 90 cm wide platform. The platform should have a railing as per item no.6.20. The platform should be located at an elevation to have a clear head room of 2.5 m from ceiling. The top of the solution tank should not be higher than 1 meter from the top of operating platforms.

(1) FLASH MIXER: .

During summer algal growth is anticipated. Arrangement to Pre-chlorinate water with a dose of 2 PPM is essential at the entry point. The raw water enter the flash mixing unit for thorough dispersion of the coagulant chemicals added to the raw water. The flash mixers shall be designed with a retention time of 30 sec. The flash mixer shall be fitted with agitators. Dosing system shall be designed on the basis of solid alum with provision of dosing pump.

It shall be circular or square tank with ratio of impeller dia to tank diameter 0.20 to 0.40 and the shaft speed of propeller to Impart tangential velocity greater than 3mt/Sec. at the tip of the blade. The ratio of the tank height to the diameter shall be 3:1. The power-mixing device shall be capable of creating velocity gradient for 300 per second. Flash Mixer will be a circular well of not less than 1.50 m dia with a detention period of at least 30 second and shall have a capacity of treating 80 MLD in 22 hours with provision of 25 % overloading. The flash mixer shall be constructed in R.C.C. M-30. The unit shall be provided with R.C.C. slab in M-30 partly covering the tank, for locating the driving unit of the mixer and for approach to the same. The agitators of flash mixer and alum mixing paddles shall be of M.S.R.L. or M.S. F.R.P. With stainless steel shaft. The dosing, feeding equipments will not have any stand by.

The power requirement of flash mixer shall be as per recommendation given in I.S. 7090.

The paddles made of structural steel conforming to I.S. 226. The agitator shall be mechanically driven consist of electric motor with continuous duty operating through a reduction gear. To achieve good results

the chemical should be added just near the tip of blade. The design should be such that there should be no possibility of short circuiting in the tank. It shall be designed for a full flow of designed capacity. A desludging pipe of DI Pipe K-7 with sluice valve conforming to B.I.S. shall be provided. The length of pipe shall be as per requirement of layout plan, it shall be connected to waste water sump. Hand railing along operating platform (1.0m diameter all around) of 0.75mt. height shall be provided. The M.S. ladder of 0.75 mt. wide shall also be provided. The specification of ladder and railing shall be of SS 304.. It shall be constructed in R.C.C minimum M-25 grade concrete. Protective cover of G.I Sheet of 8 gauge shall be provided for motor.

ELECTRICAL AND MECHANICAL EQUIPMENT :

The following shall be provided :-

Frame agitators with rubber lined M.S. blades/stainless steel blades and rubber lined M.S./SS vertical shaft mounted on bearing of sufficient strength to prevent vibrations or access fabricated.

Electric motor of suitable horse power, starter & reduction gear. The shaft speed of propeller should be more than 100 R.P.M. and ratio of propeller dia to tank dia should be 0.3. It should fulfill the requirement of para 5.4.2.2. of manual in water supply and treatment published by CPHEEO.

Desludging arrangements consisting of adequate length of suitable dia DI Pipe. K-7 and valves class PN 1.6 with operating gear. It is important that the waste water discharge shall be in the nearby nalla/natural drain. The water invert level should be fixed so as to enable discharge in nalla/natural drain in monsoon also through gravity.

Protecting covers of G.I. sheets 8 gauge for motor, giving good architectural view duly painted.

Recirculation arrangement from wash water to clear water sump with tanks, motors, pumps, sand filters etc complete

Scope of recirculation arrangement is within the scope of work. The recirculation arrangement needs one 10 Minutes capacity sump (of the back wash volume) below the back wash outlet, two sludge drying beds and one desludging pump to discharge the sludge to the drying beds. The water collected in this sump shall be admitted to the inlet chamber after silt deposition, by suitable pump and DI pipes to the inlet chamber. The contractor can also suggest system for recirculation which can be approved along with the designs.

(5) FLOCCULATION TANK

Polyelectrolyte /Alum as coagulant aid will be used. The principal objective in coagulant mixing is to obtain rapid and uniform dispersion of the chemical in the water to ensure that chemical reactions are completed in the shortest possible time. The addition and mixing of chemicals to the main flow of water is a continuous process and is described as rapid mixing.

It shall be designed with properly designed inlet and outlet arrangement with due consideration to the better efficiency of settling, mechanical sludge cleaning arrangement with sludge effluent pipe etc. complete.

It shall be designed to provide a detention time of 30 minutes at design flow. Other design parameter viz depth of water, velocity of flow, paddle area, peripheral velocity of blade. Velocity gradient G and the factor GT shall be generally in accordance with CPHEEO manual Para 7.4.3.2. Mechanical Type Flocculators. Coagulated water will be admitted through the central hollow shaft near the water surface and then will flow radially outwards uniformly in all directions through slots. The velocity of flow through these slots should be about 0.2 to 0.3 m/s. Flocculation paddles 2 or 4 in numbers depending upon design will be mounted on a vertical shaft, which will be rotated by A.C. motor 3 phase 415 v. The partition wall and the floor slab of Flocculators shall be of R.C.C. Area of opening at the bottom of partition wall should be large enough to maintain sufficiently low velocity of flocculated water.

MECHANICAL AND ELECTRICAL EQUIPMENTS :

This includes providing and erecting necessary mechanical & electrical equipments with required electrical wiring, switches etc. complete.

In flocculator paddles made of S.S. grade 216 Section 50mmx50mm dia S.S. plate clamped to central S.S. shaft of 65.0 mm dia through C.I. special flanges shall be provided. The total paddle area should be between 10 to 25% tank sectional area in the plane of the shaft. The tenderer can provide his own design. The blade shall be of S.S. plate. The S.S. shall be provided with guide bearings at the bottom suitable for under water use. The flocculator shall have two arms, each having four paddles. The flocculator driving mechanism for each arms shall comprise of motors of ALSTOM/Kirloskar/Jyoti/Crompton make 440 volts, 3 phase, A.C. Motors of suitable H.P./ with Siemens/Kilburn/M.E.I./L.T.L.K. make starter connected by worm reduction gear of suitable ratio through flexible couplings (or V pulley drive) and transmitted through pinion and bevel wheel driven, the bevel wheel being fitted with radial cum thrust bearing. Bevel shaft shall be connected to flocculator shaft through rigid couplings.

(5)-A INFLOW ARRANGEMENT -

Coagulated water from flash mixer will be conveyed to the inlet of Lamella Clarifier through precast R.C.C. pressure pipe or CI or DI D/F of suitable dia. It should be possible to regulate or stop flow, to individual unit. The pipes shall be laid over firm bedding and at uniform grade. The velocity of flow through this conduit shall preferably be between 0.25 to 0.45 mps.

(6) LAMELLA CLARIFICATION: Lamella clarifiers of RCC construction shall receive the raw water and recycled backwash water from flocculator. The lamella clarifiers shall be of square construction, with bottom of circular configuration, suitable for sludge scraper mechanism. Within each of the lamella

clarifiers lamella plates shall be provided so that the incoming solids can be distributed in between the lamella rows whereby the flocs can enter the lamella packs in the lower portion through special inlet feed ports. The clarified water overflow shall take place over adjustable overflow weirs on the upper edge of the plate pack. Each of the lamellas (the water layer in between two plates) has an individual overflow, which ensures an equal distribution of solids and water over the whole of the projected sedimentation area. The overflow weirs are attached to both upper corners of the plate rows. The Inclined plates shall be so spaced that the distance between the successive plates is maintained suitable for the inlet water quality and degree of treatment required, so that the flow through the plates shall be laminar. The plates shall be of PVC with thickness between 2 mm to 4.5 mm thick suitably reinforced as in normally used in such application.

As a standard the angle of the plates is 50° to 55° to the horizontal or as per suitable design of bidder. The incoming flow shall be directed into the influent channels between the plate packs from the bottom, then to the lower sections of the plate pack walls to feed ports through which the suspension enters the plate packs properly. Water enters and exits the system through channels, which are divided into two sections:

- Lower section (inlet flume) for incoming raw water.
- Upper section (outlet trough) for outgoing clarified water.

The bottom of the upper channel section prevents flow from streaming uncontrolled in the basin. Outside the channel walls, holders are attached for support of lamella plates, which are inclined at 60° to the horizontal. It is possible to take out each plate individually for cleaning and maintenance purposes. After entering the lamella cell, the water flows between the plates. Clarified water is directed to the adjustable outlet weir launder. These outlet launders lead clarified water towards the common collecting channel, connected to the filters. The sludge, which shall be settling on the floor of the Lamella clarifiers shall be scrapped by a mechanical scrapper to the central pit, from where the thickened sludge shall be discharged into the sludge sump continuously through a telescopic bleed device. The sludge carrying piping shall be provided with flush connection. The flocculated water from the flocculation tanks shall be fed by gravity into R.C.C. lamella clarifiers. The influent enters the clarification basin and is then directed through a series of parallel plates. The sludge settles on the plates and slides down and is collected in the central sludge hopper by a central driven mechanical scraper mechanism. The sludge shall be drained continuously from the lamella clarifier bottom through a telescopic bleed device and shall be sent for dewatering or disposed. The lamella clarifier shall be fitted with a series of inclined plates. Distribution and entry velocities shall be kept minimum to optimize the hydraulic flow regime resulting in full plate utilization, maximum efficiency and better effluent quality. There shall be a weir launder with orifices.

The plates shall be arranged in such a way that it can be easily removed even during operation.

(6) A- NUMBER OF UNITS :

Minimum 2 No. Lamella Clarifiers of equal capacities shall be provided for the total designed flow. with provision for 20% overloading under emergent condition. The inlet and outlet arrangement will however, be designed for 100% overloading.

(6)-B SLUDGE REMOVAL IN FLOCCULATORS AND CLAFIERS

- i. The withdrawal of sludge from plain sedimentation tanks and clarifier / Flocculators be carried out into a terminal sludge collection tank for disposal into the sludge drying beds by pumping. Suitable pump sets and pump house have to be provided at the sludge collection tank
- ii. Each clarifiers / Flocculators shall be provided with a scraper system to direct sludge to sludge pockets for piping to sludge control chambers. Separate draw-off pipes and valves shall be provided for each sludge pocket
- iii. Each clarifiers / Flocculators shall be provided with a sludge control chamber. The chambers shall incorporate equipment for both continuous and intermittent sludge draw-off. Hydrant connections shall be provided at each chamber for flushing / washing down purposes.
- iv. The sludge from the clarifiers / Flocculators shall be collected in the sludge receiving tanks. The pump house with suitable pumping machinery shall be provided adjacent to the sludge receiving tank for pumping out the sludge from the tank into the sludge drying beds followed by effluent disposal to the nearby water body with environmental acceptance and arrangement to pump this into inlet channel.

(6)-C De-sludging Control and Plant

Plant for the de-sludging system and control shall be located in the central control house as appropriate
Control

- a. The system shall be designed to carry out the following operations:
 - i. intermittent de-sludging alone
 - ii. continuous de-sludging alone
 - iii. Intermittent and continuous de-sludging simultaneously.
- b. Pumping of sludge from sludge receiving tank into the sludge drying beds.

(6) D Clearing of Blockages

- i. Compressed air and pressure water shall be used to facilitate purging of sludge pipes and pockets in the event of blockages.

- ii. Control of each sludge valve shall originate from a manually pre-set electrical multi-range adjustable timer with means of independent adjustment of frequency (time between draw offs) and duration (length of draw-off) of desludging together with 'hand/off/auto' switching, 'state' lights (indicating state viz. 'open/close') and associated sludge control panels. Each Clarifier shall be provided with its own independent sludge control system, with the associated panel located in the central control house.
- iii. Facilities for sequential sludge discharge shall be provided. Manual override facilities both for initiation of a discharge sequence and for operation of individual valves shall be provided. Valves controlled automatically on an intermittent basis shall be pneumatically operated straight through type or eccentric plug type, and shall be arranged to be 'fail safe' (e.g. on power or pneumatic failure, discharge valves shall close) and initiate an audible and visual alarm state at the Filter control Block. It shall be possible to open the valve manually by using a lever or similar, under fail-safe conditions; alternative facilities such as compressed air bottles (one for each clarifiers / Flocculators or foot pumps (minimum two), shall be provided for manual operation of valves. Each pneumatic valve shall be provided with a manually operated guard valve and a manual bypass facility.
- c. Continuous desludging of clarifiers shall be by adjustable bell mouth devices with cast iron bodies and bronze guides. The devices shall be provided with operating headstocks and suitably located position indication scales and arranged to operate in parallel with the intermittent desludging valves.
- d. During the periods of temporary shutdown, it is required that sludge scraping and sludge evacuation equipment shall continue to run until all heavy solids have been removed from the system which could otherwise compact during the shutdown period and cause difficulties on start up.
- e. Hydraulic design: The total hydraulic design capacity of the sludge withdrawal and discharge system shall not be less than 10% by volume of the MWF.
- f. Sludge disposal pipe work: The pipe work for clarifiers / Flocculators sludge system (within structures) shall be of RCC NP3 and shall enable to empty tank into the sludge well by gravity. Valves shall be of cast iron-rubber lined type, epoxy painted outside. The valves shall be easily accessible for manual operation. The pipe work for sludge pumping shall be in cast iron / ductile iron.

(6) E- Clarifiers / Flocculators Scraping Mechanism

- a. Sludge scrapers and mechanical Flocculators

b. Sludge scraper mechanism and discharge arrangements shall be designed for raw water suspended solids loadings up to 1000 mg/l solids in clarifiers. The design shall allow for starting up under a sludge sit down situations, and to accept without distortion any normal torsional or bending loads which may occur during erection and operation, scraper mechanism shall extend to the entire diameter of the tank.

(6) F- Clarifier Sampling:

- a. Local sampling taps of approved design shall be installed to take sample from at least three different points in each clarifier
- b. The three sampling taps for each tank shall be grouped together and shall discharge into a sink, which shall be connected to the main drainage system.

(6) H- Drainage of Plain Sedimentation Tanks and Clarifier

Each tank shall be provided with facilities for complete gravity drainage of all water and sludge from both the main body of tank and from sludge concentrates. All valves, pipe work required for discharge to and connection with the main drainage system shall be provided, so that a tank may be emptied within 6 to 8 hours. These drains shall discharge into the main works drainage duct to be provided by the Contractor.

(7) RAPID GRAVITY FILTERS

The clarified water from the lamella clarifier will flow to the Rapid Gravity Declining Rate filter of dual media type through clarified water channel. The filters shall be designed for the flow of 80,000 m³/day. At least 4 no of filter bed have to be provided according to the availability of the space. Each filter bed will be of twin type and the area to be calculated accordingly.

The maximum filtration area of an individual filter will not exceed 100 m². The rate of filtration shall be taken as 4.8 m³/ m²/hr The filters will allow for a maximum headloss of 1.8 m across the filter media. The filter run should normally be not less than 24 hours with a loss of head not exceeding 1.8m.

The filter shall be of declining rate filtration. Each filter bed self- contained and capable of working under full or part load independently of the other. Arrangement has to be made for incoming water to be uniformly distributed between the various filters and individual on each filter bed. Each filter inlet will include isolation penstock. In filtering mode, the water will be fed into the filter, above the filter media, in such a manner that the filter media is not disturbed.

The water will flow through the filter media, through filter floor nozzles, and into a plenum chamber underneath the filter floor. Filtered water will flow from the plenum chamber, through the filtered water

isolation valve, and into the filtered water header and channel. Water will flow from the filtered water header/channel, into the Filtered Water Reservoir .

The filters shall be designed to operate under normal filter rate of $4.8 \text{ m}^3/\text{m}^2/\text{hr}$ and $6.0 \text{ m}^3, 1\text{m}^2$ with 25% overloading but the inlet and the outlet control arrangements shall be designed to permit a 100% over load for emergent occasions as per provision made in para 7.6.3.3 of manual on W.S. & Treatment.

Dimensions of the filter unit should be as per para 7.6.3.5. of the manual of the “ water supply & Treatment “ published by CPHEEO.

Quality and quantity of gravel & sand shall be as per 7.6.3.6 to 7.6.3.10 of some manual.

Automatic effluent controller capable of operation between 50% to 160% of the normal flow. Make should be mentioned.

Piezometers should be provided to determine the loss of head occurring at any time during the filter run. One set of photometers should be provided for each filter unit.

Compressed air should be used in the air wash system to secure effective scrubbing action. The quantity of wash water used should not exceed 2% of the total amount of water filtered. The air should be forced through a piping system (independent of the under drains) at the rate of 375 LPM/Sqm of the filter area at $0.18 \text{ kg}/\text{cm}^2$, pressure for a duration of 5 minutes following which wash water shall be introduced at a rate of 300 LPM/Sqm of the filter area.

The duration of the washing process should not exceed ten minutes.

Both the filtered water and the water for washing should pass at uniform rates throughout the area of each filter.

The water standing on the bed at the close of the wash should be clear with a turbidity not exceeding 10 JTU.

The air wash and under drain system should be exactly in accordance with the para 6.6.3.12 (b), 6.6.3.13 and 6.6.3.9 of the manual on water supply and treatment published by CPHEEO. The capacity of air blowers provided should be such that there is 100% stand by arrangement.

The capacity of the wash water tank shall be adequate for the complete wash for 2 filter units at a time for a period of at least 10 (Ten) minutes. The size of the inlet pipe connected to wash water tank must be such as to ensure filling in 2 hrs. and the size of outlet pipe from the wash water tank to the filter must be such as to ensure flow of water within the period of one complete wash of two filter units.

Electrically driven wash water pumping units should be provided at least in duplicate. Each pump should be capable of filling the wash water tank in two hours with 100% stand by.

The wash water is proposed to be disposed off in nearby nalla through gravity. The wash water gutter invert level should therefore be fixed considering H.F.L. of nalla/natural drain so that drainage by gravity

during flood can be possible.

(8) FILTER MEDIA

The filter bed will be as per CPHEEO Manual on Water Treatment and water Supply.

(9) Back Wash Water System

The wash sequence will include air scouring followed by water washing. The air scour rates selected to provide collapse pulse washing. This will be followed by a water only rinse at a wash-water rate selected to ensure re-stratification of the filter bed. There should be no mud balls after washing. Also, there should be no air binding during filtration or during washing. Provision for necessary sump & pump house shall be made by the bidder.

The following wash rates shall be adopted for filter wash.

- Conjunctive Air/Water wash rate: min. 45 m³/m²/hr
- Water wash rate : not less than 12 m³/m²/hr (Bidder to ensure re stratification media after each back wash)

A pressure relief system will be provided to prevent damage to a filter floor should its design pressure rating be exceeded for any reason. Drain valves will be provided to allow each individual filter to be drained. Also hand railing should be provided to all filters to safe guard against accident as per factory Act. All the filter valves shall be pneumatically operated with manual override arrangement. The minimum size, of pipeline and valves shall be of as per bidders design and required to be approved by the consultant.

The backwash shall be arranged at such a pressure that the sand should expand to about 130 to 150 % of its undisturbed volume. The backwash shall be of air water type. The air shall be introduced for a duration of 5 minutes and then the wash water shall be introduced through the same under drains for 10 minutes. For introducing air and water the piping may be same or separate. it shall be worked out by the firm with due consideration to the economy.

(9)A- WASH WATER TANK -

It is advisable and economical also if wash water tank is constructed above the clear water control chamber. Its capacity will depend on the total loss of head due to expansion of sand. Loss in under drainage system loss in incoming pipe and height of wash water gutter with respect to under drainage system. The bottom of wash water tank shall be at a height of about 9.00 mt to 11.00 m, the capacity of wash water should be varied from 2 to 6% of filtered water and should be sufficient for at least 10 minutes wash of one filter or 5 to 6 minutes wash of two filters. The minimum capacity of tank should be designed for washing two filters at a time. It shall be of R.C.C. with minimum grade M-30. The most preferable shape is Rectangular. The corners of tank shall be rounded off. The top slab of tank shall be of R.C.C. minimum grade M-30 with sufficient number of manholes and ventilators of 100mm dia C.I. with Cowels and the aluminium ladder of 0.45 mt wide from top to bottom of tank.

A float operated mechanical gauge shall be provided. The arrangement should be fixed in such a way that during excessive wind flow it should not be disturbed. It shall have meter scale painted with enamel paint with black and red colour on white colour back ground. A RCC staircase from ground to top of tank shall be provided by contractor. It shall have the railing either on both sides or on one side as per site conditions.

(9)B-- APPURTENANCES -

a. RATE OF FLOW CONTROLLERS –

Since it is proposed to provide declining rate filtration hence one rate of flow controller shall be provided.

In this case filter influent shall be entered below the low water level of filters so relatively large influent header pipe or channel will serve all the filters. It shall be provided with influent valve for each individual filter.

b. FILTER GAUGES -

It shall be provided to measure accurately the rate or flow through each filter box and to determine the loss of head occurring at any time during the filter run. It must be simple in operation and easy in handling by the maintenance staff.

(10) FILTER UNDERDRAIN SYSTEM

The nozzle shall be designed so as not to dislodge the filtering media when water independently introduced for washing under drainage system and materials to be used shall be of non-corrodible materials. The false floor slab shall be monolithic RCC-M25 Bottom of slab shall be epoxy painted. The design of precast /cast in situ slab shall be such that the same can withstand against pressure during backwashing. The PVC/PP nozzles shall be placed at equal and uniform distance so that even distribution of air/water pressure occurs. Arrangements for collecting and leading away the dirty wash water is designed as to carry away the same at all depths within the reasonable time by gravity for recirculation back to the WTP. For air washing adequate compressed air supply facility along with necessary valves and piping is provided. The filters have to be provided with suitable electronic arrangement for measuring loss of head and rate of flow in the filter is provided for measurement of flow from each bed. For operation of various valves proper approach, operating platform and for access from filter gallery to operating platform is provided. Hand railing is provided of SS 304 wherever required as per factory Act and tender specification. The filter boxes shall be in RCC M.25 with a suitable filter house of adequate size to accommodate all features of the filtration plant.

Filter gallery shall be covered from the top constructed in RCC M25 side wall. Filtered bed shall be open to sky. Filtered water channel shall be provided with glazed tiles on sides and bottom and covered with RCC slab from top. For inspection glass sheeting shall be provided at various points. The building of filter gallery house shall be covered and with 250 mm thick cement brick work (1:4) with both side cement plaster 1:4 and covered with Arch type RCC roof. The ceiling of roof shall be plastered with cement mortar 1:4 and terrace of roof shall be given suitable water proofing treatment by use of Sika Latex compound and covered with ceramic roof tiles.

The design parameters in under drainage system shall be as given in Para 7.6.3.9 of CPHEEO manual. The under drain system with central manifold or laterals either perforated in the bottom or having umbrella type strainers on top shall be provided. The central manifold and laterals shall be of cast Iron, concrete or other materials. As per economy all pressure pipe shall be of cast Iron, concrete or other materials.

PIPE GALLERY: Effluent wash and waste water pipes all together with the sluice valves are placed in the pipe gallery should be well designed with minimum 2.00mt width provided with a ladder or steel rungs to make it for the maintenance staff easily accessible to the bottom. It should be well ventilated. It should have a sufficient slope to drain out the wash water or other leakage water. The two pipe galleries shall be provided one gallery for effluent pipe Air and wash water pipes and other Gallery specially for draining out the wastewater of filters. It shall be designed by contractor and preferably of R.C.C. pipe. It shall be connected with wastewater sump. The system will avoid the unnecessary congestion of the pipes and avoid the hindrances in cleaning of pipe galleries. One shall be towards the module chambers side and other towards the influent header pipe side it should be constructed with minimum R.C.C. grade M-30.

(10)-A RATE OF FILTRATION -

The rate of filtration shall be taken as 4.8 m³/m²/hour. The inlet and outlet arrangements shall be designed to permit 100% overload for emergency conditions.

(10-B) CAPACITY OF FILTER UNITS-

The capacity of filter should be such that the number of unit can take care of the total quantity of water to be filtered and with optimum efficiency to keep the filters working without undue overloading at any time.

(10)C---SIZE OF FILTER UNIT -

Where the filters are located on both sides of pipe gallery. the ratio of length to width of a filter box shall be about 1.25 to 1.33. A minimum 2 mt depth of water shall be provided above filter media. The filters shall be constructed in R.C.C. of minimum grade M-30.

10(D) FILTER MEDIA -

Filter media will be as per CPHEEO Manual .

(11) FILTER CONTROLS:

All the Inlet, Outlet, backwash, air and drain water valves for the individual bed of Filter shall be pneumatically Operated butterfly valves. The filter bed operation shall be carried out through local as well as remote control panel with PLC system.

After backwash of the filter beds, the waste water shall be collected in dirty water sump & recycled back to plant . The adequate size of chambers with CI frame, cover, rungs shall be provided be of Constant head type. **The filters shall be arranged in one row with a FILTER GALLERY of 4 mtrs to accommodate pipe and a filtered water channel.** The minimum WALK WAY near the filter should be 1.5 mt. wide and PIPE GALLERY should be minimum 4.0 m wide to accommodate all the pipes and valves and have a proper slope to drain out the wash water through wash water pipe. All sluice valves on each filter shall be pneumatically actuated, with manual override facility. The pneumatic cylinders of double acting type shall be actuated by solenoid valves which shall be arranged on a console placed in front of each filter unit. An air filter and lubricator shall be provided near individual solenoid valve console before the header for air scour to each console.

The filter consoles shall be fitted with pilot lamps to indicate shut and open positions of the respective valves or sluice gates actuated by limit switches mounted on the cylinders. The consoles shall be provided with push bottom starters for each of the wash pump and air blower motors with indicating pilot lamps. The consoles shall also be provided with arrangements to give an audio visual signal to the central control room and to the wash pump/air blower room in case of emergency.

Two electrically driven air compressors mounted on a pressure storage tank for supplying air for actuating the pneumatic cylinders, shall be provided. The displacement of the compressor and the capacity of the storage vessel shall be so designed that it will be available at all times with one unit in operation, sufficient quantity of air under required pressure to actuate the cylinders when the filters are washed one after the other at intervals of 30 minutes. The compressors shall be fitted with a pressure to actuate the cylinders when the filters are washed one after the other at intervals of 30 minutes. The compressors shall be fitted with a pressure switch to maintain the required pressure in the storage vessel and a drier for dehumidifying to ensure dry air to the cylinders. An audio visual alarm shall be installed in the central control room to indicate failure

of the pressure system. One compressor shall work at a time and the other one shall be standby. The

compressors be rated at 15 bar and provided with a pressure switch each with both cut-in and cut-out facilities.

The waste water from filter backwashing process will be reused. For this, a sump shall be provided to recover the waste water from where it will be pumped into the raw water channel upstream of the venturi throat for blending it with the incoming raw water. A waste water sump of suitable capacity with 2 Nos. (1W + 1S) recirculation pumps shall be provided for pumping the backwash waste. The storage tank shall be provided with an overflow weir to discharge the excess quantity of waste water into separate system as would be identified by Municipal Corporation RAIPUR and necessary sewer lines shall be provided to connect existing brick sewer from plant. There shall be a provision for measurement of the filtered water output from the plant, over a rectangular weir, with the help of ultrasonic flow meter.

- Filters shall be of the declining rate type with filtration rates varying by $\pm 50\%$ of the average over a filter runs length. At the start of the filter run, when the bed is clear the filtration rate shall be 50% above the average value whilst at the end of the filter run the filtration rate shall be of 50% below the average value.
- Clarified water shall be fed to each filter from the inlet channel through a submerged penstock opening.
- At the outlet of each filter the filtered water shall flow through an adjustable valve or 'setting valve', which shall limit the maximum flow to 50% above average flow. The valve setting shall be adjusted during commissioning in order to achieve the required range of filtration rates between clean bed and dirty bed conditions to within $\pm 50\%$ of the average flow though the filters.
- A separate valve drain shall be provided to drain the underflow chamber. Emergency access to the underside of the filter floor shall be provided.
- Filter valves and penstocks shall be fitted with electric actuators with facility for manual operation.
- Each filter shall be equipped with instruments for measurement of the differential head across the filter bed. Measurement accuracy shall be $\pm 2\%$ of the measured value. Each measurement instrument shall be equipped with stainless steel needle isolating and drain valves.
- A control console for each filter shall be installed in the gallery.
- These consoles shall be equipped such that the operator can initiate the backwashing operation manually.
- The control consoles for each filter shall include the following facilities and indications as a minimum:
 - Start filter wash cycle -key operated push-button;
 - Manual/automatic key operated selector switch;
 - Filter water holding tank full-lamp;
 - Open/close push buttons for each actuated valve and penstock;
 - Open/close indication for each valve and penstock-lamp;
 - Filter ready for wash-lamp;
 - Filter washing - lamp;
 - Filter in service - lamp;
 - Filter out of service
 - Wash water pump tripped - lamp;
 - Air scour blower tripped - lamp

- Filters shall be washed in sequence automatically under the control of a preset timer, adjustable from 12 to 36 hours. Filter backwashing shall be inhibited to prevent two filters washing simultaneously and also to prevent wash initiation when the filtered water holding tank has insufficient water in storage.
- Programmable Logic Controllers (PLCs) may be used for filter washing controls, with each filter being controlled by a dedicated PLC with the initiation controlled by a central PLC. PLCs shall be arranged so that failure of one unit does not disable the automatic washing of more than one filter.
- Lamps in the monitoring room shall indicate the state of each filter, i.e. filter in service, filter washing and filter wash overdue.
- Filter washing time cycles shall be manually adjusted to suit the monitored turbidity levels.

FILTER VALVES AND MOTIVE POWER SYSTEM

- Butterfly valves shall be used for the filters in preference to penstocks or sluice valves unless the penstocks or sluice valves proposed are of a size which can be operated easily by one man.
- Filter valves which require to be operated as part of the washing cycle shall be operated by pneumatic power. The system shall be capable of operation in the event of electric power failure and details shall be provided by tenderers, as to how this will be done. The time taken to open or close any valve shall generally be between 10-30 seconds.
- Compressors for valve/penstocks operation duties shall be in duplicate with duty/standby units including receivers, provided to serve only the filters. The standby unit shall be so arranged to automatically operate if the duty unit fails and also initiate an alarm state on the filter block control room enunciator. The rating/capacity of each compressor shall be designed to serve a total of 3 filters, and to enable valves on at least three filters to be operated simultaneously.
- The compressor installation shall be designed to satisfy conditions for maximum air demand and shall ensure the duty compressor does not start more than six times in any hour and the running time of the duty compressor shall not exceed 35 minutes in any one hour. The standby compressor unit and receiver shall be identical in size.
- To avoid overheating, an integral cooling system shall be provided for each Compressor unit.

PIEZOMETER TAPINGS

- In two filters (to be selected by the Engineer-in-Charge's), six piezometer tapings shall be provided for each filter to determine the head loss gradient across the media.
- The Contractor shall provide and fix on the two filter front walls in an accessible position (with standing platform if necessary) all the necessary puddle pipes, strainers, manometers, tubes, calibrated scales, mounting boards and fixing brackets, interconnecting small bore tubing, cocks and fittings.

PAVING:-

A paving in front of clear water control chamber 4.0 mt. wide shall be provided by contractor. The paving shall be in grooved vetrified tiles good in appearance and colour, laid over M-25 cement concrete.

STAIR CASE:-

The stairs made of RCC M 20 with anti skid tiles shall be provided. The staircase shall be provided to

connect ground level to the floor of control room and wash water pump or air blower floor to the operating plate from of control room.

(11)A-- EFFLUENT AND WASH WATER PIPE -

The effluent pipe shall be designed for a velocity of 0.9 to 1.8 mt./second and wash water pipe for a velocity of 1.5 mt/second. These shall be C.I. double-flanged class .Pipes confirming to I.S. 7181 - 1984 and C. I. specials shall be confirming to I.S. 1538-1976. The sluice valve provided shall be confirming to I.S. 14846-2000.

(11)-B---MODULE CHAMBER OF CLEAR WATER CONTROL CHAMBER

It shall have sufficient space to accommodate sluice valves of effluent pipes, effluent discharge weir and clear water effluent pipe feeding to clear water sumps. It shall have sufficient circulation space minimum 2.00 mt of ground floor where the module chambers shall be minimum ceiling height of floor shall be 4.00 Mt. The ground floor shall be easily accessible by providing aluminium ladders. Arrangement for effluent sluice valves. air blowers piping. Wash water tank etc. It shall be framed structure of minimum R.C.C. M-30 grade concrete. At a height of minimum 10.00 Mt. the wash water tank shall be provided for storing the water for washing the filters. The capacity of wash water tank is given in Para 7.6. The panels of framed structure shall be constructed of chimney brick masonry with cement mortar 1:5 and plastered with mortar 1:5 the ground floor as well as first floor shall have sufficient ventilation of about 30% of floor area. As far as possible natural ventilation shall be provided the window shall be of Aluminium . Z-section provided with 4 mm thick transparent glass. The gate shall be provided on all the four sides. The main gate shall be. made of aluminium automatically closing type fitted with glass and the other gates one towards filter sides and other towards chlorine room side and open area side shall be made of Z section of Aluminium fitted with glass. The windows of Aluminium frame shall be opened outside fitted with mosquito net with all arrangements of opening and closing the window stoppers etc. complete.. The flooring in chamber shall be anti-skid tiles as approved by the Engineer-in-Charge in writing with good finish upto 30-cm. height. The ground floor shall have drainage arrangement to easily drain out water in case of cleaning the water from module chamber.

(11) C---AIR BLOWER -

The Air blowers shall be designed for a free flow of Air 36 to 45 Cum/hr. at a pressure of 0.35 mt/hrs for a duration of 5 minutes. The material used for the pipe and specials should be anticorrosive preferably C.I. Class LA double flanged and C.I. Sluice valves confirming to I.S. 14846. These shall be mounted in clear water control chambers at about 1.00 mt.-depressed floor from operating floor of effluent sluice valves.

(11)-D---BACK WASH WATER PUMP :-

It shall be designed for 1.00 Hr. i.e. pump shall be in position to fill wash water tank in 1 Hr. There shall be two pumps in which one will act as stand by unit. These pumps shall be provided on the air blower floor. The pump shall be of centrifugal type with a suitable motor to operate on $415 \pm 10\%$ volt, 50 Hz. B class of insulation and degree of protection at IP-56, the suitable Auto Transformer Starter panel, Cable, suitable rating capacitors and Stabilizer. These pumps shall be provided and fixed by the contractor. The pump shall be provided suitably NRV, and sluice valve of PN 1.0. The size of the pipe to fill the wash water tank shall be designed by the contractor. The pipe shall be C.I. double-flanged class A with bell mouth at the top. The delivery pipe in wash water tank connecting to different filter to sluice valve shall be designed by contractor and made of C.I. double-flanged class A confirming to I.S. code in practice. The scour and over flow pipe also be designed and provided by the contractor. The overflow pipe shall be connected with the clear water sump pipeline or clear water sump whichever is nearer. Scour pipe shall be

connected with the waste water line of filter going to waste water sump of chamber with necessary C.I. sluice valves.

(11) E----MODULES: -

The module chamber shall be R.C.C. constructed for each filter bed separately. It shall have two compartments. In one compartment it shall have clear water effluent pipe with sluice valve. It shall be operated from the operating platform. The second compartment will be used for collecting the clear water spill over the weir; The height of weir shall be higher than the maximum water level in the filter in order to avoid the negative head. It shall be line with tiles of standard make, preferably in sky blue colour. The top of the module chamber shall be covered with M.S. framed cover divided in two parts, fixed with glass of minimum 4mm thick the cover shall be so fixed that it should be easily opened at the time of maintenance. The module chamber shall also have arrangement for draining out the dirty water (at the time of maintenance). The minimum 600mm. R.C.C. Class NP2 pipe with sluice valves should be provided. The entire module chamber shall be connected with the one waste water line & finally disposed of either in drain constructed in front of this block or in waste water collection sump Sufficient head room above the module chamber shall be provided a M.S. ladder from floor to the top of the module chamber shall be provided.

(12) CHEMICAL HOUSE: A chemical house shall be provided for storage as well as installation of dosing facilities such as alum, lime & polyelectrolyte

(i) **Alum Dosing System** :Two Nos. dosing tanks are to be provided at the first floor of chemical house. Dosing tanks should be having electrical, mechanical, interconnecting, pipeline network for dosing. Epoxy lining shall be provided in both the tanks. Required electrical, mechanical arrangement shall be provided in both the tanks. Two basket type strainers shall be provided in the solution delivery pipe line for the dosing pump. Electrically driven mechanical agitators shall be provided for continuous stirring of the solution in the tanks. There will be two nos dosing pumps for dosing Alum at the dosing point. The dosing of Alum will be done based on the Flow and Turbidity of the raw water. The dosage will be determined by doing jar test in the Laboratory. Each tank will hold 5% solution for 12 hours. The alum dosage should be considered as 50 ppm for design.

(ii) **Polyelectrolyte Dosing System:** Two nos. dosing tanks are to be provided at the first floor of chemical house. Dosing tanks having electrical, mechanical, inter-connecting pipeline network for dosing shall be provided. Epoxy lining shall be provided for continuous stirring of the solution in the tanks. There will be two nos dosing pumps for dosing Polyelectrolyte at the dosing point. The dosing of Polyelectrolyte will be done based on the Flow and Turbidity of the raw water. The dosage will be determined by doing jar test in the Laboratory. Each tank will hold 0.5% solution for 12 hours. The polyelectrolyte dosage should be considered as 0.3 ppm for design. Electrically driven mechanical agitators shall be provided for continuous stirring of the solution in the tanks.

The minimum storage shall be for 3 months for filter alum and 3 months for hydraulic lime and other chemicals. Store for the chemicals shall be provided below chemical dosing room.

The minimum ceiling height shall be 4 mt. In order to avoid moisture the minimum plinth height shall be 0.90 mt. The floor should be made damp proof and it should be filled about 0.60 mt. with sand and bituminous coating shall be provided over it in order to avoid the moisture. The flooring shall be of

concrete with acid resistance tiles cladding on the floor & in the sides upto 2.0 mt. height. The building shall be constructed in R.C.C. framed structure in M-25 grade concrete and panels shall be of second class brick masonry in cement mortar 1:6 and plaster in cement mortar 1:4. The specification of brick shall be as given in the specifications. The roof of this storage room shall have an opening of 2x2 mt. to facilitate lifting of chemicals. The arrangement for lifting and weighting of chemicals shall be provided by contractor from first floor of chemical house. Adequate ventilation and lighting will be provided. It should be easily accessible to the trucks for unloading the chemicals. The main entrance shall be 3.00 mt. wide and 3.50 mt. height with rolling shutter. The height of alum stack should not be taken more than 2.0m with 30% open space for passage.

INSPECTION CHAMBERS: All inspection chambers shall have white tiles on all the inside four walls and at the bottom also. Proper lighting arrangement “inside” shall also be provided.

- All pipes specials and valves should be of case iron double flanged and should carry ISI marks conforming to the relevant I.S. Specification duly inspected by DGS & D/SGS/RITES. Pipes and other conduits including valves and gates should be designed to carry water as per the requirements mentioned in manual on W.S. and Treatment and respective I.S. Specifications.

The firms/contractors should state clearly in the tenders the size of the various pipes, specials, valves which shall be provided by them. They should also indicate the velocities at which the necessary water would pass through these and the time taken for the water to be delivered at different points.

1.20 meters wide walk way should be provided all rounding all the filter beds with G.I. Pipe railings.

- Sufficient space for housing the air blowers and pumps for filling wash water tank should be provided in the filter housing building.
- A separate enclosure for housing chlorine tonners with adequate working space and proper ventilation of chlorine gas and inflow of fresh and cool air should also be provided in this building.
- **An office room of minimum 30 sqm carpet area should be provided.**
- 2 sanitary blocks consisting of 1 W.C. one urinal and wash basin having a carpet area of 9 sqm should be provided, 1 in the ground floor of the building and 1 in the first floor of the buildings. A septic tank of suitable capacity shall also be provided at proper place for safe disposal.
- The minimum width of the operation gallery shall be 1.50. m.
- A laboratory of 30 sqm area should be provided at the first floor of this building.
- The filter beds, shall be open to sky i.e. there shall be no roofs over the filter beds.

PERFORMANCE CAPABILITY:

For Rapid Gravity filters, the performance standards should be in accordance with para 6.6.8.2 of Manual On Water Supply And Treatment published by CPHEEO.

CONSTRUCTION

The filter house cum administrative building shall be in R.C.C. M-30 framed structure in two floors. The clear height between the floors should not be less than 4.0 m. A R.C.C. stair case connecting the floor shall be provided. Cast iron foot holds for getting into central gutters of each filter should be provided.

- 6.14 Decorative G.I. Pipe railings should be provided with CI Decorative heavy posts of suitable dia and 1.0 meter long fixed rigidly in cement concrete at 1.50 m a part with 3 rows of horizontal 25 mm dia medium class G.I. Pipes including painting etc. minimum 3 Nos. of such G.I. Pipes should be provided for the railings around circular structures but the spacing should be up to 2 meters.

The same specification of railing shall be adopted where ever necessary. The railing shall be of good architectural design. The bends, corners and horizontal/vertical stays properly finished so as to offer a fine and stream line look.

The filter house shall be R.C.C. M-30 framed structure. Filter walls should be of RCC M-30 plastered on water retaining structure. All bricks masonry work should be in cement mortar with 1:3 and should be plastered with 1:3 C.M. on both the sides. The thickness of the plaster shall be 20 mm from one side and 12 to 15 mm on another side for all the brick masonry work.

6.15 All inside surface shall have three coats of acrylic distempering painting of approved quality and shade. The front elevation and exterior finish of the building shall be designed aesthetically and architecturally. The RMC reserves the right to alter the front elevation of filtration plant/filter house if it does not appeal to the RMC on contractor's cost. The exterior plastered walls should be painted with three coats of approved, quality and shade epoxy paint. All doors, (Except central main door), windows and ventilators shall be of Best quality Aluminium framed glass panelled. The position of windows and ventilators should be such that these will be opened outside and closed easily when necessary. The total shutter area of doors, windows and ventilators shall not be less than 30% of the floor area.

6.16 The central main external door shall be Aluminum fully glazed as per I.S.148-1961 and 1081-1960. The size shape and finish of the door shall be specially selected so as to improve the get-up of filter house. The entrance of the filter house shall preferably be in the form of foyer, with suitable porch to house atleast two parallel vehicles, in front.

6.24 **PERFORMANCE CAPABILITY:**

For rapid gravity filters, the performance standards should be in accordance with para 6.6.8.2 of manual on water supply and treatment published by CPHEEO.

1.1 MCC AND CONTROL PANEL WILL BE PLACED AT THE GROUND FLOOR:

1.1.1 CHEMICAL HOUSE shall be provided to accommodate various facilities such as

- Chemical storage facility for one month period
- MCC Room
- Chlorination facility with provision of storage chlorine Cylinders (if required)
- Alum dosing facility with electrically operated Lifting arrangement of 1.5 T capacity monorails.
- Office / Lab
- Storage Room
- Toilet, connected sewerage drainage line with chambers

Chemical House is provided with ground and first floor area so as to have free access to various facilities. Adequate lifting arrangement shall be provided at dosing area, Chlorination.

1.1.2. THE CHEMICAL HOUSE IS PROVIDED WITH SUFFICIENT CARPET AREA FOR

EACH FACILITY AS PER TENDER CONDITION.

- Design & Construction of Cascade Aerator or any other suitable system, for removal of iron in incoming Raw water.
- Design & Construction of Lamella Clarifier and Flocculator
- Supply and erection of Dosing equipments of coagulants, including chemicals with facilities to store Alum and chemicals for 60 days.
- Design and construction of Flash mixers.
- Design & Construction of Distribution chamber for clarifiers / Flocculators.
- Design & Construction of Clarifiers and Flocculators.
- Design & Construction of filter galleries, wash water tank, filter back wash system and filter control block.
- Design & Construction of chlorination plant building, facilities for post and/or pre chlorination and storage of chlorine cylinders for 60 days requirement.
- The sludge, from plain sedimentation tank, clarifier and Flocculators is to be collected in sludge receiving tanks by gravity and disposed into sludge drying beds with drainage facilities to reuse at flax mixer/ inlet channel. The back wash water from filter is to be collected into settling tanks by gravity and to be recycled after settlement by pumping, raw water inlet channel. The overflow from various units shall be connected to the storm water drains for safe disposal to the nearby water bodies with environmental acceptance.
- Monitoring and instrumentation with their housing.
- Electrical works including incoming cable from substation to main control panel, Motor Control Centres, local control and panels compatible PLC/SCADA, interfacing, power and control cabling, plant ventilation and lighting etc.
- Pipe lines, valve chambers, service water installation, sampling and water quality monitoring, instrumentation and other miscellaneous works associated with the plant.
- Levelling the treatment plant site and landscaping.
- Storm water drain and sewers with appurtenances.
- Administrative building (50 sqm), laboratory (150 sqm), store, and for SCADA / control arrangements housing building, i/c services such as electrical, Lighting, water supply, sanitation and air conditioning facilities.(The air conditioning facilities shall be provided only for control room having SCADA system and other instrumentation.)
- Guard Room - with not less than 60 sqmt floor area with toilet facilities and Building services.
- Internal roads with storm water drains, landscaping and lighting etc.
- Training of Nagar Nigam personnel in operation and maintenance of the plant during the last six months of trial period before commencement of 05 years Operation and Maintenance including warranty and replacement.

1.1.3 EQUIPMENT'S FOR HANDLING CHEMICALS :

The Platform type-weighting machine 'Avery make' or equivalent of capacity 2.00 tonne for

weighing the chemicals shall be provided. For transportation of chemicals from storeroom to the solution tank, an electric operated hoist of 2.00-tonne capacity of approved make shall be provided. The chemical should be loaded in the steel tray attached to wire rope.

I.

1.1.4 SOLUTION TANK :

A Platform for construction of solution tank at a height of about 2.00 mt. from first floor level shall be provided. The solution tank will be designed for the worst condition of Turbidity for alum dosing to the designed flow. The minimum number of solution tank shall be two so that one will be stand by unit. The capacity of tank shall be designed for 8 Hrs. capacity with 0.30 mt. free board. The feeding arrangement shall be automatic based on flow. It shall be designed for 10% strength of solution. The solution tank shall be constructed in R.C.C. minimum M-30 grade and inside surface shall be lined with acid resistance material like F.R.P. or epoxy resin. The lime solution tank shall be designed for a dose of 5% strength of lime solution using 87% pure hydrated lime for the design flow for the period of 8 hrs. Each tank shall have platform at least 0.75 mt. wide to allow the worker to stand for handling the chemicals and preparation of solution the platform shall have railing up to a minimum height of 0.75 mt. The height of the solution tank shall not be more than 1.50 mt. from the first floor to the platform M.S. ladder 0.60 mt. wide shall be provided and it shall also be provided from solution tank platform to top of solution tank.

1.1.5 DISSOLVING TRAYS :

The weighted chemical shall be placed into the tray. These trays shall be made up of cement concrete with perforations both at sides and at the bottom. The weight of these trays shall be such so as to handle easily by the workers.

II.

1.1.6 CHEMICAL FEED DEVICES :

The solution feed device will depend upon the point of application. The pump type of feeder shall be preferred, chemical feeder in which the solution from the chemical solution tank shall be flown by pump through a strainer and through the float valve into the orifice box. It shall include the necessary piping arrangement with G.M. valve for drains, overflow, and delivery pipe as per I.S. standard. It shall also have necessary agitating arrangement coupled with motor as per standard. It shall also have the provision to return the excess flow to solution tank.

1.2 BY PASS CHANNEL

- Raw water channel to filters by passing lamella Clarifier and flocculator
- From Clarifier to clear water sump by passing filters.
The channels shall be designed as a one unit provided with sluice gates arrangement for isolation of channels. These channels shall be designed for capacity with 20% over load.
- Cascade Aerator - shall be designed in circular shape with circular Gullet to collect water.
- From flocculators to clear water sump by passing filters.
- Lamella Clarifier. - Designed for the distension time as per the provisions in CPHHEO Manual, it shall have properly designed inlet and out let arrangement with due consideration to the better efficiency of settling, mechanical sludge cleaning arrangement with sludge effluent pipe etc. complete.

The necessary pens stock with simple operating arrangement shall be provided as per I.S. 3042-1965 or some alternative arrangement, which suits to the proposal. It shall be constructed in minimum M-30 grade concrete and columns shall be minimum M-25 grade concrete.

1.3.1 MODULE CHAMBER ROOM OR CLEAR WATER CONTROL CHAMBER ROOM :

It shall be designed to accommodate module chambers of all filters including weir, wash water tank pump and air blowers. The height should be sufficient so that the wash water tank may be constructed above it.

1.3.2 CHLORINE HOUSE AND CHLORINE CYLINDER STORE ROOM :

It should have sufficient space to accommodate liquid or gaseous feed chlorinator with weighing machine of 2 ton capacity. The cylinder storing room should have the sufficient capacity to accommodate cylinder/toner for at least 60 days storage. It should be forced ventilated, easily accessible from at least two sides. It should have arrangement near the ramp to unload the truck by providing chain pulley arrangement at a height of minimum 5 m. A suitable scale showing delivery should be incorporated in the chlorinators. A weighing balance of suitable capacity shall also be provided to measure the quantity of chlorine in the chlorine tonner.

The chlorinators shall be housed in a separate room attached to the filter house the area of which should be sufficient to house **at least four chlorine tonners**. The tenderers are advised to quote for both types of chlorinators. The department reserve & the right to select the more suitable one. There should have a separate entrance. **The carpet area of chlorine room shall not be less than 20 sqm excluding the space required for chlorine tonner**. This room shall be a part of filter house. All the requirements specified for civil works in case of filter house shall be applicable for this also except that the doors and windows frame shall be wooden. Other requirements of chlorine room and the chlorinators shall be as per para 7.5.5 of manual on water supply and treatment published by CPHEEO. Suitable exhaust arrangement for chlorination plant should be incorporated.

The room where chlorine tonners will be stored shall be properly located and designed for facility of removing and brining in chlorine tonners. A suitable rail trolley may also be provided for bringing and taking out the tonner from the room. **The storage space of at least 50 sqm shall be provided with proper ventilation adjacent to the chlorination rooms.**

1.3.3 VENTILATION:

For chlorine stores - 2 Nos. 600 mm dia exhaust fans.

Chlorination room - 1 no. 600 mm dia Exhaust fan

In chlorine stores a monorail RSJ for handling minimum 2 T capacity shall be provided. The entry to store shall be from out side of the plant. The tonners shall be unloaded directly into the store from the transporting vehicles. The doors and windows of the chlorine room and chlorine store shall be wooden

only.

The tenderer shall be required under this contract to supply 4 brand new chlorine tonners with a nominal capacity of holding 1 M.T. of liquid chlorine. The tonners should be as per relevant standard specifications. The tenderers should also submit the test certificate and other certificate from the competent authority to enable these cylinders to be put in to use.

The tenderers shall also arrange to procure liquid chlorine in these tonners for running the plant for six months of trial period. The tenderers shall bear all the cost of chlorine required and transportation in this period. These cylinders shall be taken over by the department only after these have worked up to the satisfaction of the Deptt.

1.3.4 STORAGE TANK FOR NEUTRALIZATION OF CHLORINE :

Solution storage tank of minimum dimension 3.00x3.00x2.00 mt. size should be provided with fire resisting tiles cladding. It should be easily accessible from chlorine house or storage room.

1.3.5 CLEAR WATER STORAGE TANK :

Designed for minimum 45 minutes detention period, divided in two compartments capable for isolation provided with scouring arrangement overflow arrangement, manholes, air ventilation cowels, ladders etc.

1.3.6 CLEAR WATER PUMP HOUSE : (20mx10mx6.0m)

It should have sufficient space to accommodate minimum six Nos of pumping sets with panel board, capacitors, dismantling joints for including cable ducts, NRV, suction pipe etc. complete. It should have sufficient height to accommodate the gantry crane of suitable capacity.

1.3.7 WASTE WATER PIPE FROM FLOCCULATOR, FILTER, CLEAR WATER SUMP:

The waste water line from all the units DI Pipe K-9 up to the waste water sump shall be provided.

1.3.8 SLUDGE DRYING BEDS :

Sludge drying beds shall be designed for 5 to 7 days cycle, the settled sludge from waste water sumps will be taken to drying beds and filtrate will again be carried to flash mixer for reuse.

1.40. INTERNAL AND EXTERNAL ELECTRIFICATION :

It should be done as per details given and as per IS S/B.I.S./I.E. Rules

1.0 COMMISSIONING AND TESTING OF PLANT:

2.1 TREATED WATER QUALITY :

The plant as a whole and the units individually should show efficiency as per requirement given in BIS specification and manual on water supply & treatment by CPHEEO New Delhi. In case of any confusion BIS specification shall get the precedence to all manuals.

2.2 GUARANTEES OF CLARIFIED WATER AND FINAL TREATED WATER :

All works for the processing and treatment of raw water shall be designed for a capacity of 80 MLD (considering 22 hours pumping only) with each treatment unit for the specified overloading. The performance tests on the treatment works shall be carried out at the flow inclusive of over loading of

treated water.

Clarified water quality shall meet the following standards :

Turbidity	-	Not more than 15 NTU
Suspended solids	-	Not more than as per IS:10500
-	-	-

Treated water quality after filtration and chlorination shall meet the following standards

Color	-	Should be free from color with 3 or less on Coblat scale.
Turbidity	- -	Not more than 1 NTU or less.
Suspended Solids	-	Not more than as per IS:10500.
Taste & Odour	- -	Unobjectionable
Residual aluminium	-	Not more than 0.2 mg/l
Coliform Organism (MPN/100/ml)	-	Nil

2.3 CHLORINATION:-

The chlorinator shall be designed for a dosing of 5mg/L. It shall be designed for designed water flow. The chlorinator shall be vacuum type chlorinator with 100% stand by. If any change in requirement of chlorine comes the firm may suggest and quote the rate accordingly, the liquid chlorine shall be supplied in tonners. The contractor shall have to make arrangement for Brand new chlorine tonners with a nominal capacity of holding one MT of liquid chlorine for minimum three months requirement. The tonners should be as per relevant IS standard specifications. The contractor should also submit the required test certificate and other certificate to enable these cylinders to be put into the use. These tonners shall be taken over by the department only after these have worked up to the satisfaction of the department, after O&M. The chlorinator shall be fixed up by the firm with all required accessories. Due to corrosive nature of chlorine it should be conveyed through either heavy wrought or steel pipe on flexible annealed copper to be tested for 35kg/cm² working pressure. The long pipeline shall be avoided. The chlorine gas lines shall be used. The gasket used shall be made of antimony lead (with 2 to 3% antimony) or asbestos sheet. Screwed fitting shall be forged steel construction. Pressure indicators shall have Teflon diaphragms or silver foil protectors. Pressure reducing valves shall be of bronze or metal with a Teflon diaphragm.

- a) The dosing rate shall be manually set and each chlorinator shall be equipped with a 0

to 5 mg/l scale and a manual dose setter over the complete range.

- b) Mal-operation of the duty chlorination system shall be indicated in the chlorination room and the monitoring room in order that manual changeover to the standby system can be initiated.
- c) Chlorinator shall be fitted with a pressure switch to provide an alarm in the event of bursting disc or pressure relief to atmosphere.

2.4 CHLORINE HOUSE: -

It shall be situated in an isolated place and near to the feeding place in order to avoid the long tubing. It should have at least two doors. The ventilation shall be provided at the bottom of the floor. It shall be well lighted. In the proposed chlorinator an auxiliary water system shall be provided. The suitable capacity of tank and a pump shall be provided, capable of filling it with in 30 to 60 minutes. The structure shall be R.C.C. framed with masonry panels in cement mortar 1:6 and plastered in cement mortar 1:4. The flooring of room shall be having acid resistance tiles laid over cement concrete 1:2:4. An exhaust at sufficient height from bottom, of 300 mm dia shall also be provided. The ventilator shall be of aluminum Z section fixed with 4 mm thick glass in order to avoid the corrosion; it shall be opened outside, a ramp on the main door of 2.0mt. wide to connect the G.L. to the plinth level of chlorine house shall be provided.

2.5 ROOM TO STORE CHLORINE CONTAINERS:-

The capacity of the room shall be to store the minimum chlorine toners for three months looking to the requirement of 5mg/l, average dose the minimum requirement of room shall be provided with rails and trolley as per requirement. It shall be constructed at an isolated place near to the chlorine house for the chlorinator. It shall be constructed in R.C.C. M-25 concrete framed structure and shall have same specification as for chlorine room. Suitable numbers of exhaust fan of 450mm dia of G.E.C. or Khetan make or equivalent standard make painted with Anticorrosive paint shall be provided.

2.6 EMERGENCY KIT: -

It shall consist of various tools appliances like gasket, Yokes Studs. Tie rods, hoods, clamps, spanners, mild steel channels kits, screws pins etc. complete. It shall cover the total precautionary arrangement parts, which shall be required at the time of chlorine leakage. All the Gad gets shall be designed for using in controlling or stopping the leakages from valves, fusible plugs, and sidewalls of cylinder used for handling chlorine.

2.7 CHLORINE RESIDUAL MONITORING

- a. Residual chlorine monitoring shall be arranged by collecting water from the clear water reservoir.
- b. The chlorine residual monitoring system shall be designed to measure free available chlorine. The signal from the measuring cell transmitter shall be indicated on the panel in the chlorine house with repeat indication and recording in the Control Block monitoring room.
- c. A chlorine residual recorder shall be installed as a floor mounted unit in the chlorination room and actuated by a 4 to 20 mA signal from a residual chlorination measurement cell mounted above ground level in the clear water reservoir outlet chamber.
- d. This cell shall be fed with a continuous supply of treated water from the outlet main of the clear water reservoir. A suitable sampling pump shall be supplied to feed the water to the measuring cell.
- e. A signal shall be transmitted to the monitoring room and shall be used to activate a chlorine residual indicator to be mounted in the monitoring room panel.

- f. High and low chlorine residual level alarms shall be annunciated in the monitoring room and in the chlorination room.
- g. All necessary sampling pumps, pipe work and isolation valves, for delivering clear water to the cell shall be provided.

2.8 FIRE EXTINGUISHING - ARRANGEMENT:-

Suitable fire extinguishers shall be provided and placed in different position in pump house and chlorine storage room besides buckets filled with sand and placed at different places in clear water control chamber, chlorine room pump house shall also be provided.

2.9 WATER SAMPLING:

Continuous comparison of water samples is required and the equipment provided shall include a suitable drained bench containing two clarity bowls complete with all interconnecting pipe work, automatic sampling pumps and drainage facilities for samples drawn from:

2.10 Sludge Drying Beds

Sludge from the waste water recovery tank shall be discharged by open impeller type sludge pumps to the drying beds. The sludge from clarifiers, Flocculators and etc., shall be pumped to the sludge drying beds directly through a suitable designed, pumping main. The sludge drying beds shall be with RCC M25 floor, supported by CC bed concrete of not less than (1:3:6) prop., and with side walls of RCC M25 with proper granular material filled up over suitable drainage system designed and laid for collecting the filtrate and to discharge the same to the inlet chamber and arrangement to discharge it into nearby natural drain shall also be provided.

The drying beds shall be so sized that each can contain four times the average daily production of sludge from the waste water recovery tanks as well as from the sludge produced from clarifiers / Flocculators etc they shall be designed for a cycle period of 5 to 7 days.

Filtrate from the drying bed under drains shall be discharged in to the inlet chamber the discharge shall meet the standards for discharge into inland surface waters. When a drying bed is full to a depth of 200mm with dried sludge, the sludge shall be dug out and used for landfill wherever required.

2.0 SAFETY EQUIPMENT: -

- Self contained air-breathing apparatus with gas mask 6 numbers.
- Gas leakage detector orthotolodine (OTA) impregnated paper type leak detection system eight numbers.
- Four chlorine gas leak detectors shall be supplied and installed, each with a single, detector cell, two for the drum room, one for the evaporator room and one for the chlorination room to alarm in the event of a chlorine leak.
- The chlorine leak detectors in the drum room shall be mounted at each end of the drum room. The chlorine leak detectors shall have two adjustable alarm levels sensitive to chlorine concentrations above 1 ml/m³, and the range of adjustment of alarms shall facilitate selection of the following alarms:

low level - 2ml/m³

high level - 4ml/m³

The low level alarm shall initiate local audible and visual alarms.

The high level alarm shall initiate local audible and visual alarms, audible and visual alarms outside the

buildings, alarms in the monitoring room, it shall shut down the chlorination systems, isolate chlorine drums and stop all the extract fans./ Warning signs shall be provided in English and Hindi.

- Compressed air cylinder recharging facilities comprising of 40 liters capacity cylinder with recharging kit to refill service cylinder or breathing apparatus - 2No.
- Protective Clothing - Rubber & P.V.C. clothing 2 numbers.
- First Aid Facility - Emergency Oxygen Kit 5 No. First Aid Box complete for artificial respiration to neutralize Inhaled chlorine effect - 4 No. First Aid printed chart. It shall be mounted on a glass framed wooden board in chlorine room.
- Weighing Machine - The weighing machine of standard make of two tonne capacity shall be provided to record the weight of cylinder.
- Emergency safety showers & eye wash- the contractor shall provide two safety showers and eye bath units. These units shall be installed at location approved by Engineer-in-charge.

1.1 UNLOADING ARRANGEMENT: -

An arrangement with chain pulley block of 2 tons capacity at a height of minimum 5.00 m. supported on M.S. beam section. It shall be provided at the entrance of chlorine storage room to unload the toners.

3.0 CLEAR WATER SUMP :-

The clear water from the module chamber shall be conveyed to the clear water sumps either through pipe or channel designed for a velocity 0.9 to 1.8 m/sec. The selection of pipe or channel shall be made on the basis of economy. The pipe if openly laid according to level shall be D.I. class K-9 Tyton joints and if covered then R.C.C. if the channel is provided, then it should be of R.C.C. M-30 grade and covered with the R.C.C. cover slab it shall be in horse shoe shape as far as possible. The levels shall be so fixed up so that the tank up to water depth shall be totally underground. The tank shall be designed for a capacity for a minimum detention period of 45 minutes. A minimum free board of 0.5 mt. should be provided below the roof beam. The floor of sump shall be designed in such way that it shall have a slope of 1:20 towards the inlet end. The shape of tank may be circular or rectangular as per design and economy consideration preferably sump should have two compartments connected with each other by sluice valves in order to facilitate the cleaning of sump. It should be constructed in R.C.C. with a minimum grade M-30 concrete and shall be provided with pressure release system to relieve the uplift pressure. The sump should be covered at top with R.C.C. slab. The top slab shall have adequate number of manhole chambers of size 0.9 x 1.20 m in each compartment fixed with M.S. cover and frame painted with primer & anticorrosive paint and locking arrangement. There should be 100 mm. dia C.I. or M.S. ventilators painted with primer and anticorrosive paint with C.I. cowels in each quadrant of beams on the roof shall be provided. The top of roof shall be sloped out ward to drain out rain water easily. An aluminium ladder 0.45 mt. wide in one-man hole of both chambers shall be provided by contractor. The inlet and outlet pipes shall be located at a diagonally opposite end in order to minimize the short-circuiting and turbulence effect. An overflow pipe designed to maintain level shall be provided. The scour pipe shall be laid from bottom of clear water sump to waste water sump. All the pipes shall be fitted with sluice valve as per I.S. standard and wherever necessary provided with inspection chambers.

A locally mounted dial type digital level indicator to indicate the water level along with a suitable sensor coupled with the PLC SCADA Automation system shall be provided.

4.1 CLEAR WATER PUMP HOUSE :-

It shall have sufficient space to accommodate 6 numbers of pumps. There shall be one pump house of tentative size 20.00 x 8.00 x 4.50 m. and the minimum height shall be provided in order to accommodate

the function of Gantry. The elevation of building should be such as to give an architectural view. The size of pump house be decided by considering the actual space required for providing 6 No. HSC Pumps pump sets . Additional space shall be provided for one pump set and also for generator set if used in emergency. Sufficient minimum space between the two pumps shall be provided for circulation and the distance of pump from the sidewall should also be minimum 2.00 mt. The distance of pumps from rear wall shall be decided to accommodate the suction pipe, NRV, sluice valve to each pump individually. The ducts for laying of electric cable from substation shall be provided. It shall be of R.C.C. covered with chequered M.S. Plate and will have minimum size 0.6 x 0.9Mt. or designed M-20 grade and chimney brick masonry in cement mortar 1:6 and plastered with C.M. 1:4. The capacity of the gantry crane to be provided under this contract shall be electrically hoisting and manually moving mounted on the rails or girders to move on pumps- motors for lifting at the time of maintenance. The floor of pump house and all other units shall be ironite laid over 1:2:4 cement concrete 40mm. thick. The main gate shall be of size 3.00 x 3.50mt. shall be rolling shutter, Office room, L.T. switch gear room and store room shall be with Aluminium chaukhat and 40mm. thick flush doors as per I.S. specification including doors stoppers, tower bolts etc. complete. The door or the W.C. block shall be flush doors. The window in pump house shall be about 20% of total area or provided in each panel (except where doors are provided). The window shall also be the of Aluminium fitted with 5 mm thick glass, tower bolts and all other necessary arrangements as per I.S. specification. Minimum 08 numbers of exhaust fan 450 mm. dia shall be provided. The exhaust fan may be G.E.C. Crompton, Khetan or equivalent make. A ramp shall be provided to connect the Ground level to the floor of pump house in main only and in other doors and in depressed floor of pump house wherever necessary steps shall be provided. The minimum plinth height of pump house shall be 1.0 M. It shall provide easy loading and unloading of pumps / motors from trucks by gantry.

4.0 SPECIFICATION FOR ELECTRIC WORKS

- The work shall be carried out strictly in accordance with latest India Electricity rules, especially as per latest specifications of Chhattisgarh Electricity Board and relevants I.S. Specification.
- The size and type of wiring shall be suitable for A.C. supply at 440 (+5%) volts, 3 Phase, 50 cycles for Power and 220 Volts for lightening.
- All phase wire shall be inside concealed single metal conduit and pipe shall be properly earthed.
- Suitable protection by means of cut-out shall be provided in such live conductors for every circuit.
- Lighting arrestor along with suitable earthing arrangement as per relevant I.S. specification shall be provided.
- All switches and fittings shall be of superior type as directed by the Engineer-in-charge.
- For the work of wiring for lighting of building shall be carried through surface PVC conduit pipe as per the specification of SOR for electrical works 2010 w.e.f. 15-04-2010 issued by E-in-C, P.w.D., Raipur with up to date amendments. The tender shall be inclusive of electric connections for power from main board to drive unit and light.

5.1 ELECTRICAL WORK SPECIFICATIONS:

- The scope of work shall include work of providing; laying and fixing of power cable from electrical sub station to main distribution panel. The contractor shall provide wiring for power and light in

open PVC conduit as per specifications of SOR as specified above.

- The contractor shall provide and fix at proper places all around the plant/clarifloculator/clear water sump, 16 nos. LED of 40 watts on suitable , & work in open during rains.
- Specifications for main distribution board :

The panel board shall be designed for the complete electrical load of treatment works, e.g. for prime movers of mechanical equipments of flash mixer, clarifloculator with its and carriage, alum and lime solution tank, chlorine boosters, wash water pumps, air blowers,. Sampling table etc. and for entire load of internal and external electrification e.g. light, flood lights, LED, ceiling Fans, Cooling Fans, Coolers, refrigerator etc.

It shall consist of 4 bus bars of suitable section, designed for capacity considering above electrical load, ammeters and volt meters of suitable range with rotary selector switches, phase indicator lamps with switches, OCB or ICTPN switches of adequate capacity with HRC fuse. The panel board shall be cubical non draw out type with panel openings either from front or rear side for carrying out inspection, operation and maintenance. Suitable ICTPN rewirable fuse units of adequate capacity shall be provided for lighting load. This panel board shall be housed in a room near blowers and wash water tank filling pumps. The total area of room for blowers, pumps of WWT filling and panel board shall be a minimum 30 sqm. After completion of wiring the contractor shall fill in the necessary form required by CSPDCL Authority for getting connections and shall hand over the installation in complete working condition to the satisfaction of the Engineer-in-charge. The charges required to be paid to CSPDCL for obtaining electrical connections shall be arranged by the Department.

The tenderer has to work out details of illumination and arrangements and submit necessary drawing for acceptance of the Engineer-in-charge. Light fixtures shall be of Philips/GEC or any other standard makes to the entire satisfaction of the Engineer-in-charge.

The suitable capacity LED should be provided in the filter house. Industrial type nitrous enamel reflectors complete with original choke, starters etc. manufactured by G.E.C./Phillips or any other standard make. The required LED shall also be provided in the operation gallery to give a uniform lighting.

The inspection boxes shall be fitted with corrosion proof fittings 2 x TL 20 watts. GEC make or equivalent in Phillips or any other standard make. A common switch board shall be provided for the starters for the pumps, air blowers, compressors and other pumps. These shall be provided in wash water tank feed pump house along with necessary cables to the various motors. The panel shall be completed with incoming triple pole switch, Voltmeter, Ammeter and isolating switches for the various pilot lamps etc.

The tenderer shall also include the cost of providing and laying the incoming power box cables from the main sub station to panel in the wash water pump room and also the wiring in VIR in

heavy gauge conduit from indoor motors.

5.2 Operation and Maintenance for 5 Years

The contractor shall operate and maintain the water treatment plant including all the civil structures, electro-mechanical equipments, pipes, pipe specials, instrumentation provided by him in 80 MLD plant. He will maintain spares with stores for the proper upkeep of the WTP.

For repairs and proper upkeep of the WTP in case any repair to any equipment is required, no extra payment will be paid to the contractor.

For non compliance of the water quality parameter a penalty of Rs. 5000/- for one event in a day shall be levied.

Residual chlorine at outlet of clear water pump house \leq 2 ppm

Every day atleast 3 times raw water and treated water report shall be made available to Engineer in Charge.

5.0 DATASHEET FOR LAMELLA CLARIFIER (TO BE FILLED BY THE BIDDER)

Flowrate (m ³ /h)	:
Overload (%)	:
Quantity	:
Material of Construction	:
Outside	:
Internals	:
Plate	:
No. of Plates	:
Plate gap	:
Angle of Inclination of Plate	:
Projected Surface Area	:
Depth of Clarification Zone	:
Depth of Sludge Collection Zone	:
Surface loading rate	:
Length of the Settler	:
Width of the Settler	:
Height of Settler	:
Sludge Scrapper Mechanism	:
MOC	:
KW/RPM	:

Speed	:	
Quantity of Sludge Generated (Kg/day)	:	
Concentration of sludge generated (%)	:	
Reference Plant	:	
Name of the Client and address	:	
Capacity of the plant (Minimum 10 MGD)	:	
Whether certificate has been enclosed	:	
Outlet Turbidity achieved	:	
Whether it is for drinking water application	:	
Year of commissioning	:	

6.1 DATA SHEET FOR RAPID GRAVITY SAND FILTERS

Flow rate (m ³ /h)	:	3636 m ³ /HR
Overload (%)	:	25 %
Quantity	:	80 MLD + 25 %
Material of Construction	:	RCC M 30
Whether the design is for Twin Bed	:	Yes
Size of the each Filter Bed	:	
Total height of each Filter	:	
Size of the Filter House	:	
Width of the Filter Gallery	:	
Minimum headloss for design	:	
Filter Media	:	Sand + Gravel
Effective Size	:	As per CPHEd manual
Uniformity coefficient	:	As per CPHEd manual
Particle density:	:	As per CPHEd manual
Hardness	:	As per CPHEd manual

Rate of filtration (m ³ /m ² /h)	:	4.8m ³ /m ² /hr for design
Air Scouring rate	:	600 l pm/m ² of filter area
Air blower capacity (m ³ /h)	:	45 to 50 m ³ /hr
Head of Air Blower (mwc)	:	to be given during design of wtp
Conjunctive Backwash water rate	:	to be given during design of wtp
Final wash water rate	:	to be given during design of wtp
Quantity of backwash water generated	:	to be given during design of wtp

6.0 REQUIREMENT OF EQUIPMENTS FOR WATER TESTING LABORATORY

S. No.	Name of Equipment's	Required quantity
1	Refrigerator (310 Liters)	1 No.
2	Incubator 37 ⁰ c _± 05 ⁰ c (Bacteriological) 220 Volt A.C.	1 No.
3	pH Meter (Digital(0-14 pH range)	1 No.
4	Nephelometer direct reading (Range 0-1000)	1 No.
5	Spectrophotometer visible range 220 to 850 mm	1 No.
6	Jar test apparatus with variable speed control 10 to 1000 RPM.	2 No.
7	Conductivity meter (systronics)	1 No.
8	Water distillation plant (15L/day)	1 No.
9	Auto calve (Cabinet 15 Atm pressure)	1 No.
10	Hot Air Oven 30 lit. cap 100 ^o to 180 ^o c	1 No.
11	Water bath 6 to 8 concentric 0 to 50 ^o c	1 No.
12	Dissolve oxygen Analyser (Digital)	1 No.

13	Chlorine comparator	2 No.
14	Heating metal (Capacity 1 Litre)	1 No.
15	Magnetic stirrer (1 Liter capacity speed control)	1 No.
16	Laboratory Balance 0 to 200 gm	1 No.

7.2 REQUIREMENT OF CHEMICALS FOR WATER TESTING LABORATORY

S.No.	Name of Equipment's	Required
1	Phenolphthaline Indicator	1 Lit.
2	Mehayal orange indicator	1 Lit.
3	Sulphuric acid N/50	2 Lit.
4	Potassium Chromate 5%	1 Lit.
5	Silver nitrate	200 gms.
6	Manganese Soleplate	1 Kg.
7	Sodium thisulphate	1 Kg.
8	1-10 Phenepitheline	200 gms.
9	Hydroxylamine Hydrochloride	200 gms.
10	Eriochrome black 'T'	100 gms.
11	Murexide	20 gms.
12	E D T A N/50	5 Lit.

7.3 REQUIREMENT OF GLASSWARE FOR WATER TESTING LABORATORY

S.No.	Name of Equipment's	Required
1	Graduated pipette of capacity 1 ml.	5No.
	- do - 2 ml.	5No.
	- do - 10ml.	5No.
	Ordinary pipette of capacity 10 ml.	5No.
	- do - 25 ml.	5No.
2	Graduated Measuring Cylinder Capacity 10 ml.	5No.
	- do - 50ml.	5No.
	- do - 250ml.	5No.
	- do - 1000 ml.	5No.
3	Reagent Bottles of Capacity 250 ml.	10 No.
	- do - 500ml.	10 No.
4	Nester's tube of capacity 50 ml.	5 No.
	- do - 100ml.	5 No.
5	Conical flask of capacity 100ml.	5 No.
	- do - 250ml.	5 No.
	- do - 500ml.	5 No.

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

	- do - 1000ml.	5 No.
6	Beakers of capacity 100ml.	5 No.
	- do - 250ml.	5 No.
	- do - 500ml.	5 No.
	- do - 1000ml.	5 No.
7	Test tube with rim of size 25 x 250	100 No.
	- do - 15 x 150	100 No.
8	B O D Bottle 300 ml.	15 No.
9	Funnel 4	15 No.
10	Filter paper (Whatman's) No.1	4 Pkt.
	- do - No. 40	4 Pkt.
	- do - No. 42	4 Pkt.
12	Desiccators	1 No.

7.4 REQUIREMENT OF ACCESSORIES & MATERIAL FOR LABORATORY

S.No.	Name of Equipment's	Required quantity
	Water Sampler (Steel) of capacity 2 Lit.	2 No.
1	- do - 5 Lit.	2 No.
2	Gas Cylinder	2 No.
3	Burners (Bunsen Marks) ½" Pipe with tuner tone	4 No.
4	Wire basket 5 x 5 x 5	2 No.
5	Burette Clamps (Nickle plated)	4 No.
6	Tongs stainless steel 13"	2 No.
7	Spatula steel 8"	10 No.
8	Test tube stand (Iron)	10 No.
9	Rubber cork various sizes	50 No.
10	ICE Box (thirmocal)	3 No.
11	Iron Box with clamp	6 No.
12	Blotting paper	10 Sheets
13	Wire gage 6 x 6"	6 No.
14	Stop Watch	1 No.
15	Nessler's tube stand	5 No.
16	Sample Box	2 No.
17	Brown Paper	5 Sheets
18	Pipette Stand	3 No.
19	Non-absorbent cotton	1 Kg.
20	Test tube brush (Nylon)	10 No.
21	Burette brush	10 No.

7.5 REQUIREMENT OF CHEMICAL FOR BACTERIOLOGICAL TEST

S.No.	Name of Equipment's	Required quantity
1	Mac conkey Broth (D S)	1 Kg.
2	Mac conkey Broth (S S)	1 Kg.
3	Peptone	1 Kg.
4	Lactose	1 Kg.
5	Sod Chloride	1 Kg.
6	Bile Salt	0.5 Kg.
7	Natural Red	100 Gms.
8	Brilliant green bile lactose Broth (BGIB)	4 Kg.
9	Tryptophe broth	4 Kg.
10	Sprit	

7.0 SITE ROADS :-

Site roads shall be a minimum of 3.5 m wide with a 1m shoulder either side. The carriageway shall have camber of 1 in 40 to drain rain water from its surface. A concrete gutter shall be provided at either side of the road. The inner radius of bends shall allow the easy passage of large lorries. Parking for at least 8 Vehicles shall be provided at the administration building.

8.1 SIGN AND WARNING BOARDS

All buildings and treatment units shall be provided with sign boards as directed by the Contractor indicating the name and function of these at no extra cost to RMC for both the existing and proposed WTPs viz., All the signboards displaying name of the technical units and directions shall be written in English and Hindi.

The main signboard erected at the main gate of the plant shall have matter written in English & Hindi.

At the start of construction work the contractor shall erect signboards one at the entry of the construction site and another near the temporary site office displaying all the project related information like name of the work, client, AMRUT MISSION, value of the works, start and completion date as per contract, capacity of the plant, number of units and other details as directed by Engineer-in-Charge. The size of the board shall be decided in consultation with the Engineer-in-Charge.

Necessary sign and warning boards shall be supplied and erected at the locations to be specified by Engineer-in Charge. The size of the board shall be 1200 mm x 1200 mm minimum or as directed by Engineer-in-Charge. The signboard shall be partially reflective Flex type on SS Grade 304 minimum 1.2 mm thick supported with frame of aluminium channels / double back channels minimum 3 mm thick through aluminium rivets. The signboard shall be subsequently attached to the post(s) through steel bolts. The posts shall be 75 mm diameter galvanized steel with welded top cap in case the signboard is supported on one post only, however, if two posts are used to support the signboard the diameter of each shall be minimum 40 mm and thickness 1.6 mm. The steel posts shall be embedded in RCC footing of size as approved by the engineer or as per the design. The total height of the post shall be 1800 mm + size / depth of the signboard. For larger size boards, more than 1200 mm x 1200 mm, the contractor shall submit the designs and drawings, wind load calculations, etc for approval of Engineer-in Charge prior to

its construction.

8.2 SITE DRAINAGE: -

The site drainage system shall be designed to dispose of overflows from tanks and rain water in a manner to prevent damage to any structures. The drainage may use pipelines, culverts, conduits or open channels to convey the water to a safe disposal site leading to nearby water body. Open channels shall be lined.

8.0 TELEPHONE SYSTEM :-

A telephone system shall be provided. The system shall originate in the administration building and shall be controlled by a receptionist. Telephone instruments shall be installed in the offices in the chemical building, the workshops, the filter monitoring room and the main offices of the administration building. The connection of an outside line to the system will be provided by others.

9.0 PROCESS CONTROL :

9.1 General

The automatic process control of the plant shall typically be based on the use of a number of programmable logic controllers (PLCs). These shall be located within control panels.

The supervisory monitoring of the entire treatment plant shall be implemented by a site SCADA system provided in the administrative building control room by the contractor. The contractor shall also provide a static mimic panel of minimum 2m x 1m size within the administration building control room with the main processes engraved on mosaic tiles and with edgewise instruments displaying all main flows and levels (local raw water and clear water tank levels, residual values, number of filters in service etc.), together with indicator lamps for combined faults for each process/area of the works. It is intended that the operator will investigate each local area for the individual faults displayed.

The SCADA system shall be provided and located in the administrative building at the water treatment works at RAIPUR.

The SCADA system shall comprise the following ;

An industrial grade latest personnel computer (PC). This shall be provided to the latest industry standard conducive to the efficient and effective operation of the selected SCADA software package. It shall be provided with both diskette and CD drives. The fixed drive shall be sized to permit the operation of the system and the storage of the following ;

- In excess of 2000 historic alarms data;
- Not less than 7 months archive data.
- Plus not less than 50% spare capacity.
- One latest industry standard 20" colour monitor;
- Mouse;
- 132 column alarm/event latest dot matrix printer with fan fold paper attachment;

Colour inkjet screen dup printer with multiple single sheet feeder (the printer shall be suitable for use at the local SCADA system);

Metal computer desk with vinyl work surface and one pedestal draw unit and one cupboard unit, the desk shall accommodate the PC and alarm/event printer and permit two operators to sit side by side. The desk shall be purpose built, attractive, durable and ergonomic and it shall be sized to have not less than 50%

spare work surface when accommodating the PC and printer. The desk shall incorporate an integral power distribution system to supply equipment mounted on desk;

full height two door metal storage cupboard with three shelves; 2 Nos upholstered swivel chairs;

Printer trolley/s to accommodate the report and screen dump printer.

The Contractor shall provide proprietary SCADA software for the central SCADA systems. The SCADA software shall be windows based. It shall have a proven track record for similar applications in the water industry and shall be supported within India.

The SCADA system shall be the same as that used for the local SCADA systems. The software package selected shall provide facilities for the provision of the following :

- Colour graphic screen representation of each plant area including system overviews;
- Alarm annunciation and historic logging of alarms;
- Historic event logging.
- Real time and historic trending of analogue variables;
- Preparation of simple reports;

Archiving of system variables for retrieval on to third party machines operating industry standard spreadsheet and database software and onto machines using the SCADA software, which shall permit trend graphs of the archived data to be recreated.

The Contractor shall configure the SCADA system to provide facilities to: display status, values and totals in a graphical and tabular format (see note 1); annunciate alarms including details of the time the alarm occurred (see note 3); provide facilities for the operator to :

- (i) acknowledge alarms
- (ii) view a journal of unacknowledged alarms;
- (iii) view a journal of the last 200 alarms acknowledged and unacknowledged;
- (iv) carry out real time (see note 4) and historic trending of analogue values (see note 3).
- (v) carry out data archiving of all analogue values to optical disk (see note 5); prepare daily, weekly, monthly and annual reports (see note 6).
- (vi) The SCADA system shall be configured by the Contractor to carry out any additional requirements needed to assist in the effective and efficient operation and monitoring of the water transmission system.

Notes:

- (i) overview of the treatment works; active colour graphic flow diagrams for each process and section of the works sufficient to convey to the operations staff and power supply and control system at all times.
- (ii) A comprehensive screen navigation system shall be provided giving access to all screens via a system of menus and short cuts (i.e. it shall be possible to follow from one screen to another by clicking the mouse cursor on screen 'hotspots' to effect the move from one screen to another and back against)
- (iii)The software chosen shall have a comprehensive alarm handling capability with the ability to annunciate, acknowledge, sort and maintain a historic record of current and past alarms including details of when the alarm occurred, when it was acknowledged and when it returned to normal.

- (iv) The system shall be capable of storing real time data for one day and historic data for 7 months.
- (v) The sample rates for archiving shall be the same as for trending. The archives shall be stored in daily files. The system shall provide separate storage capacity to store archives for one year. A warning alarm shall be provided to the operator to advise that archiving to disk should take place or archived data will be overwritten.

It shall be possible to;

Reintroduced the data derived from archiving and view the archived data facility;

Display the data using industry standard spread sheet or database software in tabular format on a third party machine;

- The SCADA system shall manipulate the data it receives in order to prepare reports in order to provide the Employer with a schedule of throughput and power consumption for the period concerned. The reports shall be generated on demand and automatically as required.

The Contractor shall monitor summary status of all the treatment works as follows:

- Water level raw water and clear water reservoirs;
- Process flows and totalized quantities;
- Water quality values
- Status of each process;
- Reservoir high high and low low level alarms;
- Power outage present;
- Power consumed per day;
- Individual power consumption;
- Power factor;
- Water treated **quantity** in the last complete 24 hour period (midnight to midnight, time selectable);
- Total power outage house per day.

The SCADA system and its ancillary equipment shall be powered via an uninterruptible power supply with a hold up time at full output of the UPS for 30 minutes. The full output of the UPS shall correspond to the maximum imposed load plus 20%.

- **Control Modes**

For all drives, two basic modes of operation shall be available ;

- a. manual control;
- b. automatic control

The selection of control mode shall be by way of a switch at the respective control panel starter section. In manual mode, the drive shall be controlled by start and stop pushbuttons at the control panel. In automatic mode, the drive shall be controlled to the dictates of the area PLC program.

Manual control shall inhibit automatic control and vice versa. On transfer from manual to automatic mode a delay of 10 seconds shall prevent any immediate start-up of the drive.

It shall be possible to operate electrically actuated valves either:

- a. locally, at the valve; or
- b. remotely, at the specified control panel.

The selection of the control mode being at the valve actuator. At the control panel there shall be a further

switch to select either manual control or automatic control. Manual control shall be from open and close pushbuttons on the panel, auto control shall be via the respective PLC.

The PLC program for automatic control of plant may also contain a number of control options to allow the starting and stopping of all drives, speed control of variable speed equipment, opening and closing of all actuated valves, etc. Other options may include constant speed control, flow proportional control or constant level control.

The Contractor shall provide a means by which the operator may easily select which control option is to be active.

c. Duty/Standby Rotation

Where individual items of plant or areas of plant operate in a duty/standby configuration, the status of the item or area shall be automatically selected by the area PLC. This may either be on a 'time run by duty drive' or a 'time elapsed' basis.

Rotation of duty/standby shall take place during the first controlled stop after the preset time has expired. If a normal controlled stop does not occur within a period of 8 hours after this time an alarm shall be raised in order to prompt a manually initiated changeover.

Duty/standby pump drive groups larger than two shall be rated as follows:

	Duty 1	Duty 2	Stand by
Drive	1	2	3
Drive	2	3	1
Drive	3	1	2

On initial start up the system shall default to the lowest numbered pump being duty 1 and the second pump duty 2.

10.0 EMERGENCY LIGHTING:

Emergency luminaries shall be provided in all areas and so arranged to provide sufficient illumination to allow safe evacuation from all buildings under power failure conditions. Emergency luminaries shall be of the type utilizing fluorescent lamps and provided with self-contained rechargeable batteries of the sealed type to give a three-hour illumination period with the batteries fully charged. A visual indication that the charger is operational shall be provided.

Where considered appropriate the emergency luminary can be incorporated as part of the normal luminaries where they utilize the main lamp at a reduced output for three hours.

Emergency luminaries shall be so arranged that they are illuminated by the failure of the local lighting current. Key switches shall be provided as required to facilitate testing of the emergency luminaries.

As minimum emergency luminaries shall be positioned at or near (within 2 metres) the following points:

- a. each exit door

- b. near each staircase so each flight receives direct light
- c. near changes of direction
- d. near fire fighting equipment
- e. at each change of floor
- f. near each intersection
- g. outside each final exit and close to it.

External

External lighting shall be employed throughout the site to illuminate all site roads, turning areas, car parks, paths, tanks and building perimeters.

The following average levels of illumination are required :

Car Parking areas	5 lux
Access Roads, Pedestrian Walkways	10 lux
Lorry Loading and turning Areas	20 lux
Top of Tanks	50 lux
Building Perimeters	50 lux

The access road lighting scheme shall be designed in accordance with the requirements of BS 5489 : Part 3 : 1989 (group B5/6). Column heights shall be 5 meters and each lantern shall incorporate a photocell for control. At each position where a section of road lighting columns is fed a selector switch shall be provided having the following functions

- ON - Access road lighting permanently ON
- FF - Access road lighting permanently OFF
- AUTO - Access road lighting under photocell control

Some flexibility in positioning of road lighting units is allowed but generally units shall be positioned at intersections and junctions with spacing not exceeding 30 metres \pm 10%.

11.0 ELECTRIFICATION :-

11.1 Earthing :

General

Protective conductors shall be provided for all electrical installations and associated mechanical Plant and Equipment, exposed steel work and buildings. Protective conductors shall be provided in accordance with the requirements of IS 3043 and the latest edition of the I E Wiring Regulations/Code of Practice for Electrical Wiring Installation IS 732.

Earthing Conductor

Earth electrodes where used shall be galvanized, iron rods in accordance with IS 3043 having outer diameter not less than 38mm. The rod shall penetrate a minimum of three metres below ground level. Where multi-rods are used a distance of not less than the driven length shall separate them.

Earth rods shall have hardened tips and caps and be extendable. Galvanized iron flats buried at a minimum depth of 600mm shall be used for interconnection of rods.

Where soil conditions make the use of rod type electrodes impracticable a grid configuration may be used comprising horizontally buried bare galvanized iron strip of dimensions 50mm x 10mm minimum. GI strip shall be buried at a minimum depth of 600mm.

Each earth electrode rod if used shall be provided with an approved non-ferrous clamp for the connection of the earthing conductor or tape as required. These connections shall each be housed in individual concrete

inspection chamber set flush to the finished ground level and shall allow disconnection for testing of individual electrodes. The chamber shall be permanently marked 'Electrical Earth'.

All materials used for the earth electrode installation shall be purpose made for the application and site conditions and shall be approved by the Engineer-in-Charge.

Unless otherwise stated all excavation of trenches for the installation of the earth electrodes and the inspection pit shall be carried out by the Contractor. After the earth installation has been completed the Contractor shall demonstrate to the Engineer-in-Charge that the resistance of the electrodes to earth and the continuity of the earth network are within the limits specified. Any additional earth electrodes and test instruments required for the tests shall be provided by the Contractor.

Marker posts and plates shall be provided to mark the route of buried tape electrodes. The markers shall be similar to those provided for cable routes.

Main Earthing Terminal

A main earth terminal shall be installed in an approved location adjacent to the incoming supply to a building. This shall be labelled and comprise a 50mm x 6mm minimum cross section copper strip as per IS 3043. The bar shall be of sufficient length to accommodate bolted earth bonding connections from transformers, major items of Plant and Equipment and electrical switchgear, building structural steel work, concrete reinforcement, the earth electrode system and the lightning protection system. The earthing conductor shall be clearly marked as such and shall be accessible for disconnection to facilitate testing of the earth electrode system. For small installations an earthing terminal comprising a single brass stud of 12mm minimum diameter shall be acceptable.

Instrument Earth

A separate instrumentation earth shall be established in each control panel. This shall comprise one or more copper earth bars not less than 25x6mm cross-section electrically isolated from the steel work of the panel and amounting of power cables. The instrument earth bar or bars shall be connected radially to the main earth bar of the control panel.

The instrument earth bar shall be provided for earthing the signal earth connection of each instrumentation and control device and the screen or screens of each instrument cable.

The earth bar shall have sufficient brass terminals to terminate all devices etc. as detailed plus not less than 25% spare terminals.

The screens of instrumentation signal cables shall be earthed at one point only. This shall normally be the nearest instrument earth bar at the control panel end. Instrumentation signal screens shall be cut back and insulated at the field end.

The overall earth resistance shall be brought down to less than one ohm.

11.2 Colours :

All cables cores shall be colour coded throughout their length and shall be so connected between switchboard, distribution board, plant and equipment and accessories, that the correct sequence or phase colours are preserved throughout the system.

The colour coding should be as follows :

3 phase	red, yellow and blue
single phase or dc	red and black
earth	green / yellow

control

blue (dc), red (ac)

Conductors

Copper or aluminium conductors shall be used for power cables and copper conductors for control and instrumentation throughout. Cores of cross-sectional area greater than 4 mm². Small power and control cables shall be of a minimum cross section of 2.5 mm².

Internal wiring of control panels shall be of a minimum cross-section 1.5mm² flexible and standard.

Instrumentation and control cabling shall be of a minimum cross-section 1.5mm² for external use and 1.0mm² for internal use.

Cable Fixing

Ties and strapping shall be suitable for securing cable and cable groups to cable tray or ladder. They shall be resistance to chemicals. Plastic coated metal ties used in order to obtain corrosion resistance shall not be acceptable. Nylon ties shall be resistant to the effects of ultra-violet light and shall be self-extinguishing.

Large single cables shall be secured with cable clamps or cable cleats.

Cable Identification:

At each end of each cable, in a uniform and visible position a label shall be fixed on the cable in accordance with the cable schedule. Labels shall be made of PVC and shall be indelibly marked to the approval of the Engineer-in-Charge. The label shall be retained using proprietary nylon strips passing through two fixing holes at either end of the label. If the cable gland is not normally visible, then the label shall be fixed inside the panel by means of screws.

Marketing Location of Underground Cables :

The location of all underground cables shall be engraved on brass or other non-corrodible plates to be fixed to the exterior surface of all walls of buildings 300mm above ground level and directly above the point where cables pass through the wall.

In addition concrete marker posts shall be installed at intervals of not more than 50m at all junctions and changes of direction along the cable route. Such marker posts shall be not less than 200mm high and of substantial construction. A drawing or sample of a typical marker post shall be submitted for the approval.

The markers shall be marked 'electric cable' in English and Hindi.

11.3 Lamp Test

Facilities shall be provided to test all lamps on an assembly. This shall comprise a common lamp test section. Operation of the lamp test circuit shall energise a relay in each section of the assembly in order to light each lamp and enunciator. The lamp test circuit shall pass through auxiliary contacts on section isolators if fitted. A short time delay shall ensure that the lamp test supply is retained to allow visual checking of all lamps.

On small assemblies, less than ten starters, individual lamp test buttons on each section shall be acceptable unless otherwise specified.

11.4 Telemetry Outstation : This section shall house the telemetry outstation and associated cable marshalling equipment.

The interior of the telemetry outstation section shall be accessible without isolation of any drive or circuit. Therefore all voltages in excess of 24V shall be screened to prevent access.

Each circuit shall be protected by an MCB such that maintenance work can be carried out with the

minimum of interference to running plant.

Interconnection of inputs and outputs to the telemetry outstation shall be made via single edge knife type terminals to allow easy disconnection.

Analogue signals for connection to any telemetry outstation shall be connected via a signal isolator which shall allow disconnection of the outstation signal without disturbance to the operation of the works.

- 11.5 Emergency stop Circuitry :** Each drive or group of drives shall be provided with an emergency stop facility which shall comprise a red coloured, mushroom headed, stay-put-twist to release push button. The work shall be carried out strictly in accordance with latest Indian electrification rule, latest specification of M.P.E.B. and relevant I.S. specification. Electrification of chemical room, module chamber room, chlorine room, chlorine storage room, clear water pump house, office room, store room, L.T. switchgear room, toilet blocks, laboratory block etc. shall be done by contractor in such a manner that standard level of illumination is obtained. The wiring shall be concealed only. Separate pipes shall be provided for ordinary, power wiring and circuit wiring. Circuits shall be decided as per rules. Power wiring shall only be done in rigid steel conduit pipes. All accessories and pipes shall be I.S.I. Mark. In wiring copper conductor shall be used. The electrification shall be done by experienced electrical worker, having valid license. The contractor shall provide MCC for the load of complete Treatment Plant except the clear water pumps load.

The general requirements for lighting fixtures and wiring are given below. The tenderer shall however work out details of illumination and arrangement and submit necessary drawings to the departments. The drawing should be approved by "Chief Electrical Inspector" or his subordinate authorized officer.

DETAILED RECOMMENDED LEVEL OF ILLUMINATION

S.No.	Unites	Recommended Level of Illumination
1	Module Control Room	300 Lux
2	Rooms and passages	200 Lux
3	Office, wash water pump house.	300 Lux
4	Filter gallery	200 Lux
5	Inspection boxes	300 Lux
6	Stores	200 Lux
7	Chlorine room and cylinder room	200 Lux
8	Chemical House	200 Lux
9	Laboratory	300 Lux
10	Sanitary blocks	150 Lux
11	Around clariflocculator	150 Lux
12	Around filters	200 Lux
13	Around clear water sump and channel	150 Lux

The switches and switch fuse unit shall be I.S.I. mark confirming to 4064 & 4047 - 1967.

Approved make fluorescent tube fittings rust resistant, stove enamelled type with copper wound choke, capacitor, starter, holder etc complete with LED Lamps of 2 x 20 watts shall be provided. Approved make and accepted standard H.P. sodium vapour lamp, street lighting luminaries, consisting of metallic housing,

highly polished aluminium mirrors, clean acrylic covers, gasket and equipped with accessories such as ballast. Condenser igniters skirted ceramic lamp holder suitable for 250 watt HPSV lamp complete with sun lamp shall be provided by the contractor.

Approved make air circulatory fans mounted on motor floor in order to cool the motors shall be provided by the contractor.

Approved make ceiling fans of 1200 mm. sweep and pedestal fan 380 mm. size shall be provided by the contractor.

The tender shall also include the cost of providing and laying the cables from I.T. switch gear room to different units, street light fitting (except from sub-station) fitting for wash water pump, air blower and additional fitting for blowers is pump house, surge vessel etc.

Approved make means, Phillips, Compton, G.E.C. or equivalent makes only,

- a. The street light fitting shall be mounted on steel tubular poles swaged type as per I.S. 2713 complete including fixing on ground with concrete block with base plate etc. of 7.00 M. height.
- b. All equipment's and material shall be suitably designed and guaranteed for normal life and satisfactory operation under the climatic conditions prevalent at site. They should perform as per the characteristics without showing any sign of overload, overheating etc.
- c. Detailed specification shall be given for all the mechanical and electrical equipment's duly guaranteed for their satisfactory performance for at least 12 months from the date of commissioning of plant.
- d. Before putting the plant in operation all electrical installations, wiring etc. shall be certified by the contractor and clearance from Govt. electrical Inspector shall be taken.

11.6 MOTOR CONTROL CENTER/DISTRIBUTION BOARDS :-

There shall be fixed execution design in sheet metal housing and shall be suitable for power and light requirement and equipment's under the contract. A distribution board with M.C.B. shall be located in chemical house to provide power to alum and lime mixing agitator. Power supply to this distribution board shall be from main M.C.C. in pump house. This M.C.C. in form of L.T.O.C.B./A.C.B. shall be provided and fixed by the contractor in pump house. The cooling etc. shall also be done by contractor.

The weather proof distribution board to energize flash mixer, clarifloculator shall be located at suitable point.

For external and internal illumination in the module chamber room, a separated D.B. shall be mounted in this room. This D.B. shall consist of control for wash water pump air compressor and lighting etc.

For external and internal lighting of chlorinle room and storage room a separate D.B. shall be mounted. This will connect with L.T.O.C.B./A.C.B.

A separate D.B. shall be mounted to control the external and internal lighting of pump house.

A.D.B. for control of street light shall also be mounted in the pump house.

11.7 STARTER / PUSH BUTTON :-

For motors up to 15 H.P. D.O.L. push button starters shall be used. Motors above 15 H.P. shall have air break manually / electrically operated star delta starters.

CABLES: -All power and control cables should be of standard make and I.S.I. mark

11.8 EARTHING FOR MOTORS :-

As per I.E. rule, 440 V motors shall be earthed to two independent earth station common to all motor/M.C.C. etc. using shortest routes, and by interconnecting earth wires / strips lightning Arrestor shall

be provided at two distant location of buildings.

The earthing shall be done after digging the pit of standard size and depth with 600 mm x 600mm x 3 mm thick copper earth plate including accessories and providing masonry enclosure in C.M. cover plate having locking arrangement and G.I. watering pipe 20mm. size 2.7 m. long etc. with charcoal or coke and salt filling etc. complete.

11.9 LIGHTENING CONDUCTOR :-

Lightening conductor of 25mm dia 300mm long copper tube having single prong at top with 85mm. dia thick copper base plate including holes shall be provided. It shall have 20 x 3mm thick copper strip with necessary support to connect the strip to surface up to earthing plate. It shall be provided at the top of wash water tank.

ANNEXURE - "E-3"- Clear water Rising main.Distribution Network, House Service Connection with AMR Compatible water meter, Electromagnetic flow meters etc.

1.0 Scope of work & Specifications

1.1 Supply,laying,jointing,hydro-static testing of Water Rising Main DI (class K-9) / MS pipe including excavation,ancillary civil works,valves,DI specials,DI fittings,surge protection devices,road resurfacing

complete and 12 months of trial run for following dia and lengths.

- a) 150 mm dia, DI (class K-9) 105 m
 - b) 200 mm dia, DI (Class K-9) pipe 462 m
 - c) 250 mm dia, DI (Class K-9) pipe 5027 m
 - d) 300 mm dia, DI (Class K-9) pipe 7627 m
 - e) 350 mm dia, DI (Class K-9) pipe 1315 m
 - f) 400 mm dia, DI (Class K-9) pipe 2444 m
 - g) 500 mm dia, DI (Class K-9) pipe 5300 m
 - h) 700 mm dia, DI (Class K-9) pipe 116 m
 - i) 900 mm dia, DI (Class K-9) pipe 78 m
 - j) MS pipe , DIA 300 mm, 8 mm thick 50 m (As a casing pipe)
 - k) MS pipe , DIA 600 mm, 10 mm thick 100 m (As a casing pipe)
 - l) MS pipe , DIA 1000 mm. 10 mm thick 400 m (for delivery pipe & interconnection)
 - m) Contractor will carry out surge analysis using standard approved software and submit the results thereof to PDMC
- 1.2 Provision of Distribution Network consisting of DI (Class K-7) /MS pipeline including excavation, supply, laying, jointing with EPDM rubber gasket with suitable surge protection devices, DI specials, fittings, valves, chamber, road resurfacing complete and allied works of following diameters and length
- a) 100 mm dia DI (Class K-7) pipe 125708 m
 - b) 150 mm dia DI (Class K-7) pipe 19159 m
 - c) 200 mm dia DI (Class K-7) pipe 10014 m
 - d) 250 mm dia DI (Class K-7) pipe 5406 m
 - e) 300 mm dia, DI (Class K-7) pipe 3144 m
 - f) 350 mm dia, DI (Class K-7) pipe 1523 m
 - g) 400 mm dia, DI (Class K-7) pipe 240 m
 - h) 500 mm dia, DI (Class K-7) pipe 1411 m
 - i) 600 mm dia, DI (Class K-7) pipe 33 m
 - j) 200 Mm DIA MS Pipe, 8mm thick 100 m (carrier pipe, NH crossing)
 - k) 300 Mm DIA MS Pipe, 8mm thick (carrier pipe, NH crossing) 50 m
 - l) 400 Mm DIA MS Pipe, 10mm thick [for casing purpose, NH crossing] -- 100 m
 - m) 600 Mm DIA MS Pipe, 10mm thick, [for casing purpose, NH crossing] -- 50 m
- 1.3 With House Service Connection with AMR Compatible water meter, GIS Mapping, Consumer survey & Billing App including Earth work, filling, Providing, Supply laying, installation of G.I pipe 15mm dia for House Service with clamp saddle, Polyethylene Aluminium composite (PL-AL-PE) pressure pipes, brass stop cock, MS/PP Meter Box of required Size, of Multi Jet, dry dial, inferential type, horizontal, Magnetically coupled, class 'B' water meters Conforming to IS- 779 : 1994 and ISO 4064: 1993 standard with EEC/ MID certification mark , with IP 68 protection class with
- 1.4 Digitization of satellite image includes collection of DGPS points of important level marks geo referencing of satellite image, creation of base map by interpretation & digitization from the satellite data creating road network, rivers, water bodies, building land use etc in different layer cleaning of digitized map topology building overlaying of water supply features such as pipes, nodes, valves, tanks, reservoirs, pump etc. generating unique ID's for each properties / features which has been mapped. Generation of hard copy plot for consumer survey / field survey work handing over the two sets of soft copies of maps created from satellite image in shape file format as per direction of Engineer-in charge. Carrying out consumer survey,
- 1.5 Provision for customer facilitated center with redressal facilities and collection center
- 1.6 Provision for Billing software with creating mobile application and training to RMC staff and providing 20 smart phones with above application including trial run period of three months etc. complete and as instructed

by Engineer in Charge

- a) 15 mm Dia-7560 Nos.
- b) 20 mm Dia-30 Nos
- c) 25 mm Dia-14 nos

1.7 Provision for Billing software with creating mobile application and training to RMC staff and providing 20 smart phones with above application including trial run period of three months etc. complete

1.8 Provision for customer facilitated center with redressal facilities and collection center

1.9 Carrying out consumer survey in order to collect identification details, socio economic characteristics details of consumers connection details of consumption of water usage, Digitization of satellite image includes collection of DGPS points of important level marks geo referencing of satellite image, creation of base map by interpretation & digitization from the satellite data creating road network, rivers, water bodies, building land use etc in different layer cleaning of digitized map topology building overlaying of water supply features include submission of deliverable in shape file format etc complete.

1.10 Electromagnetic Bulk Flow Meters

Supply of Electromagnetic full bore meter complete as per specification, installation, testing, commissioning, making connections with existing pipe line, including excavation at site, cuts in the existing pipe system, dewatering and reinstating the same after completion of installation as per specification and drawings including. Accuracy of meter + 0.3% of measured value, Flange connection as per AWWA & IS, Liner: Hard Rubber, Fully welded sensor housing complying to IP 68 standard, Electrodes SS 316, Sensor housing SS 304, Cable gland 1/2" NPT, Sensor housing fully welded SS 304 housing with protective Polyurethane paint, Flow Transmitter/ Converter : Microprocessor based, modular design display 2 line back lit LCD for indication of actual flow rate, forward, reverse, sumtotalizer, Perfection category : IP 65 Output : One current output (4-20 mA) one scalable pulse output with remote reading facility including 05 years guarantee with replacement as given below(including fixing of flanges, and provision of Valve chambers as per enclosed drawings complete)

- a) 100 mm DIA 2no.
- b) 150 mm DIA 6 No.
- c) 200 mm DIA 3 No.
- d) 250 mm DIA 3 No.
- e) 300 mm DIA 10 No.
- f) 400 mm DIA 28 No.
- g) 500 mm DIA 10 No.
- h) 600 mm DIA 2 No.
- i) 900 mm DIA 1 No.
- j) 1000 mm DIA 1 No.
- k) 1200 mm DIA 1 No.

1.11 Pilot-operated, hydraulic water-level and flow control valve: Supply and fixing including installation and commissioning of Pilot-operated, hydraulic water-level and flow control valve. The valve will maintain a maximal water level in the elevated reservoir, stopping the inflow of water when the level reaches the maximal-allowed level. The valve will stay closed until the water level drops to a preset minimal value, and then open fully. While the valve is in opened position it will regulate the water flow rate to the tank. The rate of flow should be regulated within the whole range of potential flows. This will be provided with 05 years guarantee (from an internationally acclaimed manufacturer having a service centre in India) with replacement. Following dia will be provided:

- a) 250 mm DIA 1 No.

- b) 300 mm DIA 5 No.
- c) 400 mm DIA 23 No.
- d) 500 mm DIA 8 No.
- e) 600 mm DIA 1 No.

- 1.12 Contractor is to carry out topographical survey using total station along proposed alignment of pipelines and prepare and submit L sections to PDMC for their approval before starting laying of pipelines.
- 1.13 He will also carry out Geotechnical investigation/Platload test at every 1 km for determination of SBC and submit the report to PDMC

2.0 Specifications

- 2.1 **Allied Works:** All works necessary for providing, laying, jointing, testing, commissioning and O&M of above pumping mains shall fall under the scope of works including surge protection works, if any. The main items of allied works are providing, fixing, jointing, testing, commissioning etc. of butterfly valves, reflux valve, air valves, scour valves, its chambers, manholes, cross drainage works, thrust blocks, anchor blocks, expansion joints etc. complete.
- I. Including valves, fixtures, road restoration, concrete encasing and all allied civil works. The work of providing, laying, testing DI pipeline in project area including excavation cutting concrete road, tar road and restoring to the original shape after lowering the pipes including protecting public services and making good if damaged, including valves, pressure relief valves, DI and MS specials, interconnection with the existing DI pipelines if any, fixing of all the appurtenances such as chambers, road boxes, all the road crossings, railway crossings if any, hydraulic testing of pipe line, performance of the network commissioning to rated capacities and trial run for six months including all cost etc complete ISI mark socket and spigot centrifugally cast (spun) Ductile Iron Pressure pipes class K-9 with inside cement mortar lining conforming to IS:8329-2000 with suitable rubber gasket (Push on) joints as per IS:5382-1985 duly inspected by DGS & D/SGS/RITES with all ductile iron fittings and ISI marked sluice valve conforming to IS 9523-2000 including testing and commissioning. PCCP pipes conforming to IS 784
 - II. Excavation in trenches in all types of strata for laying & jointing of above pipe line with required depth and width as per specification.
 - III. Providing and fixing D.I. D.F. sluice valve including testing & jointing with cost of nut, bolts, rubber insertion duly inspected by DGS&D/SGS/RITES (Make - Kirloskar/IVC,/VAG, Durga /FOURESS/DALUI)
 - IV. Providing and fixing following DI double flange ISI mark sluice valve fitted with cast iron cap including jointing and testing with cost of jointing materials (Make - Kirloskar/IVC/VAG/Durga/FOURESS/DALUI) duly inspected by DGS&D/SGS/RITES.
 - V. Providing, laying & jointing D.I./ MJ fittings conforming to IS 9523:2000 duly inspected by DGS&D/SGS/RITES
 - VI. Providing & fixing following kinetic Air valve duly inspected.
 - VII. Providing & fixing following kinetic Air valve duly inspected.
 - VIII. Construction of RCC valve chambers in all the places where sluice valve, Air valve and non-return valve are provided, Anchor Blocks, Pedestal etc. as required as per specification. The internal dimension of R.C.C. chamber shall have clear space of 500 mm all around in valve. This clearness can be modified only after with instruction issued by the Engineer in charge looking to the site conditions.

- IX. Laying of pipes as per IS:12288-1987.
- X. Providing and making all interconnections as required to charge the laid pipe lines under scope of work.
- XI. In case, the shifting of any existing, water pipe line/sewage line is considered necessary by the RAIPUR Municipal Corporation, such service lines will have to be shifted by the contractor for which the payment shall be made for the actual work done as per approved rate of this contract.
- XII. The firms/contractors are directed to submit the details plan and elevation of all the pipelines showing the dimensions of all components and other details. The contractor shall set up an office with an access to RAIPUR MUNICIPAL CORPORATION official with proper seating arrangements. The contractor shall provide one AC Bolero/ Scorpio vehicle with driver and POL for inspection work during the entire work period exclusively for RAIPUR MUNICIPAL CORPORATION officials. The contractor shall propose colour scheme with atleast three alternatives and after approval only the work shall be started. All the valves and electromechanical fittings shall be SCADA & PLC compatible with actuators (Excluding the cost of Actuators) for implementation of SCADA in future. The successful bidder shall assist the RAIPUR MUNICIPAL CORPORATION in the process of getting the grants from State/ Central Governments. The contractor has to procure and install informatory board's displaying Name of work at the location given by RAIPUR MUNICIPAL CORPORATION at his own cost.

2.2 D.I. PIPES

I. MARKING :

Each pipe shall have cast, stamped or indelibly painted on it the following appropriate marks :

- a) Indication of the source of manufacture.
- b) The nominal diameter.
- c) Class reference
- d) Mass of Pipe, and
- e) The last two digits of the year of manufacture.

II. Marking may be done :

- a) On the socket faces of pipe centrifugally cast in metal mould, and
- b) On the outside of the socket or on the barrel of pipe centrifugally cast in sand mould
- c) Any other marks required by the purchaser may be painted on.

2.3 DUCTILE IRON FITTINGS :

- I. The Ductile Iron fittings shall be ISI mark conforming to IS 9523-2000.
- II. COATING : Fittings and accessories shall be normally delivered internally and externally coated.
- III. The external coatings shall be applied with zinc rich paint with finishing layer as included in Annexure "A" of IS 9523:2000.
- IV. The internal Linings shall be applied with portland cement mortar (with or without additions) as included in Annexure "B" of IS 9523:2000.
- V. **MARKING :** Each fittings shall have as cast, stamped or indelibly painted on it, the following appropriate marks :
 - a) Indication of the source of manufacture,
 - B) The nominal diameter,
 - C) The last two digits of the year of manufacture,
 - d) PN rating flanges when applicable, and
 - e) Any other mark required by the purchaser.Marking may be done on the barrel of castings or on the outside of the sockets.

VI. **BIS Certification Marking-** The fittings may also be marked with the Standard Mark.

2.4 LAYING AND JOINTING :

I. SITE PREPARATION :

2.4.I.1 Preliminary work required to be done before laying of pipe lines includes pegging out, clearing and disposal of all shrubs, grasses, large and small bushes, trees, hedges, fences, gates, portions of old masonry, boulders, and debris from the route.

2.4.I.2 Where trees have been felled, the resulting timber shall be stacked properly and disposed of as directed by the authority. Tree roots within a distance of about 0.5 metre from either side of the pipeline should be completely removed before laying pipe lines.

2.4.I.3 All other serviceable materials, such as wood, bricks and stones, recovered during the operation and clearing the site, shall be separately stacked and disposed of as directed by the authority.

II. FORMATION :

2.4.II.1 GENERAL : Before pipe line is laid, proper formation be prepared for pipe line

2.4.II.2 Excavation and Preparation of Trenches for Laying Underground Pipe Lines.

2.4.II.3 The width of the trench at bottom between the faces of sheeting shall be such as to provide not less than 300 mm clearance on either side of the pipe except where rock excavation is involved. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, strutting and planking, and handling of specials.

2.4.II.4 Special consideration should be given to the depth of the trench. In agricultural land, the depth should be sufficient to provide a cover of not less than 900 mm so that the pipe line will not interfere with the cultivation of the land. In rocky ground, rough grazing or swamps, the cover may be reduced provided the water in the pipe line is not likely to freeze due to frost.

2.4.II.5 It may be necessary to increase the depth of pipe line to avoid land drains or in the vicinity of roads, railways or other crossings.

2.4.II.6 Care should be taken to avoid the spoil bank causing an accumulation of rain water.

2.4.II.7 Where pipes are to be bedded directly on the bottom of the trench, it should be trimmed and levelled to permit even bedding of the pipe line and should be free from all extraneous matter which may damage the pipe or the pipe coating. Additional excavation should be made at the joints of the pipe so that the water main is supported along its entire length.

2.4.II.8 Where excavation is through rocks or boulders or at locations of B.C. soils the pipe line should be bedded on concrete bedding or on at least 150 mm of fine grained material, or other proper means are used to protect the pipe and its coating. Material harmful to the pipe line should not be used.

2.4.II.9 Temporary under pinning, supports and other protective measures for building structures or apparatus in or adjacent to the trench should be of proper design and sound construction

III. **ROCK EXCAVATION -** The term “rock” wherever used in this standard, shall have the same meaning as given in terminology in IS:1200 (Part 1)- 1974.

2.4.III.1 Blasting - Blasting for excavation shall be permitted only after securing the approval in writing of the authority and only when proper precautions are taken for the protection of persons and property. The hours of blasting shall be fixed by the authority. The procedure of blasting shall conform to the requirements of the authority

- IV. **Stacking Excavated Material** - All excavated material shall be stacked in such a manner that it will not endanger the work or workmen and it will avoid obstructing footpaths, roads and driveways. Hydrants under pressure, surface boxes, fire or other utility controls shall be left unobstructed and accessible during the construction work. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural water-courses shall not be obstructed.
- V. **Barricades, Guards and Safety Provisions** - To protect persons from injury and to avoid damage to property, adequate barricades, construction signs, torches, red lanterns and guards, as required, shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the roadways. All materials, piles equipment and pipes which may serve as obstruction to traffic shall be enclosed by fences or barricades and shall be protected by illuminating proper lights when the visibility is poor. The rules and regulations of the local authorities regarding safety provisions shall be observed.
- VI. **Maintenance of Traffic and Closing of Streets** - The work shall be carried including closing of road/street in such a manner which will cause the least interruption to traffic. Where it is necessary for traffic to cross the open trenches, suitable bridges shall be provided. Suitable signs indicating that a street is closed shall be placed and necessary detour signs for the proper maintenance of traffic shall be provided.
- VII. **Protection of Property and Structures** - Trees, shrubbery, fences, poles, and all other property and surface structures shall be protected unless their removal is shown on the drawings or authorized by the authority. When it is necessary to cut roots and tree branches, cutting shall be done under the supervision and direction of the authority. Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the work, shall be provided under the direction of the authority. The structures, which may have been disturbed, shall be restored after completion of the work.
- VIII. **Protection of the Existing Service** - As far as possible, the pipe line shall be laid below existing services, like water and gas pipes, cables, cable ducts and drains but not below sewers which are usually laid at greater depth. Where it is unavoidable, pipe line should be suitably protected. A minimum clearance of 150 mm shall be provided between the pipe line and such other services. Where thrust or auger boring is used for laying pipe line across roads, railways or other existing utilities, large clearance as required by the existing utilities, as required shall be provided. Adequate arrangements shall be made to protect and support the existing services during the laying operations. The pipe line shall be so laid as not to obstruct access to other services for inspection, repair and replacement. When such utilities are met with during excavation, the authority concerned shall be intimated and arrangements should be made to support and protect the utilities in consultation with them and in case of such damaged services will be repaired at the cost of contractor himself.
- IX. **Back-Filling** - For the purpose of back-filling, the depth of the trench shall be considered as divided in to the following three zones from the bottom of the trench to its top :
- a) Zone A : From the bottom of the trench to the level of the centre line of the pipe.
 - b) Zone B : From the level of the centre line of the pipe to a level 300 mm above the top of the pipe, and
 - c) Zone C : From a level 300 mm above the top of the pipe to the top of the trench.
- Back-filling in Zone A shall be done by hand with sand, fine gravel or other approved material placed in layers of 80 mm and compacted by tamping. The back-filling material shall be deposited in the trench for its full width of each side of the pipe, fitting and appurtenances simultaneously.

Back-filling in Zone B shall be done by hand or approved mechanical methods in layers of 150 mm special care being taken to avoid injuring or moving the pipe. The type of back-fill material to be used and the method of placing and consolidating shall be prescribed by the authority to suit individual locations. Back-filling in Zone C shall be done by hand or approved mechanical methods. The types of back-fill material and method of filling shall be as prescribed by the authority. Back-fill under permanent Pavement - Where the excavation is made through permanent pavements, curbs, paved footpaths, or where such structures are undercut by the excavation, the entire back-fill to the sub grade of the structures shall be made with sand in accordance with

5.10.4.1 Paved footpaths and pavements consisting of stone, gravel, slag or cinders shall not be considered as being of a permanent construction. Method of placing and consolidating the back-fill material shall be prescribed by the authority.

2.5 LAYING OF PIPES :

- I. **Laying Underground** - Pipes should be lowered in to the trench with tackle suitable for the weight of pipes. For smaller sizes, up to 250 mm nominal bore, the pipe may be lowered by the use of ropes but for heavier pipes, either a well designed set of shear legs or mobile crane should be used. When lifting gear is used, the positioning of the sling to ensure a proper balance, should be checked when the pipe is just clear of the ground. If sheathed pipes are being laid, suitable wide slings or scissors dogs should be used.

All construction debris should be cleared from the inside of the pipe either before or just after a joint is made. This is done by passing a pull-through in the pipe, or by hand, depending on the size of the pipe. When laying is not in progress, a temporary end closure should be securely fitted to the open end of the pipe line. This may make the pipe buoyant in the event of the trench becoming flooded, in which case the pipes should be held down either by partial re-filling of the trench or by temporary strutting. All persons should vacate any section of trench in to which the pipe is being lowered.

II. Pipe Line Anchorage -

This shall be provided as per relevant BIS 5330:1984 with up to date amendments.

2.6 TRANSPORTATION, HANDLING AND INSPECTION :

- I. **General** – Ductile iron pipes are less susceptible to cracking or breaking on impact but the precautions set out should be taken to prevent damage to the protective coating and brushing or damage of the jointing surfaces.
- II. **Transportation** - Pipes should be loaded in such a way that they are secured and that no movement should taken place on the vehicle during transit.
- III. **Off-Loading** - Cranes should be preferred for off-loading. However, for pipe up to 400 mm nominal bore, skid timbers and ropes may be used.

2.7 HYDRAULIC TESTING :

After a new pipe line is laid and jointed, testing shall be done for mechanical soundness and leak tightness of pipes and fittings, leak tightness of joints; and soundness of any construction work, in particulars that of the anchorages. The completed pipe line shall be tested for a pressure given in IS 8329:2000, Annexure “E”. 3 % amount of complete work shall be withheld till the successful hydraulic testing of the pipeline

2.8 FLUSHING AND DISINFECTION OF MAINS BEFORE COMMISSIONING :

- I. The pumping main & distribution mains shall be disinfected before commissioning as per provisions given in CPHEEO manual and IS 5822:1970.

2.9 REMOVAL, RESTORATION AND MAINTENANCE OF PAVED FOOTPATHS ETC. AFTER

LAYING OF PIPE :

- I. **Allowable Removal of Pavement** - Pavement and road surfaces may be removed as a part of the trench excavation, and the amount removed shall depend upon the width of trench specified for the installation of the pipe and the width and length of pavement area required to be removed for the installation of gate valves, specials, manholes or other structures. The width of pavement removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 150 mm on each side of trench. The width and the lengths of the area of pavement removed from the installation of gate valves, specials, manholes or other structures should not exceed the maximum linear dimensions of such structures by more than 150 mm on each side. Wherever, in the opinion of the authority, existing conditions make it necessary or advisable to remove additional pavement, it shall be removed as directed by the authority.
- II. **Restoration of Damaged Surface and Property** - Where any pavement, shrubbery, fences poles or other property and surface structures have been damaged, removed or disturbed during the course of work, such property and surface structures shall be replaced or repaired after completion of work. The permanent pavement shall not be restored to a condition equal to that before the work began but the top surface of the removed pavement shall be levelled and finished in such a manner as the traffic may pass smoothly. After proper compaction and settlement only it shall be made to original as per the type of road top is existing
- III. **Cleaning-up** : All surplus materials, and all tools and temporary structures shall be removed from the site as directed by the authority. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump and the construction site left clean to the satisfaction of the authority.

2.10 APPURTENANCES :

The following appurtenances shall be suitable designed and fixed on the suitable points on the conveyance main.

I. **SLUICE VALVES :**

The sluice valve shall be installed as per direction of engineer - in- charge. The sluice valve shall be class PN 1.6 up to 600 mm dia & class PN 1.0 above 600 mm dia conforming to IS 14846:2000 duly inspected by DGS & D/SGS/RITES & shall be of IVC/Kirloskar/VAG/Durga/Upadhaya make.

II. **KINETIC AIR VALVES :**

DOUBLE ORIFICE TYPE KINETIC AIR VALVES SHALL BE FIXED COUPLED WITH ISOLATING SLUICE VALVE AND AT THE SUITABLE POINTS BASED ON DETAILED DESIGN. THE AIR VALVES SHALL CONFORM TO IS 14845-2000. THE VALVES SHALL BE IVC/KIRLOSKAR/VAG/DURGA/UPADHAYA MAKE DULY INSPECTED BY DGS & D/SGS/RITES.

III. **BRANCH CONNECTIONS :**

“T” outlet with manually operated sluice valves shall be provided in the distribution pressure Main for Branch connections. The appurtenances shall be located in such a way that these are clearly and easily accessible for operation and maintenance.

2.11 CONSTRUCTION OF CHAMBERS FOR APPURTENANCES :

I. **CHAMBER FOR APPURTENANCES :**

The suitable RCC chambers shall be constructed around the appurtenances and valves fixed on the line, the minimum working space shall be 500mm on all sides. The chamber shall have Pre cast RCC cover conforming to IS:456-2000 suitable for heavy traffic loads.

II. **CIVIL WORKS :**

All the allied civil works necessary for laying and jointing of pipeline shall be a part of this contract; therefore, the contractor shall design and carry out the necessary civil works such as thrust blocks, anchor blocks, chambers for appurtenances and necessary earth work. All the civil works shall be designed and carried out as per the relevant Indian Standard Code of practice. All the materials used on civil work should be of a quality approved by Executive Engineer. Rejected material shall be removed from the site immediately at the cost of contractor

2.12 TESTING, COMMISSIONING OF PIPE LINE, TRIAL RUN AND DEFECT LIABILITY PERIOD :-

After completing the job of laying and jointing of pipe line the contractor will do testing, commissioning followed by trial run for a period of **TWELVE MONTHS** including training of personnel. The repairing of bursting and leakage of pipeline during this period shall be done by the contractor at his cost including cost of all materials/spares. Clearwater for hydraulic testing and commissioning of pipe line will be made available by the Deptt free of cost at the time when convenient to the deptt however the Contractor is required to disinfect the pipeline immediately thereafter. In case of delay in making available the water for testing the time extension will be given to the contractor without penalty for such period. Defect liability period shall be for **TWELVE MONTHS** from the date of completion of work. TRIAL run of **12 Months** will commence after the issuance of Completion Certificate by the Engineer-in-Charge.

2.13 Inspection of Pipes, valves & fittings

Inspection of the pipes, valves & fittings will be done by the DGS&D/SGS/RITES. The departmental officials may also inspect at factory site.

2.14 MANUFACTURE :-

The pipes shall be ISI Mark and confirming to IS: 8329:2000. The pipes should be duly inspected and approved in writing by SGS/RITES before supply at the site.

Pipes shall be tested hydrostatically at a pressure as per CPHEEO Manual in the field. To perform the test, pressure shall be applied internally and shall be steadily maintained for a period of minimum 15 seconds during which pipes may be struck moderately with a 700 grams hammer. The pipes shall withstand the pressure test and shall not show any sign of leakage, seating or other defects of any kind. The tolerance shall be permissible as per IS:8329-2000. All the D.I. pipes should be internally lined with cement mortar and externally out coated with metallic zinc coating having finishing layer as indicated in Annexure A, as per IS 8329-2000.

2.15 THRUST BLOCKS

- I. Thrust blocks are required to transfer the resulting hydraulic thrust from the fitting or pipe on to a larger load bearing soil section & shall be designed as per ISS.
- II. Thrust blocks shall be installed wherever there is a change in the direction of the pipe line, size of the pipe line or the pressure-line diagram, or when the pipe line ends at a dead end. If necessary, thrust blocks may be constructed at valves also. Thrust block shall be design and provided as per appendix 6.6 of CPHEEO manual.
- III. Thrust blocks shall be constructed taking into account the pipe size, water pressure, type of fitting, gravity component shell when laid on slopes and the type of soil
- IV. When a fitting is used to make a vertical bend, it shall be anchored to a concrete thrust block designed to have enough weight to resist the upward and outward thrust. Similarly at joints, deflected in vertical plane, it shall be ensured that the weight of the pipe, the water in the pipe and the weight of the soil over the pipe provide resistance to upward movement. If it is not enough, ballast or concrete shall be placed around the pipe in sufficient weight to counteract the thrust.

- V. When the line is under pressure there is an outward thrust at each coupling. Good soil, properly tamped is usually sufficient to hold pipe from side movement. However, if soft soil conditions are encountered, it may be necessary to provide side thrust blocks or other means of anchoring. In such cases only the pipe on each side of the deflected coupling shall be anchored without restricting the coupling.
- VI. Pipes on slopes need be anchored only when there is a possibility of the backfill around the pipe sloping down the hill and carrying the pipe with it. Generally for slopes up to 30° good well drained soil, carefully tamped in layers of 100 mm under and over the pipe, right up to the top of the trench will not require anchoring.
- VII. For steeper slopes, one out of every three pipes shall be held by straps fastened to vertical supports anchored in concrete.

2.16 DISINFECTION OF PIPE LINE BEFORE COMMISSIONING:

- I. Pipeline carrying potable water shall be suitably disinfected before commissioning as per guidelines given in CPHEEO Manual & relevant IS codes.
- II. DLP for 12 months to be carried out by the agency.

2.17 MAKES OF VALVES ETC TO BE PROCURED BY THE CONTRACTOR.

Item/Component	Recommended Makes
Sluice Valves/Scour Valves	Kirloskar/IVC/VAG/IVI/Fourcss/DALUI/DURGA
Butterfly Valve	Kirloskar/IVC/VAG/IVI/Fouress/DALUI/DURGA
Non-return Valves	Kirloskar/IVC/VAG/IVI/Fouress/DALUI/DURGA
Kinetic Air Valve	Kirloskar/ IVC/VAG/IVI/ Fouress/DALUI/DURGA
Valve Actuators	Auma/Rotork/Limitork
Hydraulically operated Flow-cum-Pressure control valves	VACi/Darling-Muesco/Singer
Electro-magnetic Flow meters	Emerson/KrohneMarshall/Yokogawa/
Woltman type Bulk flow water meters	Zcnnr/Itron/Elster/Mmol
DI/C Fittings & specials	Kiswok/Electrosteel/Kejriwal
Dismantling/Expansion joints	AnupEngg./ LoneStar /Vedaiita /Precise
Compression fittings, Tapping Saddles, Electro-fusion Couplets	Kimplas/,Georgeficher/Glynwed/Frialeii/Trustlene/GPS/Durafuse
Consumer water meter	ITRON/ELSTER/ZENNER/AQUAMET/ARAD/SAPPEL
Pressure Reducing Valve	VAG/ Bermad / DarlingMuesco/Siner
Item/Component	Recommended Makes

Water Hammer Control Devices	Sureseal
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2.18 SPECIFICATION FOR PUSHING

The pipes pushed through the Railway / Road Embankment should have minimum cushion of 2.00 m (Or as shown in the Railway’s approved Drawing) above the pipes. The cautionary boards should be kept at sufficient distance from the point of crossing. The pushing should be done with the use of Hydraulic Jacks / Winch Machine as per the standard procedure of the Railway’s. Every precaution should be taken that while pushing no settlement takes place in the track/ Road. The embankment should be protected with sand bags to avoid any seepage during working. The temporary thrust bed / thrust wall constructed for pushing should be dismantled after completion of pushing work. The M.S. Pipe barrels shall be field welded with electric arc welding machine. The entire work should be carried as per the latest specification of the Railway Department for pushing of pipe work. Jacking of the M.S. Pipes to form the opening under the Railway track under running traffic condition maximum allowable deviations from the Theoretical alignment will be limited to 200 mm Horizontally and 100 mm Vertically. Any deviation beyond this tolerance will be rectified by the tenderer at his own cost . Any temporary structures such as thrust walls etc. shall be dismantled immediately after completion of the Pushing work. Minor seepage water which can be dewatered manually by bucket etc shall be done by the contractor and no extra payment will be paid for this how ever if the subsoil water is heavy and needs dewatering by pumps then it will be paid as per regular practice of PHED/PWD.

2.19 SPECIFICATION FOR BULK FLOW METER

The Flow meter shall have following Salient features

- Suitable for conductive liquid.
- Absolutely maintenance free.
- Full bore type.
- Remote electronics.
- Simple & cost effective construction.
- Outstanding accuracy.
- Empty pipe indication.
- Universal power supply.
- Communication port.

DESCRIPTION

The bulk flow meters of electromagnetic full bore type are micro-controller based full bore type electromagnetic flow meter with remote electronics specially used for various industrial applications. These flow meters shall accurately measure the flow rate of conductive liquids & slurries in closed pipes. The meters shall be of simple & rigid design, the flow meter shall be an obstruction less & maintenance free instrument in place of conventional mechanical flow measuring device. The use of ‘Pulsed DC’ technology offers highest ability & better measuring accuracy in the form of electrical signal 4 - 20 mA DC linearly

proportional to volumetric flow in case where electric supply is available and battery operated (With one additional battery) wherever instructed by RAIPUR MUNICIPAL CORPORATION. The instrument is based on Faraday's law of electro-magnetic induction. A magnetic field is generated by the instrument in the flow tube. The fluid flowing through this magnetic field generates a voltage that is proportional to the flow velocity. Corresponding electrical output is provided with respect to measuring voltage.

TECHNICAL SPECIFICATIONS

Media : Liquids (Conductive)

Basic Application: Water

Conductivity	: 5 μ s/cm min
Viscosity	: 200 cp max
Recommended flow rate	: Min./max. full scale value(v ~ 0.3 or 10 m/s) velocity
Nominal Size	: 15 NB to 1000 NB
Excitation	: Pulsed DC coil
Type of Output	: 1) 4 - 20 mA DC , Isolated 2) Pulse
Remote Electronics Cable	: 25 mtr max
Remote Display	: 16 x 2 LCD - 4 digit for Flow Rate & 8 digit for Totalised Flow
Calibration Range	: As per requirement or (Factory Standard Calibration)
Accuracy	: +/- 0.5% F. S
Linearity	: +/- 0.5%
Repeatability	: +/- 1%
Process Temperature	: Rubber: 85 0C Max & PTFE: 100 0C Max
Process Pressure	: 10 kg/cm ² max
Material of construction	: Lining - Rubber / PTFE (Teflon) Flange - CS / MS / SS Electrode - SS 316L / Hastalloy C / Platinum Coil Housing - MS / SS 304
Power Supply	: 1) 24 V DC, External 2) 90 - 250 V AC, 50 Hz
Power Consumption	: < 10 VA
Isolation	: 1.4 KV between Input, Output & Power Supply
Response Time	: < 100 mSec
Temperature Coefficient	: +/- 0.1% per 0C
Remote Electronics	: IP- 66, 2" pipe mount type
Sensor construction	: As per IP- 68
Process Connections	: ASA 150 flanged, as per table B 16.5
Mounting	: In-Line (Horizontal OR Vertical)
Operating Conditions	: Temperature 0 to 55 0C / Humidity 5 to 95% non condensing

OPTIONAL

Communication Port	: RS 485 with MODBUS RTU Protocol
GSM Telemetry	: GSM Module Inbuilt in Electromagnetic Flowmeter with facility & Programmable(Showing Flow rate & Flow totalizar)
SMS	
ELMAG	: 200R with Remote Electronics

Note :- For process conditions other than above arising actually at site after execution of components please consult factory.

Structural Steel Works

Material

All materials used shall be new, unused and free from defects. Structural steel and other related materials for construction shall conform to IS 2062 and shall be procured from reputed manufacturers such as **SAIL / TATA STEEL LTD / RASHTRIYA ISPAT NIGAM LTD (RINL)** and as approved by the Engineer. Where steel castings are to be used the same shall conform to IS: 1030. Tolerances for fabrication of steel structures shall conform to IS 7215. Tolerances for erection of steel structures shall conform to IS 12843.

Where steel work is directly exposed to weather and is fully accessible for cleaning and repairing the thickness shall not be less than the designed thickness plus additional 2 mm or 6 mm whichever is more. Where steel is exposed to weather but not accessible for cleaning and painting, the thickness of steel member shall not be less than 8 mm. This shall not apply for hot rolled sections covered by Indian standards.

Where steel work is not directly exposed to the weather the thickness of steel member shall not be less than 6 mm.

Test certificate from the manufacturer for the material shall be made available along with each lot supplied at site. Scratched or abraded steel shall be given a coat of primer (Make: **ASIAN / BERGER / SHALIMAR**) for protection after unloading and handling prior to erection and milling.

Inspection and Testing

The Engineer shall have free access to all parts of the job during erection and all erection shall be subject to his approval. In case of faulty erection, all dismantling and reworking required will be at the Contractor's cost. No paint shall be applied to rivet heads or field welds or bolts until these have been approved by the Engineer.

The Contractor shall give due notice to the Engineer in advance of the works being made ready for inspection. All rejected material shall be promptly removed from the shop and replaced with new material for the Engineer's inspection. The fact that certain material has been accepted at the Contractor's shop shall not invalidate final rejection at site by the Engineer if it fails to conform to the requirements of these specifications, fails to be in proper condition or has fabrication inaccuracies which prevent proper assembly nor shall it invalidate any claim which the Employer may make because of defective or unsatisfactory materials and/or workmanship.

No materials shall be painted or dispatched to site without inspection and approval by the Engineer.

The Contractor shall provide all the testing and inspection services and facilities for shop work except where otherwise specified.

For fabrication work carried out in the field the same standard of supervision and quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to the Engineer.

Members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment, surface finish and painting are in accordance with the requirements shown in the Contractor's approved fabrication drawings.

In the event of failure of any member to satisfy inspection or test requirement, the Contractor shall notify the Engineer. The Contractor must obtain permission from the Engineer before any repair is undertaken.

The Engineer has the right to specify additional testing as he deems necessary, and the additional cost of such testing shall be borne by the Employer, only in case of successful testing.

The Contractor shall maintain records of all inspection and testing which shall be made available to the Engineer.

The contractor will prepare and submit the structural design calculations along with the fabrication drawings to Engineer-in-Charge /PDMC for their approval before commencement of fabrication.

Welding

The sequence of welding shall be as per IS 9595. Welding shall be done by electric arc process as per IS 816 and IS 823. The work shall be done as shown in the shop drawings which should clearly indicate various details of the joint to be welded, type of welds, shop and site welds as well as the types of electrodes to be used. Symbol for welding on plans and shops drawings shall be according to IS 813. The maximum dia of electrodes for welding work shall be as per IS 814. Joint surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. All operation connected with welding and cutting equipment shall conform to the safety requirements given in IS 818 for safety requirements and Health provision in Electric and gas welding and cutting operations.

Inspection and testing of welds shall be as per IS 822 and IS 1182.

Welders undertaking the job at site will be well qualified and experienced in their job.

Painting

Primer and finish paints shall be compatible with each other to avoid cracking and wrinkling and shall be from the same manufacturer for each painting system.

a. Surface preparation

All ungalvanized steel surface shall be cleaned by grit or shot blasting in accordance with BS 7079 - General introduction to standards for preparation of steel substrates before application of paints and related products. The cleaned surface shall have maximum amplitude not exceeding 0.1 mm. The grit or shot blasted surfaces shall be primed within four hours of blasting.

b. Primer

Two coats of primer shall be applied on the steel structures. First coat of lead-free, oil-based, high-quality, corrosive resistant steel primers such as Red Oxide Zinc Chromate as specified shall be applied before any member of steel structure are placed in position or taken out of workshop. Second coat of primer shall be applied after the erection is completed and before painting commences.

c. Paint

Two coat of Epoxy paint of approved make shall be applied on all structural steel members. Paint delivered to the fabrication shop/site shall be ready mixed, in original sealed containers, as packed by the manufacturer. Thinner shall not be permitted for usage unless specifically approved by the Engineer. The application of paint shall be as per manufacturer's instructions. The coating thickness shall consist of the following minimum dry film thickness, or as recommended by the manufacturer, if thicker:

First coating: 100 µm

Second coating : 100 µm

The contractor shall submit test certificates from the manufacturer for every batch of paint supplied. The contractor shall arrange for testing of paint (samples taken from every batch supplied) from approved laboratory if the Engineer directs to do so. Test results shall be submitted to the Engineer for approval.

Makes to be used **NINA / BASF / FAIRMATE / SIKA / MC-Bauchemie (India) Pvt Ltd.**

2.20 SPECIFICATIONS FOR METER

1. The Site shall be handed over to the successful contractor by RAIPUR MUNICIPAL CORPORATION. The contractor has to coordinate with the the distribution network contractor, as per the instructions of RAIPUR MUNICIPAL CORPORATION and allocate the magnitude of meters to be connected in every zone. A reconnaissance survey has to be carried by the contractor in complete project area and shall quantify zone wise requirement of the consumer meters. The requirement of such meters zone wise shall be submitted to RAIPUR MUNICIPAL CORPORATION for approval in writing and after the approval of RAIPUR MUNICIPAL CORPORATION only the supply order shall be placed.
2. The contractor shall submit a bar chart showing schedule of all the activities and probable time frame required to complete the same within a week's time from the work order.
3. The contractor shall carry out third party inspection from the approved TP agencies such as SGS/ EIL/ RITES etc. also he should inform the RAIPUR MUNICIPAL CORPORATION about the schedule of manufacturing and testing and arrange a visit of RAIPUR MUNICIPAL CORPORATION officials to the factory to inspect the process.
4. Every meter must carry the serial no with embossed mark and batch number in which the inspection has been done. Also the name of RAIPUR MUNICIPAL CORPORATION shall have to be embossed on each meter.
5. The contractor shall depute one site team for making awareness in the public about the advantages of the meters and how they can bring the monthly charges down by using water sensibaly. The team shall guide the public regarding the use of meters, meter reading and charges to be paid by the public on actual consumption of water. The contractor shall prepare a check list in coordination and approval of RAIPUR MUNICIPAL CORPORATION depicting the above facts and shall take the signature of the citizen where the meter has been installed along with the necessary documents pertaining to RAIPUR MUNICIPAL CORPORATION and produce the same for release of installation amount.
6. The contractor shall also take photograph of the complete system installed along with GPS point and the consumer information. The contractor needs to submit all information in GIS format to the RAIPUR MUNICIPAL CORPORATION as a submission / completion report.
7. The lumpsum item to include
Excavation
 - a. The excavation of the trenches include excavation of the pit for making house service connections from the already laid line to the respective house including all the labour, cost of material used for excavation in soft strata below CC roads the size of the pit shall be minimum but not limited to 1.00m x 1.0m x 0.70m below the CC road lowest bed surface. The pit shall be well excavated below the existing pipe line to facilitate flawless fixing of the strap on the pipe line. The pipe shall be cleaned well from all the foreign material prior to start the fixing activity.
 - b. The excavation for excavating CC road surface including chiseling and cost of all manual, mechanical means for cutting the sides to facilitate the excavation in soft rock or hard strata, the size of the pit shall be but not limited to 1.0m x 1.0m x 0.50m. The provision shall be applicable for hard strata if met with on upper side or either on the lower side of the pit.
 - c. Dewatering
The dewatering from pipeline either from the pools of ground water or from the charged pipe line shall be pumped out from the pit and the pipe line shall be made dry to make the connections of the house service connection. The dewatering shall be of but not limited to 1 BHP/Hour
 - d. Cutting the parent pipe if required
The contractor has to make cutting of pipe wherever necessary with filing and champharing and making the mouth clean for fixing the fittings

Making strap joint

e. The strap joint shall be of best quality confirming to ISO as detailed below
Providing & Supply of Clamp Saddle (DI Strap Saddle) for House Service connections from metal pipe Water Distribution mains shall be of fastened strap type with threaded outlet for service connection. Clamp Saddle shall be suitable for nominal size of distribution mains pipe line. The strap shall be elastomeric coated (insulated) type for firm grip on pipe as well as to protect the coating on the pipe and to insulate the unidentical metals. The saddle shall be single strap type up to pipe sizes of NB 600 and service outlet 15mm, 20mm & 25mm. Fasteners shall be of threaded nut-bolt- washer type. The sealing between the saddle and mains shall be obtained by using a profiled elastomeric seal matching to the curvature of the pipe. The seal shall be of elastomeric type, suitable for all potable water application. The material of construction of the body, straps, fasteners etc, shall be of non corrosive material such as engineering plastic (PE/PP) or stainless steel or a combination of both.

2.21 RESPONSIBILITY OF WATER METER MANUFACTURERS / DISTRIBUTORS:

1. To design, manufacture, test, supply and give technical support / service to the civil contractors and submit a full-fledged detailed scheme, technology & methodology for taking remote water meter readings of the AMR Compatible water meters installed on RAIPUR Municipal Corporation connections.
2. The RMC may suggest certain modifications such as software, different attributes and facilities required in Hand Held Device i.e. AMR reading device and operating software, etc. The AMR Compatible meter manufacturer shall implement / incorporate all the modifications & suggestions as suggested by RAIPUR Municipal Corporation without any extra cost.
 - (i) All components like GSM modem, AMR Compatible unit and Meter should conform to IP68 if they are integrated in a single unit. In case GSM modem/ End unit is designed separately from AMR Compatible meter they should confirm to minimum of IP67 protection class.
 - (ii) If GSM modem / End unit is proposed separately from the AMR Compatible meter the communications between meter and GSM modem/ end unit must be wireless. If integrated AMR Compatible meter is proposed then Meter, AMR unit and GSM modem can connect together with or without wire and no wire should be exposed outside.
 - (iii) Design of suitable software, frequency range of AMR Compatible meters and suitable mechanism for transferring the data from Meter to end unit and then to Central Server of RMC.**
 - (iv) Capturing of Meter Readings (data collected) from AMR unit to RMC's AMR Compatible meters central server available at RMC directly (Or) to RBS server by web services from vendor server.**
 - (v) The AMR Compatible unit shall be provided with backup battery working and maintained for a minimum period of Five (5) years.
 - (vi) Repairs & construction of meter chambers with RCC and tamper proof MS cover including lock & key arrangement as per specifications. Meter chambers are to be constructed for all pipe sizes and for pipe sizes 50mm and above either separate or combined meter strainer chambers are also to be constructed.
 - (vii) The agency is required to establish a local office (service centre) for attending day to day work.
 - (viii) The agency is required to place at least two (2) nos.of Software Engineers with suitable qualifications at RMC to monitor & analysis of meter reports of day to day work.
 - (ix) The AMR Compatible meters are to be maintained (on site Comprehensive annual Maintenance) for a period of five (5) years after successfully commissioning of AMR Compatible metering system, ie supplying, installing, testing & commissioning of AMR Compatible metering system with an initial Twelve (12) months period.**
 - (x) The agency is required to take sufficient protective measures for the safety of the AMR Compatible meters and other accessories provided under the contract.
 - (xi) The successful tenderer is required to impart training to RMCs departmental staff during the maintenance

- period.
- (xii) The bidder is requested to quote capital cost of AMR Compatible meters & Cost for on site Comprehensive annual Maintenance for each unit competitively for five years including the necessary required items as per scope of work at site conditions.
- (xiii) The agency shall provide AMR Compatible meters of one manufacturer's make for a particular size with the specifications mentioned in tender document but all meters shall be integrated with the existing software module of RAIPUR MC (OR) to the server of vendor.
- (xiv) AMR Compatible meters including all necessary ancillaries such as Meter interface unit etc shall be erected at a time without any time lag in between.
- (xv) The bidder shall quote Cost towards recovery of Capital Cost of AMR Compatible meters, strainers (wherever required) & cost for onsite comprehensive annual maintenance for five years including monthly consumption reports for all metered CANs, construction of meter and strainer chambers where ever required as per specifications with lock & key arrangements etc., including all taxes & duties etc complete.
- (xvi) The rate quoted for L.S. tender on percentage basis is final and the bidder will be eligible for proportionate quoted percentage rate to each size of AMR Compatible meter or rounding off to nearest rupee only for entire quantity and also in future to be added quantities as per NIT bid provisions.
- (xvii) Inspection & Testing:**
- a) The contractor shall arrange the inspection of manufacturer's factory premises to the Officials of RMC of AMR Compatible meters project of RAIPUR MC/Quality Control officials of RMC any Third Party Inspection agency appointed by RAIPUR MC to inspect the water meters and other material at manufacturing premises and to witness the required tests as per Specifications and as per standard tests (ISO standards etc;) as applicable for water meters with their own cost, if required by the Board.
- (xix) **Guarantee Period:-**The bidder has to give guarantee for 60 months or five years from the date of satisfactory commissioning of the work on prescribed format including replacement. The guarantee period will start from successful installation, testing and commissioning of AMR Compatible water meter under this contract.
- (xx) **Inspection:-** All the charges towards stage / final inspection until dispatch clearance shall be borne by the contractors including to and fro travel, inland transport, lodging and boarding, etc. for minimum of two Engineers / Officials and total cost offered for the bid should be inclusive of the same.
- (xxi) **Patent rights and royalties:** The contractor shall indemnify the Board from against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name of other protected rights in respect of any equipment , machine work or material or installation used for or in connection with the work or any of them and from and against all claims, proceedings, damage, costs, charges and expenses whatsoever in respect of or in relation thereto.
- (xxii) **Production of vouchers:** The contractor shall when required by the RMC produce all quotations, invoices, vouchers, and accounts or receipts etc. to prove that the materials supplied by him are in conformity with the specifications laid down in the contract.
- (xxiii) The entire cost of the AMR Compatible metering project shall be borne by the bidder and shall be completed in project period. Payment for the AMR Compatible metering project Capital Cost and on site Comprehensive annual maintenance Cost for five years as quoted by the bidder subject to satisfactory performance as per contract conditions.
- (xxiv) **Disturbance to regular functioning:**The contractor shall ensure while these works are in progress that the other functional aspects of the pumping stations and distribution of water supply are not disturbed / hampered. In case such a disturbance is envisaged they will give sufficient prior intimation to make alternate arrangements.
- (xxvi) **Submission of final completion drawings.** On completion of the work, the contractor shall furnish free of cost 3 sets of final completion reports & drawings showing all the details checked and signed by the Engineer within one month of completion of work.
- (xxvii) **Details to be Confidential:**The Contractor shall treat the details of the Contract as private and confidential, save in so far as may be necessary for the purpose thereof, & shall not publish for disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the previous consent in writing of the Employer or the Engineer. If any disputes arises as to the necessity of any publication or disclosure for the purpose

of the contract the same shall referred to the Employer whose determination shall be final.

(xxviii) Maintenance & defect liability period

(a) **Defects liability period** : The Contractor shall be responsible to make good and remedy at his own expense for entire contract period, within such period a may be stipulated by the Engineer and defects which may develop or may be noticed before the expiry of the period mentioned from certified date of completion and intimation of which has been sent to the Contractor within seven days of expiry of the said period by letter sent by hand delivery or by registered post.

(b) **Liability for defects or imperfections and rectification"s thereof** : If it shall appear to the Engineer or to his representative at any time during construction or reconstruction or during the defects liability period after the 12 months trial run that any work that has been executed with unsound, imperfect or unskillful workmanship or that any material or article provided by the Contractor for execution of the work is unsound or of a quality inferior to that contracted for, or otherwise, not in accordance with in contract, or that any defect, shrinkage or other faults have appeared in the work arising out of defective or improper materials or workmanship, the Contractor shall, upon receipt of notice in writing in that behalf from the Engineer forthwith rectify or remove or reconstruct the work so specified in whole or part, as the case may require, or as the case may be, and/or remove the materials or articles so as specified and provide other proper and suitable materials or articles at his own expense notwithstanding that the same may have been inadvertently passed, certified and paid for, and in the event of his failing to do so within the period to be specified by the Engineer in his notice aforesaid the Engineer may rectify or remove and re-execute the work and/or remove and replace with others the materials or articles complained of, as the case may be, by other means at the risk and cost of the Contractor.

(xxix) Authorization certificate from water meter manufacturer shall be submitted.

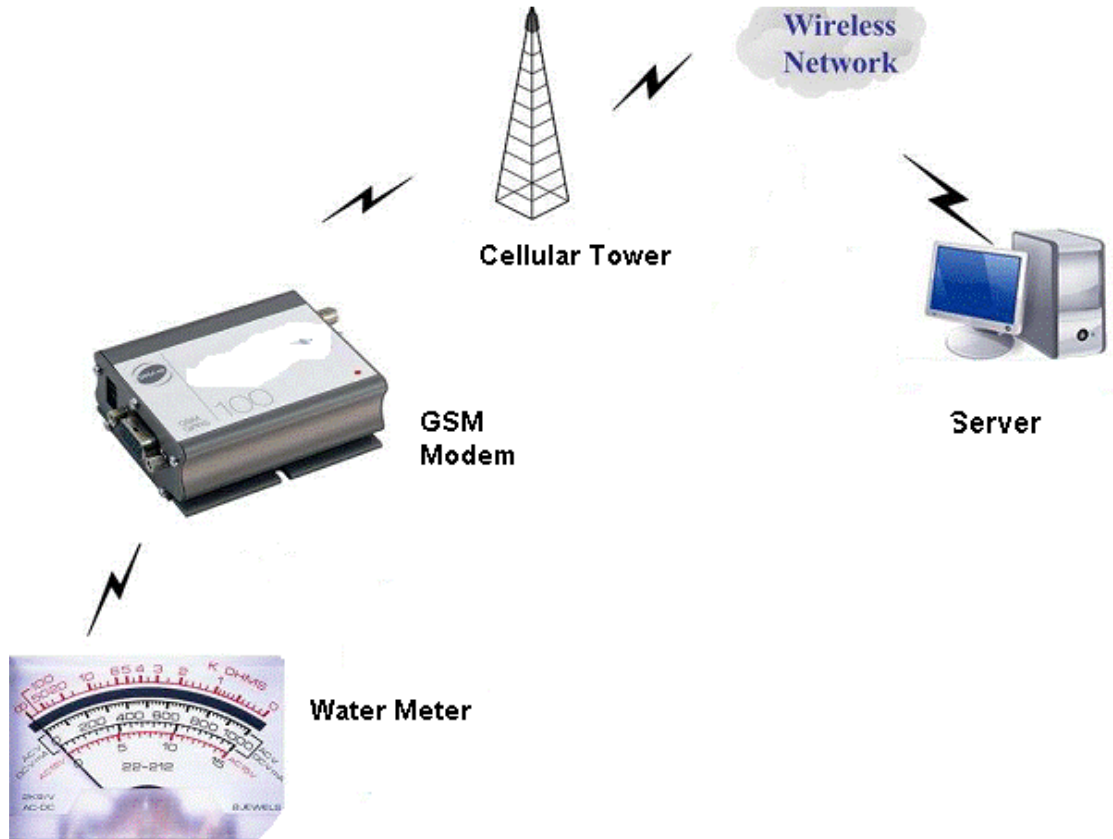
(xxx) The bidder, in case of authorized dealer, shall submit copy of certificate of dealership from manufacturer of the make quoted in the tender.

(xxxi) The authorization given by the manufacturer shall be of direct nature, without involving any intermediary firm.

(xxxii) The bidder shall extend full cooperation and interaction with other agencies at site, if involved. The bidder must have service facilities to maintain the equipment installed. The work shall be carried out with good workmanship following standard engineering practice. The successful bidder shall take utmost care not to cause any nuisance due to noise, welding operations etc. all the proper precautions shall be taken by them in this respect

Description of the System Structure

The AMR Compatible meter installed at the consumer premises shall transmit water consumption data wirelessly to GSM modem and the GSM modem inturn shall send data to Server installed RAIPUR MC data centre directly though GSM though GPRS communication securely (OR) to vendor server. If integrated type of solution is proposed as AMR Compatible meter, AMR interpreter and GSM modem integrated in single unit then wire can be used internally and no wire should be projected outside. The Software module installed at RMC data centre / vendor server module shall manage the AMR Compatible meters.



Schematic Diagram for AMR Applications for HMWSSB

(i)**The Water Meters:** The water meters size ranging from **25mm to 40mm** dia. Confirming to ISO: 4064, class-B standard or IS: 779 or IS: 2373 with their latest amendments which have ISI/EEC/MID certification marking and compatible to automatic meter reading.

(ii)**GSM modem(End Units) :** GSM modem(End Units) : GSM modem are either integrated with the water meter (with wire or wireless) or if not integrated to the water meter the GSM modem should be connected to the water meter wirelessly and receive outputs relative to the water consumption. Accordingly an internal "programmed meter" should be installed within end units which are identical to the water meter scale. GSM modem (End unit) will transmit information through GPRS network to Server at control room (RMC Data Centre at RAIPUR) or the vendor server control room or data centre. The GSM unit/End unit may or may not have LCD display.

(iii)**Communication of data:** The GSM modem that collects information from water meter should transmit the information to the control center over GSM network using GPRS communication technology. The communication between meter to GSM modem should be wireless if GSM modem is not integrated in meter.

(iv)**The Control Center:** The control centre consists of Server provided by RMCas per requirements of the bidder and installed with software module for managing all the end units in case if vendor is providing server and server side software all the cost has to be borne by vendor only. In case vendor proposes to give along with server side software they can use their control centre and software/ hardware.

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

S. No.	ITEM	DESCRIPTION
(A) WATER METER		
1	Certification	ISI (or) EEC (or) MID – higher standards
2	Standard	IS: 779 (or) IS: 2373 (or) ISO: 4064 Class “B” with latest amendments.
3	Protection	class IP68
4	Performance certification	Performance certification is „Optional“ for sizes of 50mm dia & above at the time of bidding but this condition shall „Mandatory“ for successful bidder and the successful bidder shall produce life cycle test reports as per the existing norms by the , FCRI, Palakkad, Kerala, India Govt. of India, for remaining all sizes of water meters with in 3 months period from the date of entering into agreement to this project and only FCRI certified sizes meters will be allowed for execution.
(B) Meter Interface Unit		
1	Protection	class IP68
2	Communication with GSM modem/ Meter	Only Wireless if GSM modem and Meter is not integrated. b) Wired (or) wireless if GSM modem and Meter are integrated. Wire should not be exposed outside.
3	Battery	Life should be for a minimum of 5 years
(C) GSM Modem (End Unit)		
1	Network	GSM
2	Protection Class	a) IP68 if integrated with AMR Compatible Meter b) IP67 If NOT integrated with AMR Compatible
3	Communication with AMR meter/ Meter	(a)Wired (or) wireless in case integrated with water meter. Wire should not be exposed outside. b) Only Wireless if not integrated with AMR meter
4	Communication technology	GPRS should be the default method of data transfer with automatic feed back by SMS in case of GPRS (low signal level) failure.
5	Frequency range for Communication between GSM modem and Meter interface.	To operate with the prevailing frequency range as specified by DOT/GOI.
6	Battery	Life should be for a minimum of 5 years
(D) Software Module		
1	Requirement	Should be able to manage all the AMR meters and generate all required reports with life time license to RMC.
2	Data Base to be used	bidder has to cater for license, storage and maintenance cost etc.,
3	Architecture	The architecture of the manufacturer’s software module required is web based, so as to enable online access of the Data/Reports via web interface.
4	Location of application to be hosted	IVendor has to use his own server.

5	Interface	The software module should provide the interface of meter data to existing RBS module in Tab / Comma separated value format.
(E)	Meter & Strainer Chambers	
1.	Construction of Meter & Strainer Chambers.	<p>a) Construction of RCC / CRS in C.M (1:6) / Brick masonry in C.M (1:5) chamber including CM 1:4 plastering with tamper proof M.S. frame with 8mm thick plate cover and 7 levers lock & key arrangement of size suitable to the meter with a clearance of 0.3 meter all round between to edges of meter / strainer & chamber including cost of all materials, excavation, dismantling of existing chamber & all other incidental and operational charges etc; complete to AMR meters and Strainers</p> <p>b) Meter chambers are to be constructed for all pipe sizes and for pipe sizes 50mm and above either separate or combined meter strainer chambers are also to be constructed.</p> <p>c) If the proposed AMR water meter is with out any moving parts (ie rotating mechanism) in the meter in such case providing strainer before the meter is not compulsory.</p>

DESCRIPTION OF AMR Compatible METERING SYSTEM ACTIVITIES

(a) **Data Collection:** Readings from the water meters will be collected following consumption and/or at permanent intervals. All readings must be identified by a water meter code, the value of the reading, and sampling time. In this manner a layer of data from each meter must be created in the GSM units and/or in the control center Server at designated time intervals.

(b) **Processing Information:** Information will be processed in the control center concerning the received data. Calculations and consumption balances will be calculated from the level of each individual meter. The control center Software Module will allow management of water consumption and water meters replacement. In addition, interfacing to the existing information system in the RMC is required.

(c) **Identifying and Reporting Malfunctions and Irregularities :** The system will conduct inspections and calculations in order to identify and locate hydraulic and technical irregularities and malfunctions on all levels, such as:

- a) **Suspicion of continuous leaks/consumption over a lengthy period of time** / excessive use of water / suspicion of a stopped water meter / vandalism / water meter turning in reverse
- b) Suspicion of leak / excessive use of water / cutoff / at the consumer/ building/ or compound level
- c) Calculation and warning of a large decrease in water on a local (branched), regional/neighborhood level.
- d) Malfunction in end units or between the end unit and control centre.

Billing – Interfacing to the HMWS&SB billing system

a) GSM Meter Reading system must be interfaced with the RMC system. The data structure, data quality inspections, essence, manner and rate of data transmission must be completely compatible with the SMC or duplications are created between the Remote Meter Reading system and the RAIPUR MC billing system.

(b) Access of billing data to Consumer:

Consumers will be able to access the billing details and reading through the RMC website to see their current water meter reading by connecting the AMR meter directly and as well as history of their water consumption for selected period of duration as desired by the consumer.

4. General Guidelines and Requirements

a) **The system and all its components:** The method of communication, computerization system, logging volume,

memory, databases, etc – must be able to deal with min.25, 000 water meters.

- b) The reliability of the readings must be high, with no more than 2 errors per 1,000 readings. A reading error will be defined as a deviation between the value that appears in the Remote Meter Reading and the mechanical display on the meter.
- c) All layers of the system should support the process of water meter replacements (dismantling and installation).
- d) All tasks described, including the process of accumulating information, quantity calculation, and producing reports, must be performed without flaw in case the defective water meters are replaced.
- e) All installed equipment must not hide the existing display on the water meter and allow the meter to be read conveniently.
- f) If the Interpreter, GSM modem is installed on the water meters or within as part of the meter (hereby referred to as an integral water meter). The integral water meter can use wireless or wired mode of communication between meter, Interpreter and GSM modem and no wire should be exposed outside as it leads to tampering/damage.
- g) If GSM modem and meter are separate then only wireless communication should be used to communicate between meter and GSM modem.
- h) The entire system from the field to the control center will operate continuously under all weather conditions.
- i) The system and all its components must be protected against the most severe environmental conditions such as temperature, humidity, water, and dust prevailing in RAIPUR.
- j) The system and all its layers must include means of protection against noise, excessive electrical charges, and lightning.
- k) An equal time-base must be created for all system components: the hour and date must be synchronized for all system components within a range or precision of at least 1 minute.
- (l)The system will learn the consumption profile for each consumer for identifying irregularities and malfunctions.
- m) The computer system will enable updating and rewriting of data initiated by an authorized user. For example: updating the condition of water meters and monthly quantities of water.

n) Communication Procedures

The following are details regarding several basic procedures for communication.

- (i) Pop up messages:---A pop up message should be from the end units and upward, when an irregular event such as a leak, malfunction/vandalism to the end unit is identified.
- b) Initiated Inquiry:--The control center will be able to initiate inquiries for data of the end units. When an inquiry is made the latest log data in the end unit will be received.
- c) Identifying Malfunctions in the Remote Meter Reading system (System Alarms)
The system will include routine checks to ensure flawless operation of communication and equipment, including Water meter malfunction, End unit malfunction.

Meter interface Unit (Data transmitter between METER and GSM Modem)

(i)COMPATIBILITY WITH THE WATER METERS

- a) Must have a robust structure that is as resistant as possible to vandalism, compatible and able to be connected to water meters of various sizes and types designed to be connected to a Remote Meter Reading system as per scope of work.
- b) The manner in which Interpreter/ Data transmitter are installed must not cause any hindrance to reading the water meter scale. The scale must be readable in the same manner and convenience as prior to the installation of the end units.

RESISTANCE TO NOISE, ELECTRICAL AND RADIO DISTURBANCES

- a) Ability to operate in a noisy electrical environment with electromagnetic disturbances (EMI)
- b) Ability to operate in an environment with the prevailing frequency range etc; as specified by DOT/GOI.
- c) Protection against current fluctuations and lightning as per rule in vogue.

GENERAL CHARACTERISTICS

- a) Must identify the movement of the dial and count the pulses, or identify the numbers absolutely, shall read the water meter in a more precise manner.
- b) Must be able to diagnose fluctuations in the dial as a result of fluctuations in the water flow. A system that

performs this function by reading the movement of the dial/wheel that counts in two points (creating a pulse only when the dial/wheel passes over two points) will constitute an advantage. Reading at 3 points (enabling identification of backward flow) will constitute an additional advantage. Another advantage will be a more reliable reading method.

c) Can identify backward flow and calculate the amount on the electronic counter (program) separately.

d) Information logged in Meter interface Unit must include:

- i. Meter interface Unit ID number
- ii. The water meter ID number

iii. Water meter reading

e) Include a time clock synchronized with the system clock (for a two-way).

f) Should identify and report low battery power in the end units.

g) Can identify "small leaks" by continuous consumption over a long period of time

h) Should identify measurement malfunctions caused by the proximity of an external magnet.

i) Should identify tampering and/or movement of the water meter.

WIRELESS COMMUNICATION

a) **General:** The information from water meter will be transmitted via wireless communication directly through GSM and to the control center.

b) **Codes and Licensing:** The contractor must comprehensively deal with all the necessary licensing and permits that are required for the wireless system that exist during the submittal of the project, including assignment of a frequency for operating the system and paying for licensing for operation and use and as per DOT/GOI rules in vogue.

c) **Communication Rate/Frequency:** The rate of communication between AMR meter and GSM modem must be frequent – at least once for every 15 minutes – in order to calculate water balance as precisely as possible.

d) **Communication Frequency**

e) A public frequency that is approved by the Ministry of Communication, GOI for use by the system can be proposed.

f) Proposals and systems in which the designated communication frequency is managed and supervised by the contractor, who holds a business license for the proposed frequency ("License for establishing and operating a commercial station") will constitute an advantage.

g) Energy Supply

i. Must operate using an internal battery.

ii. The life of the batteries must be at least 5 years in the required operating conditions

h) Direct access to water meter

i. Water meters must be accessible to GSM for logging data, calibration, and adjusting parameters.

ii. Water meters with two-way communication that allow access using a wireless terminal without physical connection to GSM units

INTEGRAL WATER METERS – WATER METERS + GSM MODEM (END UNITS)

If integral water meters is proposed in which interpreter/ GSM modem constitutes part of the water meter (an integral meter), the integral meter must meet ISO 4064/IS779/IS2373 which have ISI/EEC/MID certification mark and IP68 sealing standards. And send water meter readings as well as signals and warnings from Water meter with GSM communication system.

The Control Center

a) A control center will be established in the RAIPUR MC data centre – All communication, collecting and processing information, as well as the interfacing with the computer system and information in the RAIPUR MC will be implemented in Data center within the RAIPUR MC (Or) in vendor site in case vendor proposes to keep the server at his location.

b) A control center within the RAIPUR MC/ vendors location will have the following:

- i. A Server installed with management software to manage all AMR meters
- ii. Work stations for operation and/or handling terminals and/or diagnostics and system maintenance.

C) THE CONTROL CENTER – HARDWARE AND ITS SOFTWARE

- a) RAIPUR MC will provide the Server as per the specification requested by the successful bidder along with internal wiring for network connection from server with in RAIPUR MC data centre and also provides 24X7 UPS power required for the hardware.
- b) The selected bidder shall supply and install Software module for managing the AMR meters and generate alerts, required reports as per the RAIPUR MC requirements.
- c) All software items must be supplied with literature and complete documentation.
- d) All proposed software must be updated to the most recent production series and versions that exist on the market at the beginning of implementation. All this must be done at no additional cost.

9. SOFTWARE MODULE

General Requirements

- a) The web based software for Remote Meter Reading system must have all the functions of the consumer management program with improvements, including dealing with computerized water meters and readings from terminals throughout the city, as well as interfacing to the RAIPUR MC billing system.
- b) It is made clear that implementing the program must include detailed description of all program components including definition of all the processes, operation screens, reports, interface to the RAIPUR MC billing system, and to the terminal software, algorithms for identifying irregularities, calculating water balance, identifying leaks, identifying stopped water meters, etc. All descriptions and definitions for the software must be submitted to the RAIPUR MC for approval.

Note: The bidder/contractor must take into consideration that changes in definition and requirements can be expected during all stages of initial implementation and later, and that these changes are to be implemented at no additional cost.

- a) The bidder should design equipment for the control center and the entire computer system – hardware and software, communication rate, reaction time, accumulation volume, memory, databases etc, will be suitable for dealing with future capacity of up to min.25,000 water meters, while preserving the changing data base (consumer data) for at least 7 years.

**TENDERER 60 Chief General Manager (Engg)
Revenue Circle, RAIPUR MC, Hyd-4**

- c) The provided programs will be common commercial off-the-shelf programs as much as possible, which are sold and distributed on the market, and which have broad backup and technical support, so that all developments and adaptations that are required can be made based on these commercial programs.

Note: It is emphasized that all programs must be provided with life time licenses in the name of the RAIPUR MC and with full documentation.

- d) Contractors must describe the data regarding the proposed operating system, the system programs and application generators that they propose when submitting their proposal.
- e) All programs must have web based graphic interface.
- f) The system must be flexible and open, with a high degree of connectivity in all its component, to allow changes and future expansion
- g) All system components must include detailed HELP screens on all levels as well as full documentation and operating instructions. The programs must be in English on both graphic and text levels.
- h) The system must have at least two user levels:
System Administrator, Operator
 - i. The system administrator must have full access and implementation rights for all actions and system configuration.
 - ii. System administrators will have permissions for authorization of other users including passwords.
 - iii. Allotting authorizations to users (operators) must be modular so that authorization can be granted for performing certain actions according to the administrator's decision.
 - iv. Despite flexibility and required openness the system must be protected using accepted information protection mechanisms that will be approved by the client, which will prevent unauthorized penetration of the system.
 - v. Protection must include protection against penetration by unauthorized persons to equipment such as Server, end

units, and the various programs. The information security system must prevent penetration by unauthorized persons via communication lines and various data and, via the working stations and the computer network itself.

i) Users/operators/meter readers must be identified when performing various operations such as reading meters, dealing with malfunctions, evaluating consumption, changing meters, etc.

j) The Application software system must be web based. The program must be designed in such a way, that any user can login to the web based application and can perform all tasks. Moving from one task to another must be simple, userfriendly and quick. The system program must enable maintenance operations to be performed as well as everyday operation by users, including:

i. Adding/deleting lists (including definitions of water meters, buildings, areas, and consumers)

ii. Defining reports, inquiries, and graphs

iii. Backup

k) The Application can be assessable from web to all the users through standard web browsers.

l) Interfacing to thje RMC Computer System

General

(i) The RAIPUR MC control centre consists of Server provided by RAIPUR MC as per requirements of the bidder and installed with meter software module for managing all the end units. Data from GSM unit / End unit will be directly collected to manufacturer's software which will be installed at RAIPUR MC data centre and further interface will be provided to existing RBS module of RAIPUR MC. The software module should provide the interface of meter data to existing RBS module in Tab / Comma Separated Value format.

(ii) The program must provide an optimal interface to the "external" programs.

(iii) Relevant information must be transferred automatically on change and/or at regularly (daily/monthly) and in any case on request according to need and RMC definition, in order to avoid incompatibility and contradiction between the various databases and systems

m) The Database Management

The database management program must deal with collecting information, processing and making information available for use in the operating stations. The program must be able to deal with a database suitable to an expansion of min.25,000 water meters.

The following are general requirements:

i. The software will be based on a common, standard commercial program for dealing with databases.

ii. The software will allow several users to work on the same database simultaneously.

iii. The software will include mechanisms for protecting data quality.

iv. A high survival rate is required that will ensure that hardware malfunctions and communication failures will not harm the databases: no data with erroneous or partial information will enter the database, or damage the database or files.

v. The system administrator must have the possibility (and authorization) to rewrite data.

vi. The database can be updated by the user, who will operate the system and produce reports.

vii. The bidder has to bear the cost towards license, storage and maintenance cost etc.

Water Meter/Water Meter Reading System Management, Maintenance and Operation.

The software will provide a fast, user-friendly tool for managing the maintenance of water meters and their accessories, including:

i. Manufacture / Purchase of new water meters

ii. Installation of new water meters

iii. Replacement of existing old water meters

iv. Disconnection of water meters

v. Enforcement disconnections

vi. Arbitration checks

vii. Water Meter Reading system maintenance, including replacement of GSM modem (end unit)

- battery etc.
- viii. The user (operator) will be able to view all the relevant data and the status of the water meter and readings (see water meter card), as well as the identification and relating of the water meter's number and location according to the WMR (Water Meter Reading) system
 - ix. Each maintenance activity will be dated.
 - x. Various reports may be produced regarding new installations and/or maintenance activities as well as expected activities.

TECHNICAL DETAILS AND SPECIFICATIONS of Major components

(i)AMR Meter :

- a) The AMR water meters in accordance with ISO: 4064, Class-B standards with latest amendments or IS: 779 or IS: 2373 with its latest amendments and shall bear EEC or ISI or MID certification marking for each size and shall be compatible to GSM based AMR system.
- b) The bidder shall offer all sizes of water meters mentioned in the „Schedule-A Bill of Quantities“ **on prorate basis**.
- c) Water meters of each size should have been duly tested and passed as per the relevant specifications from FCRI, Palakkad, Kerala, India, for performance test. The bidder shall note that the test certificate shall be in name of water meter manufacturer. If it is not in the name of water meter manufacturer, then the same will be treated as invalid.
- d) All the charges of water meters testing, transportation etc, shall be borne by the Bidder.
- e) All the water meters shall have the facility to record the reverse flow of water and the same shall be reflected in the software system.
- f) The water meters shall have anti magnetic properties, as specified in ISO: 4064/IS779/IS2373 (when tested with 4000 gauss magnet).

(ii)GSM Modem:

- a) The GSM Modem unit shall be a self power unit containing GPRS modem capable of GPRS and SMS communication over GSM cellular networks.
- b) The system should use SMS transmission to permit operating with very low GSM signal levels (compared to GPRS and GSM Data) and to enable a more predictable battery lifetime of minimum five years.
- c) The system has to communicate daily for Flow rate Analysis, Consumption Profile and Data Alarms, in order to extend battery lifetime.
- d) The system should communicate in real time for Peak flow, Back flow, Battery low and Tamper alarms, in order to provide relevant monitoring and management data for operational purposes.
- e) The battery shall be replaceable without any data loss; during this process the device shall receive the confirmation from the server in order to prevent differences between devices and server.
- f) The system will provide a real-time transmission of GPRS/SMS with the GSM reception level to ensure that the device will operate under installed conditions.
- g) The Configuration Menu shall be protected by password to ensure only authorized personnel can modify the parameters.
- h) The device should be capable of displaying the battery capacity in the field.
- i) The device should be capable of measuring backflow.
- j) The device should be capable of being sealed using tamper seals. The devices need to be protected from unauthorized opening.
- k) The device should have mounting points for installation. The device should be easily installed to achieve best efficiency during installation.
- l) The device should be able to display GSM Signal Strength to allow Technicians to ascertain very quickly whether the device will work in the chosen location, at the same time the Server software should generate alarms.
- m) The device should have a possibility for tamper detection.
- n) It shall be possible to send real-time alarms to mobile phones.
- o) Real-time alarms shall be sent to server, permitting the system operator to manage the workforce.
- p) The system shall be providing a real time alarm for battery replacement to avoid losing data.

- q) The system shall be provided with a real time alarm for peak flow to help identify when network is overloaded, or when meter is running above specifications.
- r) The system shall provide an alarm for under-sizing of the meter.
- s) The system shall provide an alarm for over-sizing of the meter.
- t) The system shall provide an alarm to indicate that the meter is out of range.
- u) The system shall provide a daily alarm if the meter is stopped based on zero consumption.
- v) The system shall maintain accuracy between actual meter index and communicated index of 99.9% or more.
- w) The reading shall not be affected by magnetic interference as outlined in ISO 4064/IS779/IS2373.
- x) The system shall provide hourly interval data **with hourly basis daily communication** to a server.
- y) The system should be capable of storing data in every fifteen (15) minute intervals on the device.
- z) Individual meters should be configurable independently of other meters in order to take into account individual consumption parameters.
- aa) The system shall permit that all configuration parameters for similar meters can be updated in one time.

3.3 SOFTWARE MODULE REQUIREMENT.

- a) The system shall be providing allow grouping of meters together for consumption analysis of zone metering.
- b) The system shall provide capability of exporting data by a group of meters and/or individual meters to facilitate sharing of information with other stakeholders.
- c) The configuration of the devices should be possible “over-the-air” to enable updating the configuration of devices without having to go on-site.
- d) The system should have at least two different user levels. 1)Administrator 2)User
- e) The system shall provide automatic recover of any missing daily data for up to 62 days in case there is a communication failure.
- f) The system shall provide a summary report of successful transmission of all meters.
- g) The system shall provide a summary of alarms occurred in the last 24 hours for a quick analysis of the performance of the system and to identify potential problem meters.
- h) The system shall display the date and time of peak-flow events to facilitate the identification of the source of the issue.
- i) The system shall display the percentage of meters installed that have been successfully read.
- j) The system shall be able to display the actual read index of meter to enable billing of the end-user from the system and to ensure legal compliance.
- k) A view should be given to consumers to view the meter reading details to know consumption pattern.
- l) The system shall be providing a means to facilitate comparison between different meters.
- m) The system shall be providing a means to facilitate comparison between different time periods.
- n) The system shall be capable of displaying historical consumption information (minimum two months period).
- o) Individual meters should be configurable independently of other meters in order to take into account individual consumption parameters.
- p) The system shall permit that all configuration parameters for similar meters can be updated in one time.
- q) The software will include advanced tools to deal with replacing water meters in the middle of the billing period, reading in the middle of the billing period for account closing purposes, producing consumption estimates in case of malfunctions, etc. All the above will be fully synchronized with the existingRMC billing software in order to avoid double-entries and/or missing data.
- r) The software module/package shall allow secure internet access for authorized personnel, as well as consumers, for the purpose of reading water meters, viewing aggregate consumption and consumption distributions, etc.

3.4 Specifications for Meter Chamber & Strainer Chambers:

- a) Construction of RCC / CRS in C.M (1:6) / Brick masonry in C.M (1:5) chamber including CM 1:4 plastering with tamper proof M.S. frame with 8mm thick plate cover and 7 levers lock & key arrangement of size suitable to the meter with a clearance of 0.3 meter all round between to edges of meter / strainer & chamber including cost of all materials, excavation, dismantling of existing chamber & all other incidental and operational charges etc; complete to AMR meters and Strainers
- b) Meter chambers are to be constructed for all pipe sizes and for pipe sizes 50mm andabove either separate or

combined meter strainer chambers are also to be constructed.

c) If the proposed AMR water meter is with out any moving parts (ie rotating mechanism) in the meter in such case providing strainer before the meter is not compulsory.

(i) Pipe Reducer/Pipe enlarger if required as per site conditions that the agency shall be arranged and necessary costs will be included in the quoted rate.

(ii) Agency shall be intimate to concerned Manager (E)/DGM(E) minimum 48hrs before to install AMR Meters at site in their jurisdiction.

(iii) If LCD screen display type meter interface unit should be displayed the Consumption reading along with date and time.

(iv) The few of following sample report charts shall be generated through Web based and RMC feels if any other reports required as per site conditions and time to time base, those reports shall also be arranged by the bidder as a part of AMR project.

AMR WATER METER – 15 MM to 40 MM (Multijet)

SPECIFICATIONS

Meter shall be manufactured as per ISO 4064 standards & have European Economic Council (EEC) or International Organization of Legal Metrology (OIML)/MID pattern approvals & shall bear EEC marking on dial of water meter for each size.

1. The water meters of domestic sizes shall be equipped with RF based AMR technology, inbuilt / directly fitted on the water meter & wireless, , multi-jet, inferential type, dry dial, MID approved water meters .
2. Water meters of each size should have been duly tested and passed as per the relevant standards and specifications from Fluid Control Research Institute (FCRI) Kerala for performance test supported with test certificate.

2.2 Applicable Standards:

The domestic type water meters from 15 mm to 40 mm sizes shall be equipped with RF based AMR technology, inbuilt/directly fitted on the meter & wireless, magnetically coupled, multijet, inferential type, dry dial, IP68 class protection, Class-B water meters (screwed ends) conforming to IS-779: 1994 with up to date amendments or ISO 4064:1993 standard with ISI/EEC/OIML/MID certification on meter dial for each size.

All sizes of water meters shall be with RF based wireless remote trans-receivers inbuilt/directly fitted on the meter & wireless for A.M.R. reading. The RF trans-receiver shall be of the same brand/manufacturer as that of the meter.

The meters shall be supplied complete with brass nuts and brass nipples. Strainer & sealing shall be provided as per relevant IS provision.

2.3 Detailed Description:

- The AMR domestic water meters, inferential type, multi jet, magnetically coupled, having dry dial, Class 'B' conforming to IS-779 : 1994 with up to date amendments or ISO 4064:1993 standard with ISI/EEC/OIML/MID certification mark on each meter and shall be with protection class of IP-68.
- The water meters of domestic sizes shall be equipped with RF based AMR technology, directly fitted on the water meter & wireless, multi-jet, inferential type, dry dial, ISI/EEC/OIML/MID approved water meters .
- Water meters of each size should have been duly tested and passed as per the relevant standards and specifications from Fluid Control Research Institute (FCRI) Kerala for performance test as well as Endurance test as per ISO 4064/IS779 supported with test certificate.
- The meters shall be supplied complete with brass nuts and brass nipples. Strainer & sealing shall be provided as per relevant IS provision.

2.3.1 Material of construction:

- The manufacturer shall provide specific details of materials used for various parts of the meter which must meet the specifications for the material of construction of the individual parts of the meters as per IS 779:1994 (latest amendments) or ISO 4064: 1993.
- The body of the meter shall be of either Brass or Bronze. The firm shall specifically mention in the offer, the metal used in manufacturing. Material that come in contact with the water supply shall withstand 2 ppm (parts per million) of chlorine residual in the water supply and shall be resistant to corrosion.
- The water meter and accessories shall be manufactured from materials of adequate strength and durability. The materials, which come in contact with the potable water, shall not create a toxic hazard, shall not support microbial growth, and shall not give rise to unpleasant taste or discoloration in the water supply.
- The spindle and bearings inside the hydraulic chamber shall be made of polished stainless steel with hard metal tip/ sapphire.
- An anti-fraud shield of stainless steel is mandatory to avoid magnetic tampering on meter or to protect the magnetic transmission
- The internal pressure cup shall be made of Engineering plastic. The lower case of the meter shall be painted with thermal painting externally. The painting materials should be safe for human uses and not affect human health.
- Meter will be provided with monolithic plastic seal with copper/SS wire or Rust proof sealing wire

2.3.2 Markings On The Body Of The Meter:

(a) Marking on dial/ cap.

- i. Class "B"
- ii. Multijet/ Model Name
- iii. As per ISO: 4064-1993.
- iv. EEC/ISI/OIML/MID Mark and approval no.
- v. Make/Brand
- vi. Sl.No. / Year of Manufacture.
- vii. Size
- viii. Direction of flow of water on both sides of the body of meter.

2.3.4 The Totalizer and Totalizer Shield:-

The Register shall be designed in such a way that if the Register protective glass is broken for a reason or another the Register cannot be removed from its place. The Register protective cover shall be made of mineral glass and shall have a thickness of not less than 5mm and shall pass specified tests.

2.3.4.1 Totalizer :-

- It shall be of straight reading type
- The totalizer shall register in cubic meter units
- The initial totalizer reading should be less than 1KL
- The Register shall consist of a row of at least 5 in-line consecutive digits to denote minimum reading of 99999 KL. Another two digits or pointers shall register flows in litres and should be of a different colour.
- The totalizer should be of closed type.
- The totalizer must be suitable for test on an electronic test bench.
- Totaliser shall be made of copper CAN having 5mm thickness mineral glass or any other suitable material required to maintain IP 68 protection class

2.3.5 Metrological Characteristics

The meter's performance shall be as per IS 779 or ISO 4064 1993 with accuracy class B.

2.3.6 Pressure and temperature –

The mechanical water meter working pressure shall be at least 10 bar, The testing in accordance with IS 779 / ISO 4064. The meter shall be capable to operate in an ambient temperature of up-to 500 C.

2.3.6 Pressure loss

Through mechanical water meter shall not be greater than 0.25 bar at Qn and 1.0 bar at Qmax.

2.3.6 Endurance Test

The meters proposed should possess successful Life cycle/ Endurance Test Certificate as per IS 779 /ISO 4064- 1993 from Fluid Control Research Institute, Kerala.

2.3.7 Weight

Variation in weight of the meter will be permissible to $\pm 5\%$ of the weight indicated by the bidder in his technical bid.

2.3.8 Packing

Each meter should be supplied in separate individual box with brass nuts - nipples and test certificates. The no. of individual boxes of meters shall not exceed 30 nos in each carton.

B) AMR WATER METER – 50 MM to 100 MM (Woltman)

SPECIFICATIONS

Meter shall be manufactured in accordance with ISO: 4064 standards & have EEC or OIML/MID pattern approvals & shall bear EEC/MID marking on meter dial for each size.

1. The water meters of bulk water meters equipped with RF based AMR Technology, inbuilt / directly fitted on the meter and wireless, with removable mechanism, magnetic drive, dry dial, hermetically sealed register of IP68 protection class, Class-B water meters manufactured in accordance with ISO: 4064 standards & have EEC or OIML/MID pattern approvals & shall bear EEC/MID marking on meter dial for each size
2. Water meters of each size should have been duly tested and passed as per the relevant standards and specifications from Fluid Control Research Institute (FCRI) Kerala for performance test supported with test certificate.

2.2 Applicable Standards:

The bulk water meters should be Woltmann Type for 50 mm to 100 mme sizes, shall be equipped with RF based AMR technology, inbuilt/ directly fitted on the meter & wireless, with removable mechanism, magnetic drive, dry dial, hermetically sealed register of IP68 protection class, Class-B water meters manufactured in accordance with ISO: 4064 standards & have EEC or OIML/MID pattern approvals & shall bear EEC/MID marking on meter dial for each size

All sizes of water meters shall be with RF based wireless remote trans-receivers inbuilt/directly fitted on the meter & wireless for A.M.R. reading. The RF trans-receiver shall be of the same brand/manufacturer as that of the meter.

2.3 Detailed Description:

- The AMR bulk water meters, with removable mechanism, magnetic drive, dry dial, hermetically sealed register of IP68 protection class, Class-B water meters manufactured in accordance with ISO: 4064 standards & have EEC or OIML/MID pattern approvals & shall bear EEC/MID marking on meter dial for each size and shall be with protection class of IP-68.
- The water meters of bulk sizes shall be equipped with RF based AMR technology, inbuilt / directly fitted on the water meter.
- Water meters of each size should have been duly tested and passed as per the relevant standards and specifications from Fluid Control Research Institute (FCRI) Kerala for performance test as per ISO 4064 supported with test certificate.

2.3.1 Material:

2.3.1.1 Main Casting:-

- The meter body shall be manufactured of cast iron and shall be coated with a high quality fusion bonded powder coating inside and outside the meter body. The meter bodies will be flanged for connection above 50mm.

2.3.1.2 Register:

- The meter will have a magnetic coupling between the meter mechanism and the register. The register mechanism will be mounted within a copper housing and should be fitted with a mineral glass window or any other suitable material to maintain IP68 protection class.
- The register shall consist of both a direct straight reading numeric display and two dial displays with sweep hands. The main dial display will show the lowest unit of registration and the second dial display will show the tens of units Registers will be available in cubic meters.
- Registers will be available to measure consumption in cubic meters (m³).
- Indicating device shall be able to record in straight in-line digits a minimum 9999999 m³

2.3.1.3 Strainers :-

- A full range of strainers will be available in sizes compatible with the meters and will have the same general specification as the water meter.

2.3.1.4 Marking :-

Each water meter shall be marked with the following information

- Direction of flow of water on both sides of the meter.
- Serial number.
- Manufacturers name.
- Year of manufacture.
- EEC/OILM/MID Mark.
- Nominal Flow Rate

2.3.1.4 Metrological Characteristics :-

- The meters performance specifications shall be to ISO 4064 Class B performance.
- The meter offered will be able to meet the performance specifications laid out in the following table.

Nominal diameter (DN)	mm	50	65	80	100	125	150	200	250	300	400	500
	inch	2''	2''	3'	4'	5'	6'	8''	10	12	16	20

	es		1/2	'	'	'	'		"	"	"	"	
Nominal Flow rate Qn m ³ /h	N	15	25	40	60	100	150	250	400	600	1000	1500	
Max. flowrate (Qmax) m ³ /h													
Accuracy ± 2%	N	30	50	80	120	200	300	500	800	1200	2000	3000	
Transitional Flow rate (Qt)													
Accuracy ± 2%	N	3	5	8	12	20	30	50	80	120	200	300	
Min Flow rate (Qmin)													
Accuracy ± 2%	N	0.45	0.75	1.2	1.8	3	4.5	7.5	12	18	30	45	
Admissible peak flow (10 'max) *	m ³ /h	90	200	300	450	600	900	1000	1500	2500	4500	7000	
Head loss at Qmax *	bar	0.2	0.5	0.55	0.23	0.23	0.15	0.12	0.2	0.2	0.17	0.3	
Max. admissible temperature	°C	50											
Minimum Scale Interval	L	2						20					
Indicating Range	m ³	9999999,9						99999999					
Pulse Rate	L	100						1000					

* Average values

2.3.1.5 Testing and Approbation Certificates

- The meters must have passed the performance/accuracy test from FCRI, Palakkad, Kerala as per ISO 4064 1993. Copies of the relevant Approbation Certificates are to be provided by the Tenderer.

2.3.1.6 Headloss

- Meters shall show a loss of head not exceeding 1 Bar at Qn in accordance with ISO 4064.

2.3.1.7 Working Pressure

- The meters working pressure shall be 16 Bar with test pressure of 25 Bar.

2.3.1.8 Working Temperature

- The meter must be able to withstand a maximum working temperature of 50 Deg C.

2.3.1.9 Technical Specification of Dirt Box with S. S. Strainer

- The Dirt box shall be made of materials, which are not susceptible to electrolysis, corrosion and non toxic. The cover shall be fixed with the help of hinged bolts, nuts with rubber gaskets/packing for easy removal of the strainer basket and quick cleaning of dirt. The dirt box shall be of sufficient size and design to trap the silt and foreign materials so that the frequency of cleaning the strainer and dirt box is minimum/ optimal.
- The strainer basket shall be of rigid special web design made of stainless steel with perforated punched opening which provided largest possible area of filter element with minimum head loss.

- The strainer with dirt box shall be of doubled flanged flat machined faced type and details of the flanged shall be similar to that of water meter type WOLTMAN. The internal diameter of the strainer shall be same that of the corresponding meter.

2.3.1.10 Strainer Materials

- Body: C.I. IS:210 FG 200
- Strainer Frame : SS Perforated Sheet, SS 304
- Mesh (30) : SS Perforated Sheet, SS 304
- Gasket : Rubber
- Cover : C.I. IS:210 FG 200
- Stud / Bolts / Nut : IS:1363CL4.6 & CL4.0
- Eye Bolt : IS:1363CL4.6 & CL4.0
- Plug : 13% CR. SS (AISI 410)
- Flange Dimensions as per IS:1538 table 6/BS-4504 PN16

C) AMR SYSTEM

1. The water meters shall have the anti – magnetic properties / immunity, as specified in ISO: 4064 – 2005, when tested with 400 gauss magnet is mandatory. For AMR system resistivity against application of magnate is not required
2. The remote reading of AMR water meter needs two way communications without affecting battery life and reading perforations throughout O&M period.
3. The remote readings of AMR water meter, should be obtainable by either ‘Walk by’ or ‘Drive by’ methods.
4. The AMR trans-receivers shall be wireless and have IP 68 protection class i.e. no ingress of water after submerging AMR water meter for 48 hours under 3 meters of water column.
5. The AMR trans-receivers shall be used (RF End units/ Wireless RF transmitter/Receiver) for communication and remote reading. If the water meter & AMR trans-receivers are independent units then they must be from the same manufacturer
6. AMR shall be obtainable even under submerged conditions.
7. Remote readings of different water meters shall be obtained with single command. The remote readings shall have instant reading facility. The remote readings and dial readings of water meters shall match at all the times.
8. All A. M. R. readings shall show the date and time of the reading recorded.
9. The AMR system shall have facility to detect the reverse flow in water meters readings on the Hand Held Device (HHU) i.e. AMR reading device and on computer screen.
10. The AMR system shall have the facility to record the abnormalities like application of very high consumptions, water leakages etc. along with necessary alarms in HHU and in software
11. The battery life of AMR water meter shall not be less than 7 (seven) years from successful installation of said AMR water meter along with its AMR system, the battery life shall be calculated by considering the monthly remote reading. During remote reading the battery life of AMR water meter shall be displayed / indicated on HHU.
10. If the AMR communication frequency is using / operating on paid frequency band, then the AMR water meter manufacturer has to produce the valid copy of license issued by Govt. of India / Deptt. of Telecom (DOT), for using the said operating frequency band. The cost of the same will be presumed as included in the quoted rates.
12. The technically qualified bidders shall obtain license for using frequency band to conduct the demo in the area of demonstration. The bidder will have to start the demonstration within 10 days of submission of bids and hence they would be allowed to produce the certificate till such time.

13. The AMR water meter shall not get affected for its AMR functioning due to High Tension or High Voltage line concentration.
14. All the time electronic index of the water meter shall match with mechanical index.
15. All water meter shall be fitted with RF based wireless remote trans receivers for AMR reading. It shall be either inbuilt or directly fitted on the water meter without wires.
16. The water meters fitted with A.M.R. shall have the facility to transmit reading in maximum submerged condition (as specified for IP-68 compliance)& the remote readings should be obtained outside the meter chamber, with water meter in submerged condition & lid of the chamber closed.
17. The manufacturer shall specify the frequency of the AMR operating system & shall possess the necessary license of said operating frequency, as per norms of Department of telecommunication, Govt. Of India issued by Government of India (GOI) / Department of Telecom (DOT). In case, if he claims frequency of the operation in the free band, necessary documents / clearance from GOI / DOT shall be submitted, along with the offer. However, the RMC reserves the right for acceptance of offered frequency & Power subjected to the guidelines issued by DOT / WPC.
18. AMR system should be compatible for up gradation to fixed net work if required in future.

D) HAND HELD UNIT (HHU)/ AMR METER READING DEVICE

1. The hand held device or reading device shall have the sufficient memory for storage of maximum data / reading along with sufficient power back up.
2. The HHU or reading device shall have the onsite search facility, to locate the exact physical location of water meter in particular area and to obtain the corresponding details of it.
3. The HHU or reading device should be adjustable back light, sun light readable, colour display and touch screen.
4. The HHU or reading device shall have minimum 64 MB flash memory and 128 MB RAM.
5. The battery of HHU or reading device shall give power back up for at least 5 hours continuously.
6. The HHU or reading device must be ergonomically designed to be comfortable for handheld meter reading.
7. The handheld must come with an integrated intelligent fast charge capability that allows full charge within 5 hours.
8. The hand-held must have a 3G/GPRS connectivity for real-time data communication with central server and integrated Global Positioning System (GPS) for route monitoring and configuration.
9. HHU software should have at least three different level of security.

E)SOFTWARE

1. The software shall give output, at least in XML format and the data should be in standard format compatible to the RMC RMS system.
2. The Route Management software must be capable of running on a standard PC compatible with minimum Pentium processor; in addition the software must run under Windows95, Windows XP Professional, Windows Vista, Windows 7, windows 8 and / or latest version of windows operating system.
3. The software shall allow the PC operator to review and edit any account in Route Manager database. Also, the PC operator shall be able to generate route and activity reports. The 90 days historical data should be available in the route as well as the data along with historical data in the output in the XML/CSV/XLS format compatible To RMC Billing system without affecting the system performance throughout project period.
4. The software shall alert the meter reader for unread accounts in that route.
5. The software shall enable the user to specify the data to be exported from the database for transferring to billing system.
6. The software shall take routes from an existing database for loading into a reading device.
7. The software shall select the routes to be read, and assignment of routes to a reading device and dynamic updating of routes and sub-routes to be enabled.

8. The software shall upload routes from the reading device.
9. The software shall post the reading from the reading device onto appropriate accounts within the database.
10. Software shall be able to set meter status such as , meter not okay, reading not reliable, meter maintenance required etc
11. The GPS coordinates can be visualize in the PC software itself.
12. The software must have web portal access, so that user can view customer data (address, meter details, meter reading) through web browser. Also it should have analysis facility of meter data.
13. Addition to above specification, software should have facility for individual customer's to view their meter consumption data through web portal.
14. Development of software shall be done in coordination with RMC and software shall be property of RMC
14. Reading and billing shall be done with coordination with RMC and as per their project requirement.

F) ADDITIONAL SPECIFICATIONS:

1. HHU should have at least three different level of security or as directed by Engineer -in charge of RMC
2. In case of AMR reading, if reading not captured due to some reason, HHU should have capability to record to data manually along with route data to be downloaded with notification of cause of manual reading.
3. Different type of indications such as read meter/unread meters/meters to be read, meters read with observations , meter with alarm, unreadable meters/meter not okay, reading not reliable, meter maintenance required should appeared on HHU & BCS.
4. Since HHU integration for route monitoring and configuration is required, bidder should adopt off field method. However field experience should also be utilized to optimize the grouping of meters.HHU should also have the facility to create route, modify route on site and to arrange in desired sequence as per site conditions.
5. HHU should be a single unit with required storage capacity and capable to receive required data from already defined numbers of installed meters through radio frequency and to download the same to the base computer.

G) Water Meter Box for Multitjet (sizes 15mm to 100 mm)

SPECIFICATIONS

Material of construction: Weather resistant polyethylene (PE) or Polypropylene(PP) Compound/ Sheet Molding Compound(SMC)

- Colour : Sky blue
- Meter Box variant with built- lock can be locked using Allen key the built-in lock provided.
- Cutouts for passing pipe : The body has inlet and outlet windows to pass the pipe through .suitable for use with pipes of size up to 1"
- Material is Ultra Violate, Chemical resistance.
- Manufacturing process Should be injection moulding, it should not be fabricated/High pressure molded.
- Box top- Top shall be hinged to allow opening of more than 90 degree.
- Size:-8"x12"(200MM x 300MM) meter box enclosure size. (Contractor to verify the same)
- Height:- 190mm, (+_5% acceptable)
- Weight- Not less than 600 gm.

Installation:-

- 8" x 12"(200mmx300mm) can be installed permanently by fixing minimum 8 no. anchor SS bolts/nails with or Below ground level with providing cement concrete base,(1:1½:3) as and when required.

Meter Box Markings :-

The water meter enclosure shall be marked with the following identifications:

- Trade mark and/or name of the Manufacturer.
- Stamped with the initial Municipal Corporation Raipur on meter enclosure Top.

Application:-

- The meter box are design to protect the water meter from unauthorized Access and damage.
- The meter box are use in heavy traffic situation.
- After installation of Meter box it may be not effect the AMR system. Signal can not be lost due to the box.

Testing:-

Testing as per manufacturing QAP plan given.

Installation, Testing and Commissioning Of Water Meter Box

Scope of work

Installation, Testing & Commissioning of Water meter box with all labour, material, tools, tackles, site excavation, refilling etc complete required as per site clearance given by RMC

INSTALLATION OF WATER METER BOX

- The new water meter box are to be fixed on the service connections of consumers.
- The consumer data including name, address and other details shall be provided Municipal Corporation Raipur". Contractor has to submit the program of fixing of water meters box before actually starting the work.
- Contractor will have to prepare a data entry form as approved by Municipal Corporation Raipur which shall be filled at the time of replacement of new water meter box & subsequent replacement for repairs.
- Contractor shall suggest the preventive arrangement required to be made by the consumer to avoid damages to the installed new meter box. Issuing guide lines for suitable location and installation system, procedures etc. shall be the responsibility of Contractor.

General:

- All new consumers to be covered under this contract are spread throughout the project are of city. Municipal Corporation Raipur will provide the data of these consumers including name, address etc. Contractor will have to form specific zone wise groups of these consumers and prepare the program of replacement/ fixing of consumer water meter box of each group such that the water meter box of all the consumers in specific group shall be fixed within a specified period (not more than 30 days) and all the works are completed within the stipulated completion period as per site clearance given by RMC
- The Contractor's staff referred to in the Conditions of Contract shall include at least an approved skilled working installer to supervise the installation of the Works and sufficient skilled, semi-skilled and unskilled labour to ensure completion of the Works in time. The Contractor shall not remove any representatives, installers or skilled labour from the Site without the prior approval of the Municipal Corporation Raipur Engineer's Representative.
- The working installer who shall be deemed to be the Contractor's Representative shall be conversant with the installation, commissioning, operation and maintenance of the complete Works. Should there be more than one installer, one shall be incharge and the Contractor shall inform the Engineer's Representative in writing which installer is designated as his representative and is in charge.
- The Contractor's installation staff shall arrive on the Site on dates to be agreed by the Engineer's

Representative who will give to the Contractor one months' notice in writing of the dates on which they will be required. Before they proceed to the Site, however, the Contractor shall first satisfy himself, as necessary, that sufficient material of his (or his sub-contractor's) supply has arrived on Site so that there will be no delay on this account.

- The Contractor shall be responsible for setting up and installing the system to the line and level required and shall ensure that such Water meter box is kept in position while being built in.
- The Contractor shall furnish all supervision, labour, tools, equipments, rigging materials and incidental materials, such as bolts, wedges, anchors, concrete inserts etc .required to completely install, test and adjust the equipment.
- The Contractor shall submit in Schedule the list of tools, tackles and testing and calibration equipment with quantities which he proposes to use on the job at the time of bidding. The Corporation/Engineer's Representative reserves the rights of inspecting them during the execution of the construction and advice any additional equipment or increase in quantities that may be required to complete the job and the same shall be arranged by the Contractor.
- The Contractor shall move all material into the premises through the regular doors.
- The Contractor shall take utmost care in handling of the material.
- This item also includes necessary excavation in any type of strata as per site condition including dewatering and refilling of trenches (including dewatering by pump if necessary), cutting of existing line, threading of GI pipes /flanged welding of CI pipes, etc complete.
- This item also includes the necessary fittings required to install meter box .
- After installation of Meter box it may be not effect the AMR system. Signal can not be lost due to the box.
- For installation of meter box below ground level it may required concrete base (1:1½:3) for fixing the box.
- During time of meter box installation if water meter or line is damage charge of thesame is recover from the running bill.

Commissioning

- During commissioning the Contractor shall supply all labour to supervise, operate, keep in operation, repair, and do all things necessary to keep the water meter box.
- This shall include for the provision of such labour / staff during the first run period and for such other period of continuous operation as the Engineer's Representative may consider necessary to establish the efficient operation of the water meter box.

Supply of Consumer Water Meter Test Bench

The item includes supply of consumer water meter test benche capable of testing of water meters of sizes (15 and 20mm). This should include all the accessories, fittings, constant head tank etc. The water meter test bench supply should be as per the provision of ISO 4064.

Other key points to be noted with regards to this contract

1. The bidders need to provide along with their bid sample of 10 number (6 no of 15mm and 4 no of 20mm size) of consumer meters of the same model which the bidder has proposed for this tender. The accuracy and compliance of these meters will be tested by the client independently. The Technical bid will be declared responsive only after satisfactory compliance of the technical specifications provided in the bid for all these meters and subsequently the Financial bid will be opened.

2. The supply period of the contract is 6 months for the total quantity of ?????? meters which will be supplied in 3 lots of 5000/lot **and the schedule for delivery is 1st Lot – by end of 2nd month; 2nd Lot – by end of 4th month and 3rd lot – by end of 6th month of the contract.**

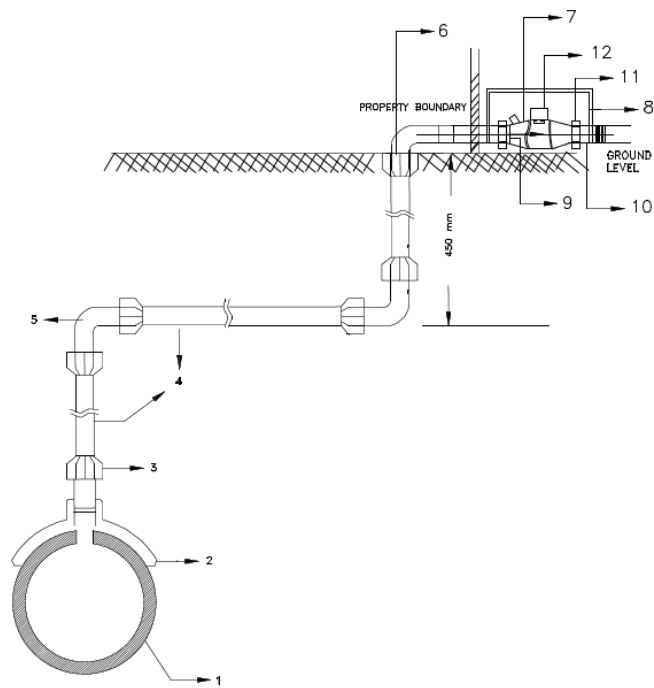
3. As a part of the inspection and testing requirements of the products, 1% of the meter supplied in each lot will be sent for accuracy testing at FCRI, Pallakad or any other authorized test benches as deemed fit by client. Based upon the outcome of the test results the lot will be accepted, otherwise the client may have the prerogative of rejecting the total lot and the supplier has to provide replacement of the total lot. The cost of the testing of the 1% sample meter at FCRI, Pallakad, Kerala need to be borne by the bidder.

Brief Scope of services for the 05 years Technical and spare parts support period

Apart from the 7 years Warranty on the products supplied, following are the minimum support which the supplier has to provide during the 7 year technical and spare parts support. This will be for a period of 7 years after completion of the 6 months supply period as set in the contract. These are included in the list below but not limited to:

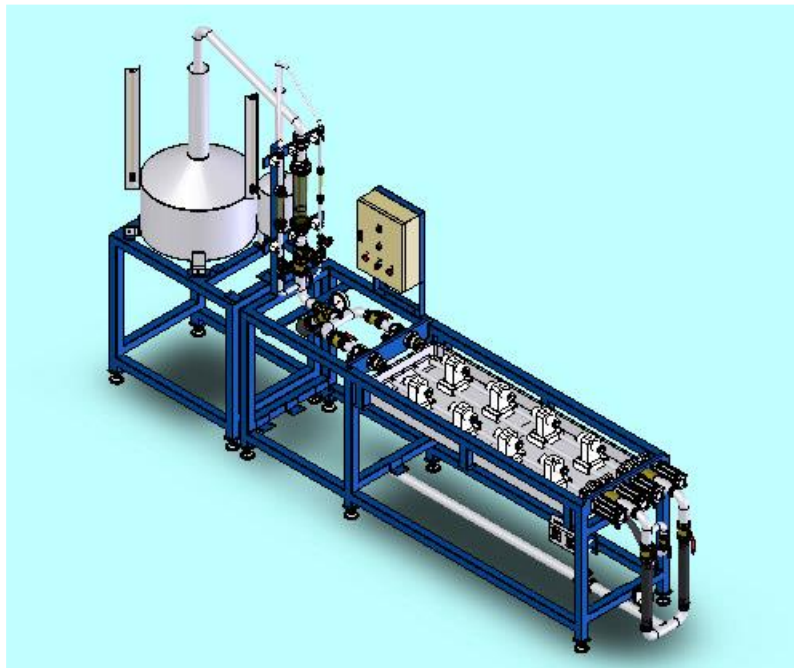
- a. Provide the necessary after sales support with respect to defects in the products supplied
- b. Provide the necessary stock of the spare parts of the meters which includes but not limited to register, spindle, bearings, pressure cap, totalizer, strainers etc during the period of Technical and spare parts support.
- c. The bidder need to make all necessary arrangements such that sufficient stock of spare parts and local logistic supports are available at Guwahati so as to ensure smooth operation during this 5 years Technical and Spare parts support period between the bidder and RMC.
- d. Provide support for fixing or replacement of the spare parts of the meters as and when required. The meter test bench which will be supplied by the bidder is planned to be installed in the RMC premises and the same place can be used as a workshop for fixing and replacement of the spare parts. However in case the meter test bench facility is not immediately available during the initial phase of the Technical and Spare parts support period the bidder need to make his own arrangements for premises where he can take up the spare parts fixing and replacement activity.
- e. Impart training to the technicians and staff in the meter testing, repair, recalibration of the meters etc. This will be part of the capacity building exercise which will provide the necessary expertise to the RMC staff to take up such activities independently in future. The training will be provided during the initial phase of the Technical and Spare parts support period to the RMC technicians and staff so as to develop the in-house expertise.
- f. Provide clarification in case of any technical issues encountered during this period on the functioning and operations.

TYP INSTALLATION SKETCH – AMR WATER METER



S.NO	DESCRIPTION
1	HDPE MAIN 110mm
2	PE80 ELECTRO FUSION TAPPING SADDLE WITH SS304 MALE THREAD
3	PP COMPRESSION METAL INSERT MALE THREADED ADAPTER
4	20mm MDPE PE 80 PN16 BLUE
5	PP COMP ELBOW (BOTH SIDE COMP END)
6	PP COMPRESSION METAL INSERT FEMALE THREADED ELBOW
7	15mm MULTIJET MAGNETIC WATER METER
8	PROTECTIVE PLASTIC REGISTRATION BOX
9	STRAINER
10	BRASS/BRONZE TAILPIECES
11	BRASS/BRONZE BODY NUT
12	METER PROTECTIVE PLASTIC TOP LID

Specification Water Meter Test Bench DN 15-25



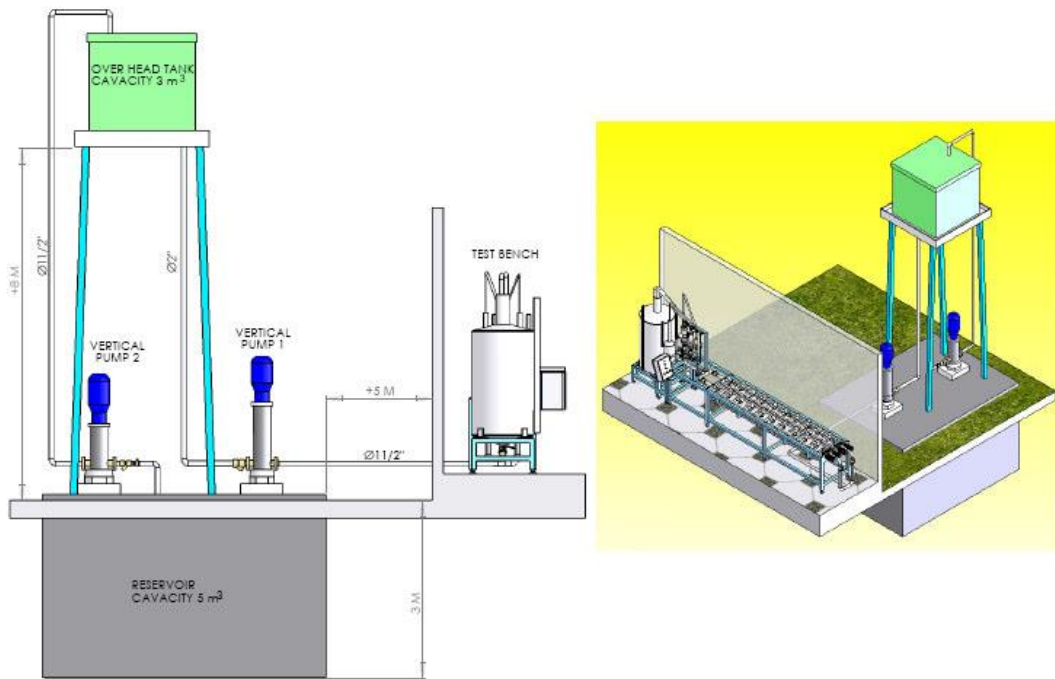
TECHNICAL DESCRIPTION

Meter Size	DN15 up to DN25
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TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

Number Of Meters	10 for DN 15mm 8 for DN 20mm 6 for DN 25mm
Flow rate	Maximum 10.000 l/h, minimum 10 l/h
Flow adjustment	3 lines, with flow ranges of : 10 to 100 l/h 100 to 1.000 l/h 1.000 to 10.000 l/h
Meter clamping	Pneumatic
Reference device	Two calibrated stainless steel tanks Calibrated tank 1 : nominal volume 100 liters, reading graduation 0.1 liter Calibrated tank 2 : nominal volume 10 liters, reading graduation 0.01 liter
Maximum pressure	10 bar (dynamic pressure)
Water supply	Open circuit using elevated tank (gravitational flow) for low flow rates and electric pump for high flow rates
Pump Capacity For Testbench	Vertical Multi-Stage Pump Flow 3-10m ³ /h □ Total Head 186m (18 bar) Liquid temperature range -25LC to 120LC Standart voltage 380-415Vac. 50/60 Hz. 15 Kw
Overall dimensions	Length 3300 mm x width 710 mm x height 1680 mm
Construction materials	Epoxy-coated mild steel for test bench frame; AISI 304 stainless steel for water tray, tanks and pipe work; engineering plastic (hard polyamide) for movable racks; copper alloys for water valves.

TEST BENCH INSTALLATION :



Fitting the compression joints

The compression joints, bend, adopters and other fittings shall be fixed as per the latest norms in this field

f. Fitting the nipples and pipes

Providing and fixing Polythelene- Aluminium- Polythelene (PE-AL-PE) composite pressure pipes confirming to IS 15450-2004 UV. Stabilised with carbon black having thermal stability for hot and cold water supply, capable to withstand temperature up to 80° C including jointing & testing of joints as per the direction of the engineer in charge. External work.

SPECIAL CONDITIONS

- (i) Tolerance limits for AMR meters with physical calibration shall be within the range of $\pm 2\%$ as applicable.
- (ii) If the AMR meter record incorrect readings which differ by more than 2%, a penalty of Rs.1, 000/- per each AMR meter shall be levied.
- (iii) Down time allowed for any AMR meter is 48 Hours and down time will be considered from the time of alert from AMR unit. If not functioning AMR unit that the agency personal should be thoroughly monitoring about failures and to take up down time from the actual time of failures.
- (iv) At any point of time, 99.5% of AMR meters shall work, and the non –functioning of AMR meters shall not exceed 0.5%.
- (v). At any point of time, less than 0.5% of AMR meters shall be allowed to be under repair stage. All the meters which are under repair over and above 0.5% shall be levied with a penalty @ Rs:3000/- per day. (vi) The contractor is required to adhere to the Programme of Schedule of manufacturing, testing, supplying, installation and commissioning of the AMR meters with in **the project duration** , failing which penalty at Rs.250=00 per uninstalled meter per day shall be levied up to a max. of **5%** of the Total Contract Value.
- (vii) Penalties for non performance of installed and commissioned AMR meters over the allowed period of two days shall be levied @ Rs.10, 000/- per day per each AMR meter up to 0.5% of AMR meters. Payments towards

balance 40% shall be arranged to the agency on annual basis. The initial 60% payments to the agency will start from the date of completion of successfully installation, testing and commissioning of AMR water meters after satisfactory performance observed for three months period.

(viii) On submission of bills by the contractor with due certification by the Engineer-in-charge.

(ix) With regard to the new water meters to be installed during the project implementation & CAM Contract period of five years (including warranty period), the operation and maintenance of those meters shall be total for a period of sixty (60) months from the succeeding month of installation and commissioning.

(x) The successful tenderer is required to impart training to RMC departmental staff during the aintenance period. The successful tenderer shall give provision/ screen / web services for accessing CAN wise meter readings live reading, hourly, monthly or for a specific period.

(xi) Attending repairs if any to the existing meter chambers and their maintenance is also in the scope of the contract.

(xii) The space required will be provided by the RAIPUR MC within the RMC premises if available to the Agencies for accommodating the test bench facility duly collecting the necessary rental charges as per market rates. If not the agency has to make its own arrangements and load the same in their on site comprehensive annual maintenance (CAM) Contract.

(xiii) If any existing valid FCRI approval certificates to meters will be considered, but as and when required the meters shall be sent to FCRI. Which shall be got approved from RAIPUR MC for performance test from the lot installed by the Agency and the charges for handling, Engineer's conveyance & stay etc charges shall be borne by the Agency.

(xiv) The Agencies have to prove that the GSM Technologies for AMR meters which varies from 25mm dia. to 300mm dia under this contract shall be integrated with the RMC's existing Revenue Billing System data base as per RMC's requirement and as directed by the RAIPUR MC Officers.

(xv) The formats shall be generated in the system by the successful Agencies in Tab/Comma Separated Value formats to integrate with the RMC Revenue Billing System on meter readings data on **hourly basis** daily, weekly and monthly report basis.

(xvi) The taxes, duties and other levies etc will be included in the capital cost & CAM cost to be quoted by the agency.

(xvii) The RAIPUR MC has under discretion may extend installation of new upcoming connections with AMR meters during the contractual period **up to 50% of tender quantity** and the payments shall be applicable as per the agreement with the successful bidder.

(xviii) Repairs to existing meter chambers / construction of meter chambers etc as per specifications is the job of the Agency, hence while quoting the rates the same may be considered.

(xix) The tentative list of water meters is enclosed at Annexure "C". The bidder may be required to install water meters on the water connections that may come up during the currency of the contract in the project area in future. This work will be carried out in consultation with & as directed by the RAIPUR MC. The bidder shall procure, supply and install all the water meters strictly against the written site clearance from RAIPUR MC. Prior to this, successful bidder shall conduct ajoint survey with RAIPUR MC officers of the sites where water meters are to be installed.

(xx) The selected eligible bidder has to provide the demonstration of his remote meter reading.

(xxi) Testing for **performance** would be as per ISO: 4064, Class-B standards etc; at FCRI, Kerala , and test report shall be submitted to RMC. The cost of the testing fees, traveling & lodging of all concerned including RMC engineers will be the responsibility of the bidder. full working order to RAIPUR MC after the project contract period.

Installation of AMR Compatible Meters

1) The bidder shall install the water meters as per **IS / ISO** installation standards & manufacturer's recommendations, at the existing locations of RAIPUR MC or at any other location, as per the program approved by RAIPUR MC. He shall also suggest the preventive arrangement required to be taken by the consumers to avoid damages to installed water meters. Issuing guidelines for suitable location & installation system / procedures, etc,

will be the responsibility of bidder.

2) The meters shall remain in bidder's custody in every respect at the risk of bidder till the expiry of the contract period. He should take all care to protect the meters from misuse, tampering, theft or any other damage. RAIPUR MC does not undertake any responsibility for damage or loss of installed meters. In case of damage or loss, the bidder shall repair or replace within a prescribed time period and will be responsible for making good the value of any Non revenue water that may result because of damage or loss of meters.

3) The bidder shall submit monthly progress & completion report of the work under the contract in duplicate to RAIPUR MC, along with soft copy of the same.

Maintenance of AMR Compatible Water Meters during the Contract period

1) The bidder shall give necessary test certificates in respect of all sizes of water meters along with entire A.M.R. system & shall provide comprehensive maintenance and support afterwards for 60 months after the installation period.

2) If any AMR meter is deliberately damaged it should be brought to the RMC Engineer in-Charge who in turn will give the enquiry report. Based on the enquiry report if proved RAIPUR MC will bear the cost the meter duly recovering the suitable charges from consumer. The bidder has to replace/ repair the AMR meter immediately without waiting for HMWSS payment to the bidder.

3) The accuracy of the installed water meters will be tested periodically, if desired or if disputed and if not found accurate within the acceptable / permissible limit, the bidders will replace the meter at free of cost. The installed water meters shall be the property of the RAIPUR MC and after the expiry of the contract period, the metering system shall be handed over in working condition to the RAIPUR MC at the end of the contract period.

5) In the event of breach of any conditions, the RAIPUR MC will recover liquidated damages to the extent of 10% of contract value and by forfeiting the Security Deposits and enter into a separate contract agreement with any other supplier.

6) After supply & installation of water meter, service facility should be assured in the bid. During the contract period, the bidder shall as and when required, carry out necessary repairs to the installed water meters or any parts thereof or replacement of entire meter if necessary, failing which the bidder is liable to pay the value of resulting NRW to RAIPUR MC.

7) The bidder shall not be entitled to claim any sort of concession, whatsoever on account of the rise in the prices of the articles in the market due to whatsoever reasons during the period of contract.

8) In case of any disputes, the RAIPUR MC will settle the disputes as per the existing policy.

9) The bidder must establish a local office equipped with telephones, fax machines, e-mail address etc with adequate manpower as a service centre. For removing / repairs of meters and fixing of meters, workman should be arranged by the bidder only.

SPECIFICATIONS FOR MULTILAYER COMPOSITE PIPES AND ASSOCIATED FITTINGS

1. MULTILAYER COMPOSITE PIPES (As per IS 15450:2004):

1.1. Description:

Co-extruded polyethylene composite pressure pipe as per IS 15450:2004 having welded aluminium tube reinforcement between inner and outer polyethylene layers being bonded to Aluminium tube by a melt adhesive with welded aluminium tube of itself being capable of sustaining internal pressures. The Composite Pipes will have pressure rating of 13.8 Kg/Cm² at 230 C. and 11.0 Kg/Cm² at 600C. The pipes should also withstand 6 Kg/Cm² pressure at 800C operating temperature.

1.2. Pipe Dimensional Details:

The dimensional details will be as under:

Description	Pipe Size						
	1014	1216	1620	2025	2532	3240	4050
Minimum Outside Diameter (mm)	<u>14</u>	<u>16</u>	<u>20</u>	<u>25</u>	<u>32</u>	<u>40</u>	<u>50</u>
Minimum Wall Thickness (mm)	<u>1.70</u>	<u>1.75</u>	<u>2.00</u>	<u>2.45</u>	<u>2.80</u>	<u>3.40</u>	<u>4.00</u>
Standard Coil Length (meters)	<u>200</u>	<u>200</u>	<u>200</u>	<u>100</u>	<u>50</u>	<u>50</u>	<u>50</u>
Minimum Aluminium Thickness (mm)	<u>0.20</u>	<u>0.20</u>	<u>0.25</u>	<u>0.25</u>	<u>0.30</u>	<u>0.30</u>	<u>0.30</u>
Minimum Outside PE Layer Thickness (mm)	<u>0.40</u>	<u>0.40</u>	<u>0.40</u>	<u>0.40</u>	<u>0.40</u>	<u>0.40</u>	<u>0.40</u>

2. ASSOCIATED FITTINGS:

The composite compression fittings shall be manufactured from engineering polymer blend with DZR brass inserts. The fittings when tested alone or in assembly with composite pipe shall comply with the requirement as required for the duty conditions applicable for pipe.

3. TECHNICAL PREQUALIFICATIONS FOR PE-AL-PE PIPE MANUFACTURER

- The Contractor must submit the copy of the BIS licence granting the ISI mark Certification for materials having BIS specifications and being used in the contracted job.
- The Quality Control Laboratory of the manufacturer should be well equipped to carry out all the acceptance tests specified in IS 15450:2004 standard. Having laboratory recognized by IAPMO India will be added advantage.
- The manufacturer of Pipes & Fittings must have ISO 9001-2008 certification for its Quality system.
- The contractor shall undertake to only supply materials manufactured by such pre-approved manufacturers.
- The contractor shall also obtain a letter of confirmation from the manufacturer that the manufacturer will be fully support the warranty given by the contractor and will also support and depute the engineer for testing the system so installed.
- The Contractor shall submit a note from the manufacturer for site testing procedure.
- The installed capacity of the manufacturer of PE-AL-PE Composite Pipes should be minimum 50 Lac meters per annum. The Contractor shall submit the certificate from the manufacturer on the available installed capacity at the manufacturing facility.
- The contractors must provide an undertaking from the manufacturer to have access to the factory to witness the manufacturing and testing facilities.
- The contractors must provide an undertaking from the manufacturer to the effect that the manufacturer will supply pipes, fittings and specials required for successful and timely execution of the project without any interruption irrespective of any possible dispute between the manufacturer and contractor.
- The pipe, fittings, specials as a system must pass all the tests specified in Annexure A of 15450:2004.

4. TEST PRESSURES FOR ON-SITE TESTING:

- Test duration should not exceed 24 hour.
- Maintain the test pressures at 1.5 times the operating pressure of the system.
- In no case test pressure should be more than 15 bar.

5. INSTALLATION PROCEDURE

The manufacturer's "users' manual for pipe & fittings" should be submitted for installation instructions in detail.

6. PRECAUTIONS:

- a) Pipe should be stacked carefully so as to prevent them falling or causing damage with any external sharp edged material.
- b) It must be ensured that end caps are retained when pipes are stacked in storage yard.
- c) Where pipe will be connected to heavy items such as pumps or valves, the pump or valve should be supported directly using the support brackets
- d) The pipe should be protected from any heavy load/impact and drilling or nailing etc.
- e) Where these pipes are provided under the ground, adequate top sand cover should be provided.
- f) Proper sand bedding must be provided for laying the pipe in trenches.

The rate to include providing and fixing of PE-AL-PE pipes upto 6 m length for each connection. If the length of pipes required to be increased beyond 6 m then the payment for the extra length of pipe shall be regulated by PHE unified SOR 2012 with upto date amendments as per

g. Fixing the ball valve

Providing, Supply and installation of PP/Composit Ball Valves in PN1.6 rating with one end compression using Blue colour compression nut in polypropylene material & other end with female threads Conforming to ISO:4422-4, certified from WRAS UK/KIWA etc. suitable for food products & drinking water, female threads in accordance with ISO:7/BS:21/ IS: 554 and shall be inclusive of all cost such as testing, all taxes related to central, state & municipal, inspection charges, transportation up to site, transit insurance, loading, unloading, stacking etc. complete.

h. Providing and fixing the protective box

Weight shall not be less than 850 gms.

- Load carrying capacity 15 Kg/ Cm² Certificate of Testing along with consignment - More than pedestrian load
- Unique lock and key arrangement shall be provided and least Metallic to be used to make it weather proof
 - Unique Pipe griping arrangement shall be provided to secure Water Meter Box in place.
 - Unique flap shall be provided to avoid mud/ sludge/ reptiles to reside inside
 - Can be mounted on wall as well as use on ground.

i. Testing and making water tight the complete system

After successful installation the complete system shall be checked for water tightness and any drops or leakage shall be rectified to the fullest satisfaction of the engineer in charge. The contractor shall take a signature of the person in whose house the connection has been installed, that the

1. Connection has no leakages in it
2. The site restoration work has been done satisfactorily
3. The ball valve is functioning properly.
4. The meter wheel is functioning properly
5. The contractor has performed the volume delivery test and the units in the meter are exactly matching with the volume of water

The rates quoted by the contractor shall be inclusive of all the above activities and specification except the the extra length of MDPE pipes which shall be regulated as per the clause g mentioned above.

The drawing shown above is for the general idea of the system to be installed at each house service connection, however the contractor shall consider other additional fittings also which are necessary and may get it complied in the prebid meeting.

Specification - Pilot-operated, hydraulic water-level and flow control valve

PN16 / PN25, Flanged Weir Type

Control parameters

The valve will Maintain a maximal water level in the elevated reservoir, stopping the inflow of water when the level reaches the maximal-allowed level. The valve will stay closed until the water level drops to a preset minimal value, and then open fully. While the valve is in opened position it will regulate the water flow rate to the tank. The rate of flow should be regulated within the whole range of potential flows.

The control valve should, in all the specified diameters, regulate in a stable accurate manner even if the flow velocity reduces to 0.2 m/sec as a standard feature. This should be possible without additional non-standard throttling device or using a smaller low-flow by-pass valve. The pressure losses inflicted by the above mentioned fully opened valve should not exceed 0.3 bar at nominal flow speed of 3 m/sec. The minimal required pressure differential for reliable closure should not exceed 0.1 bar. Closure time shall be controllable and shall not be longer than 5 minutes from fully-open position at minimal flow conditions.

Pilot-trim

The valve will be controlled by a two-positions electric float pilot, which is located in the tank, at maximal water level. The float pilot will be connected by electric wires to a battery-operated control unit that opens or closes the main valve by a latching (pulse) solenoid valve. At maximal water level, when the float is at horizontal position, an internal contact causes the control unit to set the solenoid valve to “close” position. When the level drops, and the float position is vertical- the internal contact reverses, setting the solenoid to “open” position.

The control unit will be energized by two standard 9V batteries. They will be able to activate the unit for one year, in case the valve is activated twice in an hour. The float pilot may be replaced by an electronic sensor of the static pressure of the water level. This sensor will activate the control unit the same way as the electric float- closing the valve when the water level reaches maximal value, opening it when the level drops to a pre-set, adjustable point.

When the main valve is in “open” position, it will regulate the water flow rate to the tank. The valve will be controlled by a pilot valve, which enables regulation of the whole range of potential flows, from almost zero to

maximal value. The regulated parameter will be the flow rate, not upstream pressure, due to varying demand along the supplying main.

Main Valve

The main valve is hydraulically operated, direct-sealing diaphragm valve. A diaphragm and a spring will be the only moving parts, and the diaphragm itself is the component that closes or opens the liquid flow. Oblique- shaped pattern of valves, larger than 150mm, is not allowed due to dismantling difficulties of the internal trim.

The standard basic valve has the capability to regulating at near zero flow, no low- flow devices such as a V-port or bypass valves are allowed.

The standard valve model **fits all control operations**, using different pilot control systems.

Valves at sizes 20mm to 250mm have a single control chamber and diaphragm, sizes 300mm and 400mm are assemblies of 2 control chambers and diaphragms, sizes 500 and 600mm are assemblies of 4 chambers and diaphragms, all actuated simultaneously by a common control circuit- as determined by the required control function.

The standard valve body is made of ductile iron, withstanding both high hydraulic and mechanical stresses. While the valve closes, the closure pace slows down, reducing the risk of water hammer.

The ratio between valve flow capacity (KV) and the valve position shall be linear so to allow stable regulation even under high pressure differentials and low-flow conditions.

Disassembly and reassembly of all the valve's components shall be made possible on site, without having to remove the valve from the line.

The valve shall contain a resilient, nylon reinforced rubber diaphragm.

Control-trim's fittings and devices will be produced of brass or SST and the control-tubes shall be flexible, reinforced polyethylene or higher grade and shall be hydrostatically tested with the main valve

The valve manufacturer should:

1. Hold a range of the requested valve type at least in the range of 50mm to 600mm
2. Prove a history of production of the requested valve type for over 20 years
3. Be certified to OHSAS 18001 and ISO 14001

Maintenance

- The bidder should propose a recommended five year set of spare parts per a batch of 5 valves of the same diameter and quote their price.
- The bidder should specify the warranty period.
- The valve should require low maintenance. No set periodic packing or parts replacement should be required.
- The valve's pilot control loop should include a low maintenance, inline "self-cleaning" control-filter.
- The typical weight of any control chambers and trim assembled as a complete unit, regardless of valve diameter, shall not exceed the permitted lifting weight for a single person as defined in the regulations. Disassembly will not require usage of sophisticated, heavy lifting devices such as cranes of any type. Should such devices be required – these are to be provided and installed at the assembly site by the supplier.

Material of Construction:

Body	Ductile iron to ASTM A536
Internal trim- metals	Spring- SST302
Internal trim-	Diaphragm- NR, Spring disc- GRP

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

Non-metallic parts	
Pilot	Body Brass EN12164, Elastomers NBR, Sleeve POM
Circuit fittings	Brass EN12164
Control tubes	Nylon
Surface Protection	Epoxy coating min. 150 microns, color RAL 5005 Blue Polyester coating min.100microns, color RAL 5005 Blue
Operation	Automatic, manual override enabled

System 1 Analysis of Clear Water Feeder Main feeding Existing and proposed OHT FR/SPom PS of Existing 150 MLD WTP

Label	Elevation (m)	FSL of OHR (m)	Qm ³ /h	Q future	Pressure Head (m)	DH valve	Control Valve	
AIIMS OHR (St-20M)	283	310	344	430	57	30	77-10-LCU/FR/SP	Ver. 2
Ama Seoni OHR (St-18M)	287	312	155	193	29	4	77-8-LCU /SP	Ver. 3
Amlidih OHR (St-20M)	290	317	344	430	55	28	77-10-LCU/FR/SP	Ver. 2
Bhatagaon OHR (St-20M)	283	310	344	430	68	41	77-10-LCU/FR/SP	Ver. 2
BoriyaKhurd OHR (St-20M)	287	314	235	293	64	37	77-10-LCU/FR/SP	Ver. 2
Changura Bhata OHR (St-20M)	286	313	344	430	63	36	77-10-LCU/FR/SP	Ver. 2
Daldal Seoni OHR (St-20M)	280	307	344	430	43	16	77-10-LCU/FR/SP	Ver. 2
Devpuri OHR (St-20M)	297	324	187	233	45	18	77-8-LCU/FR/SP	Ver. 2
Dindayal Nagar OHR (St-20M)	284	311	344	430	63	36	77-10-LCU/FR/SP	Ver. 2
Gogaon OHR (St-20M)	283	310	344	430	47	20	77-10-LCU/FR/SP	Ver. 2
Idgah Bahta OHR (St-20M)	296	323	344	430	49	0	77-12-LCU /SP	Ver. 3
Jarway OHR (St-20M)	281	308	344	430	50	23	77-10-LCU/FR/SP	Ver. 2
Jora OHR (St-18M)	290	315	71	89	49	24	77-6-LCU/FR/SP	Ver. 1

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

K U Mandi OHR (St-20M)	284	311	376	470	39	12	77-12- LCU/FR/SP	Ver. 2
KACHNA OHR (St-18M)	287	312	100	124	30	5	77-6-LCU/FR/SP	Ver. 1
Kabiranagar OHR (St-20M)	287	314	344	430	46	19	77-10- LCU/FR/SP	Ver. 2
Kamardih OHR (St-20M)	287	314	344	430	54	27	77-10- LCU/FR/SP	Ver. 2
Kota OHR (St-20M)	286	313	344	430	43	16	77-10- LCU/FR/SP	Ver. 2
Kushalpur OHR (St-20M)	289	316	215	269	56	29	77-8-LCU/FR/SP	Ver. 2
Lalpur OHR (St-20M)	294	321	344	430	52	25	77-10- LCU/FR/SP	Ver. 2
Mathpurena OHR (St-20M)	297	324	344	430	55	28	77-10- LCU/FR/SP	Ver. 2
Mowa OHR (St-20M)	279	306	344	430	46	19	77-10- LCU/FR/SP	Ver. 2
RDA 1 OHR (St-20M)	284	311	68	85	65	38	77-6-LCU/FR/SP	Ver. 1
RDA 2 OHR (St-20M)	283	310	48	60	67	40	77-4-LCU/FR/SP	Ver. 1
Ramnager OHR (St-25M)	287	319	526	658	42	10	77-12- LCU/FR/SP	Ver. 2
Saddu OHR (St-20M)	278	305	344	430	39	12	77-10- LCU/FR/SP	Ver. 2
Sarona OHR (St-20M)	278	305	344	430	64	37	77-10- LCU/FR/SP	Ver. 2
Shyamnagar OHR (St-20M)	287	314	355	443	58	31	77-10- LCU/FR/SP	Ver. 2
Vidhan Sabha	288	288	68	85	25	25	77-6-LCU/FR/SP	Ver. 1

Road resurfacing

- i. Construction of embankment with Material Obtained from Borrow Pits/Borrow Area (Construction of embankment with approved material/selected soil having C.B.R.>5 (unless specified otherwise in the contract) obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement.
- ii. Granular Sub-base as per Table:- 400-1 Construction of granular sub-base by providing graded Material, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface watering, rolling and compacting with vibratory power roller at OMC to achieve the desired density, complete as per clause 401
- iii. For Sub-base cum drainage layer or upper sub-base with Grading-VI Material
- iv. Dry Lean Cement Concrete Sub-base (Construction of dry lean cement concrete Sub-base over a prepared sub-grade with coarse and fine aggregate conforming to IS: 383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per table

600-1, cement content not to be less than 150 kg/ cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, laid with a paver with electronic sensor, compacting with 8-10 tonnes vibratory roller, finishing and curing).

ANNEXURE - “E-5”

1.1 Construction of RCC Overhead Reservoirs including water tightness testing complete at different locations of capacity and staging complete and 12 months of trial run as indicating below:

1.1.1 Scope of Work:-

The Tenderer Is Required To Complete The Work Of Provision Of Overhead And Ground Level Service Reservoirs including overflow pipes, incoming, outgoing pipes and scour pipes, digital level indicators with the a sensor to send signal to PLC SCADA Automation system including water tightness testing , installation and commissioning and 12 months trial run conforming to relevant IS Code.

- i. 1 Nos. OHSR of 1000 kL capacity @ 18 m staging at Amaseoni, in RAIPUR
- ii. 1 Nos. OHSR of 1000 kL capacity @ 18 m staging at Kachana, in RAIPUR
- iii. 1 Nos. OHSR of 1000 kL capacity @ 18 m staging at Jora, in RAIPUR
- iv. 1 Nos. OHSR of 2000 kL capacity @ 20 m staging at Devpuri, in RAIPUR
- v. 1 Nos. OHSR of 2500 kL capacity @ 20 m staging at Dunda, in RAIPUR

Including the Planning, Design, Construction, Testing, Commissioning and 12 months of trial run

All tanks will have central ventilation lantern. R.C.C. Stair case and Valve chambers

- Pipe line arrangement including providing and laying pipes and specials of required diameter, length as per attached drawing.
- Providing and fixing required Valves and Sluice gates .
- Providing and fixing of Lightening Conductor, Water Level Indicator, Aluminium Ladder, Railing, Manholes with locking arrangement and Ventilation hole arrangements, internal lighting arrangement and external campus electrification etc.
- Protection work all around the Reservoir, Weather Shield Apex painting, suitable colour enamel painting, cleaning, finishing and handing over finished work to the department.
- Contactoris to carry out topographical grid survet at all proposes site of OHSRS before starting the execution of work and to determine the average ground level.
- He will also carry out Plate load test at each OHSr to determine SBC and submit the report to PDMC.
- **The tenderers shall submit the general drawings of proposed OHSR i/c pipeline arrangement in Envelope ‘B’ of Technical Offer. They will further be required to submit detailed design, drawing, approximated quantities of cement, steel, pipes, valves, gates and specials etc and calculation in five copies within one month from the date of acceptance of their tender duly checked from the approved Engineering College, as directed by the Executive Engineer for scrutiny and approval from Competent**

Authority. The responsibility for design construction/structural stability and water tightness will however rest solely with the contractor which shall be carried out as per relevant IS Code.

- 1.2 The Service Reservoir should be circular in shape supported over circular columns. The depth of water in the tank shall be the difference of level between lowest supply and full supply level of the tank and shall not be greater than 5.0m for OHT's upto 2500 KL and 7 m for OHSRs above 2500 KL. The construction of such building works is not included in this lump sum contract except specified. Free board for the container of OHT shall be 30 cm.

2.0 GENERAL

- 2.1 The work of construction of R.C.C. Over Head Service Reservoirs involves specialised workmanship, hence requirement of higher standard than general concrete work is essential. The height of staging will be reckoned from an assumed ground level at the site and main road level to the site, i.e., the ground level at the site or road level whichever is higher shall be treated as the base level for determination of staging height. The contractor shall construct proper plinth protection surrounding the GL brace to give finished look after construction.

- 2.2 The contractor has to carry out plate load test at OHTs site to ascertain bearing capacity for all design purposes. At other locations the contractor can use other renowned practices but the SBC shall be got certified by the Govt Engineering / Polytechnic Colleges at the cost of contractor and also checked & verified by conducting suitable Soil Bearing Capacity conforming to relevant IS code. Indtz type tanks shall not be allowed.

- 2.4 **LIGHTING AROUND OHSRs:** Each OHSR shall be provided with a LED lighting fixture rated for 20 watt, 230V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The illumination lamp shall be operated by door switch or manual switch. Each of the OHTs will be illuminated with provision of luminaires using LED only.

- 2.5 **PAINTING ON PROPOSED OHSRs :** Painting 2 coats with approved shade of Synthetic Enamel paint having a warranty of five years of approved Make viz., Weathershield APEX over white cement primer all over the exposed R.C.C. surface of the overhead tank. Inside the tank 2 coats of cement wash will be provided as approved by the Engineer-in-Charge.

- 2.6 **RESERVOIR TYPE AND STRUCTURAL REQUIREMENT:**The Service Reservoir should be flat bottom circular in shape supported over circular columns. The difference of level between lowest supply and full supply level of the tank and shall not be greater than 5.0 m for 2000 kL and 1000kL capacity OHSR and 6 m for 2500 KL.

- 2.7 **WATER LEVEL INDICATOR FOR PROPOSED OHSRS:**The contractor shall provide the water level indicator as given below:

DigitalwaterlevelIndicator

Interval, event andlogarithmic data loggingoptions. Logrecordsallsetupandcalibrator; data as well as recorded readings,Pressure and TemperaturereadingsEasytouse,intuitive software. Firstinside 2inch (50mm)bore hole. User replaceable batteries. Designed forextened fielddeployment

Technical Specification

The digital water level monitoring system consists of two components: a logger at the top of the well

containing the batteries: and an SD-12 sensor unit at the bottom. Measurement occurs in the sensor unit. The sensor unit then applies a proven temperature compensation algorithm before digitally transmitting the calibrated pressure reading to the data logger. This allows the logger units and sensor units to be inter-changed. The cable is permanently attached to the sensor but can be detached from the logger. The Digital water level monitoring system is available with three standard length options or with a user defined cable length. Borehole mounting kits are also available. Digital water level monitoring system. Range 0-10m. Comprising; sensor 10m cable. Data logger and software.

3.2 **TRIAL PIT**

Contractors are advised to carry out their own trial pit section to get the idea of soil condition.

4.0 Steel Reinforcement :

4.1 The contractor shall have to arrange himself the entire quantity of steel required for the completion of the work under contract, No steel shall be supplied by the department. No extension of time will be granted by the department for non-availability of or non procurement of steel in time or late supply of steel or for any other reasons what-so-ever. Steel shall conform to relevant IS code.

4.2 The steel for reinforcement shall be ISI mark Thermo Mechanically Treated bars conforming to relevant IS code. a test certificate shall be required to be furnished to the department in support thereof. The stresses in steel for design purposes should be taken as specified in IS Code 3370 (Part-II) 1965 amended up to date.

The weight of steel shall standard & as per ISI

4.3 In additions, the contractor shall be required to get tested the random samples of the Steel brought at site to see whether they conform to relevant I.S. specifications. The cost of such tests shall be borne by the contractor.

5.0 The contractor shall have to make his own arrangement for requirement of electric power and telephone connections for construction work, if they desire these facilities. The department shall provide assistance by way of recommendation only.

6.0 For blasting operation, if required in foundation, excavation, the contractor will make his own arrangement for license, permits and blasting materials from competent authority.

7.0 The contractor will have to make his own arrangement for water, required for execution of the works. For testing of tanks, the department will provide water. However all other arrangement for testing of tank shall have to be made by the contractor at his own cost.

8.0 The tank will have a 1.2 m wide balcony all around the tank at bottom slab level.

9.0 The RCC stairs of 1.2 m width from ground level to the balcony at bottom slab level should be provided. The width of the R.C.C. stairs from balcony to roof of the tank shall be 0.70 m.

10.0 GI pipe medium class of 25mm dia, in three rows shall be provided for RCC stairs from ground level to balcony, around the balcony, one side on stairs from balcony to roof of the tank and around the roof slab.

11.0 The Railing post shall consist of 150 mm dia RCC posts having four nos. T.M.T. bars of 8 mm dia, 1.2 m clear height @ 1.2 m c/c. These bars shall be welded with the main reinforcement of RCC stairs, balcony and roof slab. The RCC post shall be very carefully fixed and embedded into concrete.

- 12.0 A steel ladder shall be provided from man hole on the top slab to the inside floor of the tank. The steel ladder 600 mm wide shall comprise of 2 nos. 100 mm x 12 mm steel flat section stringers and 2 nos 20 mm dia M.S. bar footrest at 400 mm c/c. The bars of 20 mm dia shall be inserted in to the flat section by drilling holes in the flat and the bars shall be welded with the flat from inside and outside. The ladder shall be finished at welded joints so that all sharp edges are removed. The ladder shall be painted with chlorine resistant epoxy paints.
- 13.0 To avoid any unauthorised person to climb the overhead tank, the entry at the bottom of the stair case should be closed with suitable arrangements.
- 14.0 Two C.I. Manhole covers and frame of approved quality 455 mm x 610 mm internal dimension weighing not less than 38 kg shall be provided. The weight of cover shall be 23 kg and weight of frame 15 kg.
- 15.0 Air vents wherever necessary shall be 150 mm dia swan neck type or ventilating shaft, as per design.
- 16.0 To avoid any accident at the time of cleaning or maintenance of the tank, the opening of the out let and scour pipes should be covered with aluminium Jali of suitable size.
- 17.0 **Lightening conductor** Copper Lightening conductor shall be provided & fixed with proper earthing arrangements as per relevant IS Specification.
- 18.0 **By-Pass Arrangement** While erecting CIDF / DIDF pipes for Inlet, Outlet and Overflow and scour pipe arrangement By-pass Arrangement shall be made directly connecting the Inlet pipe with Outlet Pipe before Inlet pipe entering the OHT and which shall have a controlling valve which will be closed always except when needed for Repairs, O&M of OHT.
- 18.0 **Water level indicator-** Water level indicator shall be as per para 2.7
- 19.0 **M.S. Clamps**The MS clamps 50mm x 10 mm should be provided at 3.0 M C/C for clamping all the vertical pipes, the clamps should be fixed in bracing with nut bolts.
- 20.0 **Painting**Painting of OHT, exposed surface of sump well & RCC pump house shall be done with premium smooth emulsion paint WITH FIVE YEARS WARRANTY WITH make SUCH AS WEATHERSHIELD APEX as per manufacturers specifications to give protective & decorative finish. The inside of container above water level and the roof from inside shall be painted with Epoxy paint to avoid corrosion due to chlorine. The horizontal piping shall be laid up to outlet inlet open flow chambers 5 m away from the outer column.
- 21.0 WORKMAN SHIP :
- 21.1 EXCAVATION :**
- The depth of excavation will generally be guided by the underground strata and the safe bearing capacity of the foundation soil and as directed by the Engineer-in-Charge. The contractor has to carry other tests of under ground strata/soil at his own cost. No payment will be made to the contractor for carrying out test or on account of any variation in the soil bearing capacity & design change due to strata. No dewatering shall be payable under any circumstances whether natural, artificial man made.
- 21.2 FILLING FOUNDATION WITH BED CONCRETE (Levelling course) :**

The foundation shall be laid over bed concrete (i.e. levelling course) of at least 150 mm thick or more, with at least 1:2:4 (M-150) concrete with 40 mm gauge graded metal or the prescribed mix as per instruction of Engineer-in-Charge and as per relevant I.S. Code.

21.3 REINFORCED CONCRETE WORK :

It shall be strictly as per Annexure 'E1' special condition. The concrete mix and minimum cement concrete specified in Annexure 'E1' shall be rigidly followed all RCC work shall be carried out as per IS 456:2000. Where the concrete has not fully hardened all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of the particle of aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 15 CM (or 6") in thickness, and shall be rammed against old work, particulars attention being paid to corners and close spots. Concrete should be thoroughly compacted and fully worked around the reinforcement around embedded fixes and into corner of the form work.

Styrene-Butadiene copolymer latex type admixtures may be used in the design mix concrete for improving the resistance to water penetration, abrasion resistance and durability. Admixtures based on sulphonated naphthalene for producing low water cement ratio high strength design mix concrete mix are permitted with prior approval of Engineer; however, the use of such admixture should not affect the workability of concrete adversely. Other admixtures, as per the requirement of site, may be used for designing the concrete mix with prior approval of Engineer and after establishing its use and advantages. **Nominal mix concrete** May be used for concrete of grade M 20 (1 cement : 1½ coarse sand : 3 graded stone aggregate 20 mm nominal size) or lower or if the quantity of concrete is less than 6 cum at a location on a single day subject to approval of Engineer.

Design mix concrete shall be used for concrete of grade M 25 and above.

The contractor shall get the Mix design approved from NIT Raipur or any other Civil Institute as approved by the Engineer. The Contractor shall not alter the approved mix proportions or the approved source of supply of any of the ingredients without obtaining the approval of the Engineer.

21.4 MEASURING (Concrete mix proportioning) :

The quantity of cement shall be determined by weight. The quantities of fine and coarse aggregates shall be determined either by volume or by weight. The proportion of fine and coarse aggregate shall be in accordance to para 8 of IS 456-2000.

21.5 MIXING :

Concrete shall be mixed in a mechanical mixer. Mixing shall be continued till there is a uniform distribution of the ingredients and the mass is uniform in colour and consistency but in no case the mixing shall be done for less than two minutes the contractor can use cement admixtures, plasticizers for enhancement of the quality of concrete but no extra payment shall be made on this account.

21.6 TRANSPORTING :

Concrete shall be handled from the place of mixing to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of any ingredients and maintaining the required workability.

21.7 PLACING AND COMPACTING :

The concrete shall be placed and compacted before setting could commence and should not be

subsequently disturbed. Methods of placing should be such that there is no segregation (Concreting) shall be carried out continuously up to construction joints, the position and arrangement of which shall be determined by the designer. When the work has to be resumed on surface which has hardened, such surface shall be roughened. It shall then be swept clean, then the roughly wetted and covered with a 12 mm layer of mortar which shall be freshly mixed and placed immediately before the placing of the concrete.

21.8 MECHANICAL VIBRATION :

When mechanical vibrations for compacting concrete are used, reduced water content should be adopted. Over vibration or vibration of very wet mixed is harmful and should be avoided when-ever vibration has to be applied externally the design of form work and the disposition of vibrators should receive special consideration to ensure efficient compaction and to avoid surface blemishing.

21.9 CURING :

The concrete shall be covered with a layer of old gunny bags or canvass or similar absorbent material and kept constantly wet for at least twenty eight days from the date of placing of concrete.

21.10 FORM WORK

21.10.1 The form work shall conform to the shape lines and dimensions as shown on the drawings and so constructed as to remain sufficiently rigid during the placing and compacting of concrete, and shall be sufficiently tight to prevent loss of liquid from concrete. Only well designed and proper steel form work shall be used.

21.10.2 The form work shall be cleared off. All rubbish particularly chippings, shaving and saw dust shall be removed from the interior of the forms before the concrete is placed and the form work in contact with the concrete shall be cleaned and thoroughly wetted or treated with an approved composition.

21.11 STRIPPING OF FORM WORK :

22.11.1 In no circumstance form work should be struck off until the concrete reaches the strength of at least twice the stress to which the concrete may be subjected at the time of stripping.

22.11.2 In normal circumstances i.e. temperature above 20⁰ C form work may be struck after expiry of the following periods as per IS 456-1978.

- (A) Vertical sides of slabs, beams and columns 48 hours.
- (B) Bottom of slabs under 4.5 M Span : 7 days
- (C) Bottoms of slabs over 4.5M Span : 14 days
- (D) Bottoms of beam under 6 M Span : 14 days and
- (E) Bottoms of beam over 6 M Span : 21 days

The form work should be left longer, as it would assist the curing. The number of props, their sizes and position shall be such as to be able to safely carry the full dead load of the slab, beam or arch as the case may be together with any live load likely to occur during curing or further construction.

2 MATERIAL :

22.1.1 Cement

- 1) The Contractor shall procure minimum 43 grade, unless otherwise stated separately confirming to BIS specifications, ordinary Portland cement, as required in the work only, from reputed manufacturers such as Ultra Tech, Grasim, Birla Uttam, ACC, Gujarat Ambuja, Cement Corporation of India, Vikram, J.P. etc. of cement having a production capacity of one million tones per annum or more, and as approved by Employer, Ministry of Industry, Government of India and holding license to use BIS certification mark for their product, whose name shall be

got approved from Engineer-in-Charge. Supply of cement shall be taken either in silos or in 50 kg. bags bearing manufacturer's name and BIS marking. Samples of cement arranged by the Contractor shall be taken by the Engineer-in-Charge and got tested in accordance with provisions of relevant BIS codes. Cost of such tests shall be borne by the contractor. In case test results indicate that the cement arranged by contractor does not conform to be relevant BIS codes the same stand rejected and shall be removed from the site by the Contractor at his own cost within one week time of written order from the Engineer-in-charge.

- 2) The cement shall be brought at site in bulk supply of approximately 50 tonnes from the manufacturer direct, or as decided and approved by the Engineer-in-charge, as the case may be.
- 3) The cement godown of the sufficient capacity should be constructed by the contractor and at all time it should have a stock of minimum of 2000 bags. The contractor shall facilitate the inspection of the cement godown by the Engineer-in-Charge at any time. Storage of cement shall be as per CPWD specification.
- 4) Cement brought at site and cement remaining unused after completion of work shall not be removed from site without written permission of the Engineer-in-charge.

22.1.2 TOR / TMT Steel

- i) The contractor shall procure TMT 500 steel reinforcement bars and structural steel conforming to relevant BIS codes (BIS code 1786-1985) from main producers such as SAIL, TISCO, RASHTRIYA ISPAT or as approved by the Ministry of Steel. The steel reinforcement, structural steel shall be brought to the site in bulk supply of 10 tonnes or more or as decided by the Engineer-in-Charge. For small or occasional quantities of TOR steel reinforcement bars that less than 10 MT, the Engineer-in -charge may authorize the contractor to purchase the same from authorized dealers of the approved manufacturers. The contractor shall have to obtain and furnish test certificates to the Engineer-in-Charge in respect of all supplies of steel brought by him to the site of work. Samples shall also be taken and got tested by the Engineer-in-Charge as per the provisions in this regard in relevant CPWD/BIS codes. Cost of such tests shall be borne by the contractor. In case the test results indicate that the steel arranged by the contractor does not conform to CPWD/BIS codes, the same shall stand rejected and shall be removed from the site of work by the Contractor at his cost within a week's time after written orders from the Engineer-in-Charge.
- ii) The steel reinforcement, structural steel shall be stored by the contractor at site of work in such a way as to prevent distortion and corrosion. Bars of different sizes and lengths shall be stored separately.
- iii) For checking nominal mass, tensile strength, band test, re-band- test etc. specimen of sufficient length shall be cut from each size of the bar at random at frequency not less than that specified below: -

Size of Bar	For consignment below 100 tonnes	For consignment over 100 tonnes
Under 10 mm dia	One sample for each 25 tonnes or part thereof	One sample for each 40 tonnes or part thereof.
10mm to 16 mmdia.	One sample for each 35 tonnes or part thereof	One sample for each 45 tonnes or part thereof.

Over 16 mm dia	One sample for each 45 tonnes or part thereof	One sample for each 50 tonnes or part thereof.
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- iv) **Steel brought to site and steel remaining unused shall not be removed from site without the written permission of the Engineer-in-charge.**

22.1.3 PLACING :

All reinforcement shall be placed and maintained in position shown in the drawing. It is very difficult and costly to alter concrete once placed. It is, therefore very important to check the reinforcement and its placing before being covered.

22.1.4 SIZE AND QUALITY OF STEEL BARS :

The steel bars used for reinforcement shall be strictly as per relevant IS Specifications, and the contractor shall have to produce the test certificate of the Steel to be used.

22.2 AGGREGATES :

All aggregates shall conform to all provisions and test methods of IS 383-1970

22.3 STORAGE OF MATERIALS :

Cement shall be stored properly in a dry ventilated buildings.

23.0 DESIGN CONCRETE MIX :

23.1 The contractor shall submit mix designs for each strength the proposed slump proportional weight of cement saturated surface, dry aggregates and water. The mixes shall have to be designed as per relevant I.S. Specification.

23.2 The proportion of the concrete shall be such as to work readily into forms angles and ground the reinforcement without excessive manipulation, segregation of water gain.

23.3 The water content shall not be increased from the amount required by the design mix unless cement at required water cement ratio added. The Engineer-in-charge may require additional cement without extra compensation to the contractor if he considers that concrete does not produce the required strength.

24.0 TESTS IN GOVT APPROVED LABORATORY:

24.1 All tests as specified in the I.S. Specifications codes and required for the execution of the work shall be carried out by the contractor at his own cost in a Govt. approved Laboratory as per instruction of Engineer-in-charge.

24.2 FIELD TESTS :

The contractor shall provide all arrangements for field test to exercise proper quality control over works specifically for test mentioned under para 25.1. The contractor will also establish a field Laboratory consisting of all relevant equipment as given below as required for testing of materials such as aggregate, sand, cement, steel, Bricks, Concrete Cubes, and crushing machine with calibration duly certified by Government Engineering/ polytechnic college.

- 24.3 All double flanged pipes shall be ISI mark (D.I. pipe conforming to relevant IS code) and D.F. cast iron puddle collars, bell mouths and other specials required for inlet, outlet, over flow and scour shall be ISI mark conforming to IS 1538:1976 required for inlet, outlet, overflow and scour will be supplied and fixed in position by the contractor from desired inside level of the tank to duck foot bend one metre below G.L. and further providing and fixing all double flanged D.I. Pipes and specials from duck foot bend on ward up to minimum 5.0 m outside the supporting structure of the tank (i.e. RCC column) shall also be supplied and fixed by the contractor including testing of the fittings and joints with cost of the materials and joints. All the fittings shall be cast iron mechanical joint fittings suitable for DI pipes as per I.S. Specifications.

The arrangement for inlet, outlet, overflow and scour pipes shall be such that all these pipes and independent of each other and each of these shall have bell mouths at their ends. The top of bell mouths of inlet and over flow shall be at F.T.L. and top of bell mouths of outlet shall be 15 cm above floor of the tank, where as the bell mouth of scour pipe shall be flushed with floor level. All these vertical pipes shall terminate with flanged duck foot bends bottom fixed one meter below ground level. Further D.F. pipes should be provided up to minimum 2.0m away from the supporting structure of the tank.

All these duck foot bends shall be fixed with sluice valves class PN 1.6 of IVI/IVC/Kirloskar/VAG/Zolotto make with dismantling joints. The contract also includes providing and fixing of sluice valves, RCC Valves chambers and chamber covers. The size of valve chambers shall be such that a clear space of minimum 500 mm is available on all sides of the valve. All the valves, fittings and pipes and specials shall be third party tested.

All the pipes and specials required for above shall be fixed during concreting. Specials which are to be embedded in concrete shall have puddle collars at the centre of concrete thickness.

The dimensions of the CI/DI/MS DF pipes shall be as under: -

Note – All the CI/DF/ DI DF/MSDF pipes, valves & specials should be duly inspected and approved by DGS&D/SGS/RITES. The pipes above 500mm shall only be MS DF pipes/ CI/ DI DF pipes, for diameters below 500mm shall invariably CI/DI DF pipes

- 24.4 Scour pipe of OHT should be connected to the nearest natural drain/sewerage line lable with pipes and other required specials provided by the department but including ng by the contractor.

25.0

HYDROSTATIC TESTING OF LIQUID RETAINING CONCRETE STRUCTURES

The contractor shall make all arrangements including provision of water for hydro-testing of liquid structures as per IS: 3370, temporary bulk heads, pressure gauges, pumps, pipelines, etc. Hydro-static test for water tightness shall be done upto top level of structure, as may be directed by the Engineer in charge. This test shall be carried out preferably in dry season in accordance with the procedure given below:

The water tightness test shall be carried out when the structures are ready for filling. Before the filling operation is started, the structure shall be jointly inspected by the Engineer and the Contractor's representative and the condition of surfaces of wall, contraction and expansion joints shall be noted and it shall be ensured that jointing material filled in the joints is in position and all openings are closed. The filling of the structure then shall be carried out gradually at the rate not exceeding 30 mm rise in water level per hour and shall preferably extend over a period of 72 hours. Records of leakages

starting at different level of water in the structure, if any, shall be kept. The structure once filled shall be allowed to remain filled for a period of seven days before any readings of drop in water level are recorded. The level of the water shall be recorded again at subsequent interval of 24 hours over a period of seven days.

The total drop in surface level of a period of seven days shall be taken as indication of the water tightness of the structure, which for all practical purpose, shall not exceed 40 mm or the provision of relevant international code. If the structure does not satisfy the conditions of the test and a daily drop in water level is found, the period of test may be extended for a further period of seven days and if the specified limit is then reached the structure may be considered as satisfactory. The Engineer shall decide on the actual permissible nature of the drop in the surface level, taking into account whether the structures are open or closed and the corresponding effect it has due to evaporation losses.

In case of structures whose external faces are exposed, such as elevated structures, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days, after allowing a seven day period for absorption after filling with water.

Each compartment/segment of the structure shall be tested individually and then all together.

Backfilling of earth on the sides for underground or partly underground structures shall be withheld till the structures are hydro statistically tested and found leak proof to the entire satisfaction of the Engineer.

Any leakage that may occur during the hydro-test or subsequently during the trial run period shall be effectively stopped either by cement / epoxy pressure grouting, guniting or such methods as may be approved by the Engineer in charge. All such rectification shall be done by the contractor to the entire satisfaction of the Engineer at no extra cost to RMC. The tank & sump well will have to be tested for the water tightness as per IS 3370 and it will be the responsibility of the contractor to make it water tight. Any defects, shrinkage or other faults which may appear within six months from the commissioning of the tank arising out of defective or improper materials or workmanship are upon the direction of the Executive Engineer to be amended and made good by the contractor(s) at his/their own cost and in case the contractor fails to rectify the defects the Corporation/ RAIPUR MUNICIPAL CORPORATION of C.G. may recover from the contractor (s) the cost of making good the works.

The arrangements of water for construction and testing shall be done by the contractor at his own cost.

For testing purposes, the contractor will have to conduct a test of water tightness of the reservoir & sump well to the entire satisfaction of the department. The responsibility of structural stability shall also rest solely with the contractor. The refund of earnest money and security deposit contemplated in the agreement clause 15 shall be refunded only after expiry of defect liability period after the satisfactory commissioning of tank.

- 26.0 No charges for the plastering if required for proper finishing of the surface of structures shall be paid under any circumstances.
- 27.0 The contractor shall be required to submit the detailed completion drawing in six copies of

- the work immediately on completion of the work.
- 28.0 The work shall be treated as completed when the same is completely tested and handed over to the department including site clearance.
- 29.0 The tenderer should give at time of tendering the outline of architectural appearance, design and drawing.
- 30.0 The tenderer shall have to produce the complete design and working drawing of each component of structure before starting of work and get the same approved by the Engineer –in-charge.
- 31.0 Special considerations should be given in the preparation of design for seismic forces.
- 32.0 The structural design of R.C.C. service reservoir shall be done on continuity theory and rotation of joints.
- 33.0 Due consideration for wind pressure should be taken in the design of structure, as per provision of relevant IS specification, the wind pressure may be take as per the wind pressure map of India in IS 75 – 1964 with special consideration to the previous experience of wind pressure experienced in the locality.
- 34.0 All duck foot bends shall be fixed and anchored properly in concrete blocks to prevent any displacement of pipe due to water trust.
- 35.0 The contractor may note that the department may not be in a position to acquire or make available sufficient land (space) for collection, storage of construction materials and equipment's and working. It shall therefore be contractor's responsibility to make arrangement of land space for this purpose.
- 36.0 In case there is any delay in land acquisition by the department by the concerned competent authority the contractor shall only be allowed extension of time on this account. No compensation for financial claim shall be accepted.
- 37.0 If under unavoidable circumstances or for reasons beyond control of the department, the proposed site of construction of tank is required to be changed/shifted, the contractor shall have to take up construction at alternative site, and the contractor shall not have any claim on this account.
- 38.0 The R.C.C. elevated tank shall be designed, executed and tested in accordance to relevant I.S. Specification.
- 39.0 The firms/contractors are directed to submit the details plan and elevation of all the overhead tanks showing all components and other details.
- 40.0 The contractor shall set up an office with an access to RAIPUR MUNICIPAL CORPORATION official with proper seating arrangements.
- 41.0 The contractor shall provide one AC Bolero/ Scorpio vehicle with driver and POL for inspection work during the entire work period exclusively for RAIPUR MUNICIPAL CORPORATION officials.
- 42.0 The contractor shall propose colour scheme with at least three alternatives and after approval only the work shall be started.
- 43.0

44.0 All the valves and electromechanical fittings shall be SCADA & PLC compatible with actuators for implementation of SCADA in future.

45.0 The successful bidder shall assist the RAIPUR MUNICIPAL CORPORATION in the process of getting the grants from State/ Central Governments.

46.0 The contractor has to procure and install INFORMATION board's displaying Name of work at the location given by RAIPUR MUNICIPAL CORPORATION at his own cost.

Change in design due to strata, no dewatering in any condition shall be payable. The foundation shall be filled with minimum 150mm thick leveling course in cement concrete grade M-15 with 20mm metal.

R.C.C. STAIR CASE & VALVE CHAMBERS:-[A] R.C.C STAIR CASE:-

Suitable R.C.C. Staircase of grade M-25 concrete from ground level to top of roof Reservoir along circumference with 25 mm dia medium class G.I. railing .The riser should not be more than 150 mm and tread should not be less than 300 mm. The width of stair shall not less than 1500 mm. The flight of minimum 1500 mm wide should be provided after not more 12 numbers steps.

[B] VALVE CHAMBERS:---The valve chambers for each valve of grade M-20 concrete should be constructed as per tentative drawing given Annexure I.

[III] PIPE LINE ARRANGEMENT:----

PIPES:-

[1] Each compartment shall be provided with be provided with Inlet pipe, Outlet pipe, Overflow pipe and scour pipe as per Annexure F. Thus, there will be one Inlet, one Outlet, one Overflow and one scour pipe in each compartment of the reservoir.

The inlet pipe shall be as far away from the outlet pipe as possible and outlet should be 15 cm. above the floor level so as to keep it above deposited sediment at bottom of reservoir.

The scour pipe shall be provided at the bottom. The top of bell mouth on inlet shall be at FTL and overflow about 5 Cms. above the FTL. The overflow in any case shall not be connected to the outlet pipe.

The cast iron or stainless steel grates of 20 mm x 20 mm on enlarge diameter of bell mouth of outlet and scour pipes shall be provided in order to avoid the accident during maintenance.

Specifications :-

The D.I. Double Flanged pipe should be as per B.I.S. specifications and while double flanged cast iron pipe should confirm to I.S. 7181 latest edition.

(B) Specials:-

All specials required for this work of pipe line arrangement, such as duck foot bends, puddle collars, bell mouths, bends, tees and end caps etc. shall be provided and fixed in position as per relevant I.S.

The bell mouth required to be embedded in the concrete should be specially manufactured with their collars as per requirement. The duck foot bend of all the pipe shall be grouted minimum one metre below ground level.

(IV) Valves and Gates:-

The contractor should provide and fix in desired position the valves and gates for easy and effective working.

All valves should be I.S. mark and inspection and testing certificate should produce to engineer in charge.

The double-faced sluice gate has been provided to pass water flow from one compartment to other compartment. In close position gate face should be capable of resisting water pressure force. There should be no leakage in closed position when water pressure of full depth on one side and other side being empty.

Flow Measurement :-

The arrangement for water quantity reaching to the tanks by providing & installing in position electromagnetic flow the metre of suitable diameter in inlet pipe should be made by the contractor. The flow meter should be of standard make EMERSON/KROHNE MARSHALL/YOKO GAMA or equivalent.

(V) Lightning conductor, Water level indicator, MS ladder, Railing, Manholes, ventilation holes arrangement, Internal lighting arrangement and external campus lighting arrangements etc.

Lightening conductor:-

The arrangement for lightening protective system for protection of service reservoir should be made as per I.S. 2309 – 1969 C revised up to date.

The Lightening protective system should be designed, installed and tested as per this code and all components of the system should also be provided as per specification mentioned in this code .

Water Level Indicator: -

Each tank should be provided with water level indicator. Thus sufficient water level indicators shall be provided in reservoir. Water level indicator shall comprise of PVC float which should be 10 cm. more in diameter than outlet pipe. The plate shall have turned edged to accommodate and to make easy movement of counter weight made of iron pointer fixed with guide pulley provided with white enamel paint write up with radium blue or black colour letters. It shall be fixed on container wall.

Steel Ladder :-

The MS ladder from top of roof to the inside bottom of container shall be provided. It shall be 600 mm wide consisting of 2 No. 100 mm x 12 mm flat iron as stringer of 2 No. 20 mm dia MS bars @ 400-mm. c/c as foot rests. Ladder shall be rigidly fixed.

Ventilators :-

The suitable air vent shall be provided as directed by Engineer-in-Charge.

Electrification:-

The electrification inside and outside should be done in such a manner that standard level of illumination is obtained inside the reservoir and in the campus. All electrical fixtures, wires etc. shall be ISI marked. The wiring shall be copper wiring and concealed.

(VI) Protection work all around the Reservoir, Weather Shield Apex painting suitable colour enamel painting, cleaning, finishing and handing over finished work to the department :-

Protection work around OHSR :-

Protection work all around the OHSR shall be provided. It shall be circular in shape and 5m in width around the outer edge of wall. It shall have 1:60 slope from center and a drain be constructed all around the tank. The protection work shall be in M-15 grade concrete.

Weather Shield/ Apex painting :-

Two and more coats suitable colour Weather Shield Apex as directed by Engineer-in-Charge shall be done with necessary curing after the testing of water tightness.

Colour enamel painting :-

All iron work, railing and pipes etc. shall be painted with two or more coats of black Japan or suitable colour enamel paint over primer as directed by Engineer-in-Charge.

Finishing :-

Although concrete shall be off shutter finish means no plaster shall be applied over concrete to make It finish but in unavoidable circumstances if plaster is done, then no extra payment shall be made

Inspection & testing of concrete structure :-

In order to ensure that the construction complies with the design and all the structural requirement, clause No. 17 of IS 456-2000 shall be followed. It should also be noticed that during construction the settlement of sump due to self weight during construction should be noticed by proper procedure

Water Tightness Test

After the completion of structure it shall be tested for water tightness.

Initially the sump shall be filled gradually to ensure uniform settlement all over the area. The full supply should reach in a period of not less than 72 hours. At the time of testing verticality of sump should be checked by theodolite as per IS 3370 (part I general requirement) code of practice for concrete structures for the storage of liquids specifies water tightness test at full supply level.

After seven days period for observation after filling with water the external face of sump should not show any sign of leakage and remain apparently dry.

The water for testing and pump for lifting water shall be arranged by the contractor at his own cost.

The contractor shall give the test for water tightness to the entire satisfaction of the department.

The responsibility of structural stability shall solely be rest on the contractor.

The contractors are advised to visit the site of RCC Reservoir and see the availability of land etc.

The department shall not be responsible to provide extra land for any purpose. It should also confirm the lead lift etc of material brought to site regarding any matter, no claim shall be entertained.

In case there is delay in handing over the land to the department by the concerned competent authority, the contractor shall only be allowed extension of time on this account. No any other claim shall be entertained on these accounts.

If under unavoidable circumstances or for reason beyond control of the department, the proposed site of construction of sump is required to be changed/shifted the contractor shall have to take up construction at alternate site or if design change due to any reason, the contractor shall not make any claim on this accounts.

ANNEXURE - “E-5”- O&M for 5 years including replacement and warranty

- 1) **Operation and Maintenance of 80 MLD proposed WTP, PLC SCADA automation & monitoring control system covering all existing WTPs (150 & 80 MLD), existing and proposed WPS, CWPS, OHSRs, bulk flow meters & 38 nos pilot operated hydraulic water level & flow control valves complete for 05 years including replacement and warranty.**
- 2) **5 years Operation and Maintenance including replacement and warranty of all new raw water clear water pumps, Electromagnetic flow meters and Pilot-operated, hydraulic water-level and flow control valve and all electrical actuated valves provided by the Contractor.**

The Contractor shall operate and completely maintain the the following installations for 05 years including warranty and replacement:

- 1) Proposed Water Treatment Plant (80MLD) for a period of 05 years (60 months) including all civil, Electro-mechanical equipment including the clear water pump house, PLC –SCADA Automation system including clear water pump house including replacement and warranty.
- 2) Raw water sump cum-Pump House – 2 nos
- 3) Existing 150MLD WTP and 80 MLD WTPs including the existing clear water P/houses complete for 05 years including replacement and warranty.

For maintenance services of the new installation works including civil works under this Works during the defect liability period, the contractor shall have to carry out all works as per its obligation under the contract free of cost. All necessary repairs shall be made to maintain the WTP during the above period as per the status at taking over. After the successful 12 months Trial Run of the 80MLD WTP including clear water pump house, 150 MLD & 80 MLD existing WTP, Raw water intake well cum pump houses – 2nos., the Contractor shall operate and maintain :

- (1) Proposed Water Treatment Plant (80 MLD) for a period of 05 years (60 months) including all civil, Electro-mechanical equipment including the clear water pump house, PLC –SCADA Automation system including clear water pump house including replacement and warranty for 05 years.
- (2) Raw water intake wells cum pump houses-2 nos including civil structures all pumps and panel etc complete for a period of 05 years including replacement and warranty.
- (3) Existing 150 MLD WTP and 80 MLD WTP for a period of 05 years including replacement and warranty.
- (4) AMR compatible system based on GSM technology including all the water consumer meters and software including replacement and warranty.

The contractor will carry out the complete operation and maintenance of the all the above mentioned installations for 05 years including supply, replacement of electro-mechanical parts/equipment, repairs, repairs to civil structures, distemping and painting of structures at no extra cost to the Municipal Corporation.

The complete operation and maintenance, services shall be performed according to the following principles/specifications:

Minimum down time	<p>The WTP shall never be operated at less than 50% of its design capacity due to maintenance and repair works. Period of such operation shall not exceed more than two consecutive days and not more than three days in a week. The maximum downtime of the whole plant shall not exceed more than 6 continuous hours. In case the downtime continuously in a day exceeds 06 hours, contractor will be penalised Rs.5000 /hour(Rupees five thousand per hour only). Exceeding 06 hour. Further if this downtime exceeding 06 hours takes place more than on 3 no. Occasion in a month a penalty of Rs 10000/-(Rupees ten thousand per event only)event will be imposed. The period for repairs and maintenance has to be communicated to the Engineer-in-Charge (EIC) at least one month in advance.</p> <p>The down time due to non-availability of power or of raw water at Contractor's point of receipt for any reason shall not be included in the above period.</p>
Operation of the plant as per O&M Manual	<p>The WTP shall be operated according to the rules and procedures laid down in the O&M Manual provided by the manufacturers and CPHEEO. The working hours of the plant and the output quality shall be as per IS 10500 given here.</p>
Awareness & Cleanliness	<p>The Contractor and his staff shall maintain a high degree of awareness in operation and maintenance of the WTP (s). At all times the WTP, its equipment and surroundings shall be kept clean and in order including building floors, walls, roof, windows, road, drains etc.</p>
Frequency of Preventive Maintenance	<p>The preventive maintenance will be done according to the recommended preventive maintenance schedule of the manufacturers of the WTP/components of the WTP with prior intimation to the Engineer-in-charge well in advance. The regular staff may be reinforced by short term specialists by the Contractor for special maintenance tasks at the contractor's own expenses.</p> <p>All required equipment, materials, manpower and other resources for the operation, maintenance, and repairs shall be arranged by the contractor.</p>
Repairs	<p>Repairs shall be made as and when needed very promptly on the spot or at the Contractor's workshop; the need of repair on the spot or at the Contractor's workshop has to be defined in co-ordination with the EIC. No extra payment shall be made for any repairs (including E & M, Civil) & replacement.</p>
Equipment, Spare parts, Consumables etc.	<p>The contractor shall arrange all spare parts, equipment, other consumables etc., and their fitment as and when necessary for smooth and efficient operation and maintenance at contractor's own expenses throughout the contract period. The contractor shall always have the spares available in his store as per the list approved by engineer for carrying out repairs properly.</p> <p>Old / worn out part after replacement shall have to be returned to the Employer as per direction of the EIC.</p>
Civil Structures and Civil Works	<p>All existing and proposed civil structures and works shall be maintained by the contractor including all minor and major repairs/works at the contractor's own expenses. The contractor before initiating any major works shall obtain approval of the EIC.</p>

Transportation	All necessary transportation required for operation, and maintenance activities to be carried out shall be arranged and made by the Contractor at his own costs.
Consumables	The Contractor has to ensure that there is always sufficient stock of 30 days of the consumables (like alum, grease, lubricant, oil etc) required.

General Obligations

The Contractor shall operate and maintain the WTP including PLC-SCADA Automation system, Raw water sump cum pump house, and all the proposed facilities, including roads, plantations, illumination etc., within the premises under this contract for the period specified in the scope of services. Contractor shall submit a detailed Operation and Maintenance plan for approval of Employer one month before taking over. All Operation and Maintenance activities by Contractor shall be carried out strictly in accordance with the approved plan. The General Obligations of the Contractor shall include but not limited to:

- (a) Operation and Maintenance of the proposed WTP including all associated facilities.
- (b) The Contractor shall comply with all safety rules and regulations as per the CPHEEO manual and relevant BIS codes.
- (c) Provide necessary skilled/ unskilled labour/ supervisors/ technicians for maintaining all utility services, sweeping, cleaning of Office room, laboratory, privies, toilets, washroom etc., including cost of all materials and equipment for maintaining the utility services. Personnel employed by the contractor for the services will in no case be absorbed by the Employer.
- (d) Providing necessary labour for cutting of grass, removal of debris, shrubs, development of grassed areas etc as maybe required from time to time. Personnel employed by the contractor for the services will in no case be absorbed by the Employer
- (e) Maintaining strict vigil so as to secure the areas and not allow any trespassers into the area.
- (f) Liaison with concerned Power Supply Agency in case of any voltage trouble (high or low) or breakdown in Power Supply or Low power factor or any other troubles, is the responsibility of the Contractor and the same to be recorded in the Log Book accordingly.
- (g) The contractor shall submit to EIC for approval the calculated power requirement for operating all the facilities, machineries and equipment for the entire services prior to the finalization of the contract including O & M services. The Contractor shall ensure that minimum power requirements are consumed for Operation of the WTP (s). The calculated power demand will be compared with the actual power consumption and if the actual consumption is more than 15% higher than the calculated (expected) consumption, the costs for the same will be deducted from the Contractors monthly bills.
- (h) All maintenance activities shall be recorded in the maintenance register and to be checked and countersigned by the EIC.
- (i) The Contractor shall insure the entire premises against burglary/ theft/ malicious damage/ rust and fire during the tenure of the operation and maintenance activities. The insurance policy shall be endorsed in favour of the Employer. The Contractor shall insure his workmen/ supervisors against all statutory rules and regulation viz. workmen's compensation, third party liability, accidents etc. The Employer shall not bear any responsibility or cost for any such untoward incident, accident, death, injury, medical treatment etc. The premium shall be borne by the Contractor and shall be considered while quoting the price of operation and maintenance services in the Bill of Quantities.
- (j) The contractor shall be liable to compensate the Employer for any loss of property within the WTP (s) on premises due to theft, pilferage, damage, etc. caused as a result of negligence, mishandling, wrong

operation, etc. on the part of personnel engaged by the contractor for operation and maintenance of the WTP (s) and all other existing and proposed facilities. The penalty amount shall be fixed by the Employer or the same shall have to be restored in original condition to the satisfaction of the EIC.

- (k) All prevalent labour laws are to be maintained by the Contractor as per norms.
 - (l) Fighting fire with the fire extinguishers in the event of such contingency shall be the responsibility of the contractor. The contractor shall ensure that refilling of fire extinguishers is done as per norms.
 - (m) The Contractor must adhere to the regulation of E.S.I., E.P.F., Service tax, labour license etc. The Contractor shall be responsible for depositing the subscription of the E.S.I., E.P.F, Service tax etc. to respective government agencies. The Contractor shall submit their documents regarding payment of E.S.I., E.P.F., Service tax etc, to the EIC as per norms. The monthly claim of the contractor shall enclose proof of month before the previous month's deposition of E.S.I., E.P.F. and related tax.
 - (n) At the end of maintenance period, an assessment of the condition of the WTP (s) and all other facilities will be carried out by the Employer. Based on the above assessment the Contractor shall, at no extra cost to the Employer, repair and re-condition all the electro-mechanical equipment in the concluding year of the maintenance contract to a condition so that they are in satisfactory running condition with regular preventive and recommended maintenance as per manufacturers' recommendations and/or as per CPHEEO manual/ standard Engineering practice.
 - (o) Hand over the WTP including all associated facilities and also the entire premises, immediately after completion of O&M period, in good, running, and acceptable condition.
 - (p) The contractor shall furnish atleast 03 reports
- (1) At different times of the day daily indicating the raw water & treated water reports highlighting physico-chemical & biological characteristics to engineer-in-charge.
 - (2) Further he will furnish atleast 02 reports at different times of the day daily indicating the incoming and outgoing water characteristics of each treatment units of WTP to the engineer-in-charge. These reports will indicate the efficiency of each treatment unit.

The operation of the proposed WTP will include running all electro-mechanical equipment uninterrupted for all days (24x7) including all holidays. Operation shall be done in proper coordination and in consultation/direction of the Employer to avoid any malfunctioning of the machineries. During operation, the contractor shall adhere to the following points for smooth operation of the plant:

- a) Operation of all pumps, valves, instrumentation controls at the WTP and allied structures / facilities like Wash water tanks, including all allied electro-mechanical components of the WTP excluding Clearwater Pump House & Electrical Sub Station as per requirement. Any sorts of defects, faults in electro-mechanical equipment/components are to be intimated immediately to the EIC and contractor will take corrective action for repairs & replacement without any extra cost.
- b) Operating the valves as necessary on a diurnal basis, considering the inflows or that maybe required from time to time.

Staffing Requirements for Operation and Maintenance of WTP:--

The Contractor shall provide experienced technical, administrative, and non-technical personnel, and labour necessary to operate and maintain the WTP and also to maintain other works under scope of work as stipulated in the contract, properly, safely, and efficiently on a continuous 24 hours basis for the full term of the O&M Period including holidays.

The qualifications and capability of the Contractor's personnel shall be appropriate for the task they are assigned to

perform. The staff provided shall be fully trained in the operation and maintenance of the works before being given responsibility for operation of the services. If, in the opinion of the EIC, a member of the Contractors staff is considered to be insufficiently skilled or otherwise inappropriate for the task he is required to perform, he shall be replaced by the Contractor with a person with the appropriate skills and experience for the task, with the approval of the EIC.

The bidder shall propose in its tender a staff management structure for the Operation and Maintenance of all the services under O&M Scope in the Contract. This structure for O&M work shall be expected to include at least but not necessarily be limited to the following personnel:

Position	Minimum Qualification	Nos.	Requirement
Supervisor cum Shift in-charge	Diploma holder in Mechanical/ Electrical / Instrumentation/Telecommunication with knowledge of computer	1 Nos.	In each shift
Operator	ITI qualification and having Supervisory Electrical license preferably with knowledge of computer	2 Nos.	In each shift
Helper	-	1 Nos.	In each shift
Electrician		1 Nos.	In each shift
Mechanic		1 Nos.	In each shift
House Keeping including Jungle cutting, reservoir cleaning	-	2 Nos.	Each day
Security	-	1 Nos.	Each Shift

The above personnel suggested are the minimum requirement. It is expected that the contractor will provide the above personnel for operation and maintenance of all works under the scope of work taking together all three shifts in a day. Necessary stand by provisions shall have to be made to take care of absences / leave.

The shift-in-charge shall be responsible for total management of the operation and maintenance. He shall have authorization to receive instructions from the EIC time to time and acts accordingly. The Contractor shall provide all secretarial support, printing and publishing services, office furniture and office supplies as necessary for entire O&M period. Procurement of office furniture and other utilities will be made under provisional sums before the commencement of O&M services and these shall be the property of the Employer. The list of office furniture to be procured shall be approved by the EIC before procurement.

The Curriculum Vitae of the Contractor's personnel shall be submitted to the EIC for acceptance at least two months (60 days) before the anticipated commencement of the pre-commissioning. Normal time duty hours for the Contractor's Operation & Maintenance personnel may be modified as necessary and agreed by the EIC. A rotating shift schedule shall be established by the Contractor and approved by the EIC which will ensure that an adequate number of the Contractor's staff will be available for on duty at WTP 24 hours each day, 7 days per week, including

all holidays.

The O&M personnel shall dedicate 100% of their time for the specified duties and responsibilities and shall not be diverted to perform Contractor's administrative duties, construction arrangement, office management, or other non-project activities. Adequate support staff shall be provided by the Contractor in order to avoid any such diversion. No claim for idle hour shall be entertained.

Employer shall direct the contractor to remove any or all staff employed for O&M services if in his opinion continued presence of such staff is detrimental to safety or proper O&M. The contractor shall comply with such directions & post suitable substitute(s) thereof. Whenever the EIC has to inform the Contractor in writing that any person on the work is in his opinion unsatisfactory or/incompetent or unfaithful or dishonest, untruthful or disorderly or to be otherwise unsuitable/such person shall be discharged by the Contractor from the work and shall not be reemployed.

No labour below the age of 18 years shall be employed on the work. List of staff is to be given by the agency to the Contractor and advance intimation to be given before deputing/removing any staff from site during the O&M period. Not more than one of the Contractor's key staff shall be absent from the Project site at any given time. In case it is necessary for more than one of the key personnel to be absent at a given time, the Contractor shall provide replacement of equivalent or better qualifications. The CVs of such key staff replacements shall be got approved from Employer in advance.

Recording and Reporting Requirements:----

Contractor shall record quantity and quality of raw water inflows and out flows on a daily basis along filter bed-operation through SCADA. Staff attendance shall also be recorded along with register for cleanliness.

Overall reporting formats will be finalized and approved by EIC and may have to be modified from time to time as required and approved by EIC. Contractor may have to prepare and submit additional reports on particular matter and incidents as and when required by the EIC.

Besides, submission of reports, the contractor shall have to maintain various charts / books / registers recording daily data on operation and maintenance. The following are the charts/books/registers that are required to be maintained other than specific requirements raised by the EIC:

Sl No.	Name of Register/ Log book	Contents	Frequency of Record keeping
1	Attendance book	Attendance of workmen and supervisors	Daily shift wise
2	Log Book for Operation	Parameters of performance of pumps, motors, panel, power factor etc as per the direction of EIC. These shall include but not limited to <ul style="list-style-type: none"> - Voltage - Current - Power - Power factor - Pressure - Water level 	Hourly

Sl No.	Name of Register/ Log book	Contents	Frequency of Record keeping
		<ul style="list-style-type: none"> - Duration of operation of each filter bed - Flow - Other physical, electro-mechanical and hydraulic characteristics. 	
3	Cleanliness Register	Record of cleaning of pumping Machineries, various buildings, office room, control room, floors, toilets and surrounding areas and WTP premises etc	Daily to be submitted to EIC
4	Maintenance book	Record of regular, preventive and breakdown maintenance	Based on requirement
5	Consumption / Consumables book	Record of spares required for equipment	Based on requirement
		Record of fittings, fixtures, etc. required for replacement	Based on requirement
		Record of consumables	Based on requirement supplied by the Department

Maintenance Activities

The scope shall include regular maintenance of all the pumps, motors, starters, circuit breakers, switches, control panel, cranes, valves/gates, flow measuring devices etc. for smooth and efficient operation/performance of the WTP . Regular maintenance of the Treatment plant area shall be taken up with proper cooperation and coordination with the personnel concerned with the operation & maintenance of the said WTP and in consultation/ direction of the concerned EIC. During the maintenance activities the Contractor should adhere to the following points:

- (a) The contractor shall prepare and implement an effective plant maintenance programme in consultation with the EIC. It is the Contractor's responsibility to provide all sorts of maintenance - preventive, minor, major, or break-down in nature. Further, the Contractor shall attend to any defects/repair works that may be required during the tenure of the O&M contract.
- (b) The contractor shall plan and arrange all spares and all consumables including grease, lubricating oil, cleaning agents, etc. Further the contractor shall plan about the requirement well in advance (At least 1 month) and procure the material from the market, thereby maintaining a safe stock of the spares and consumables.
- (c) Regular/periodical maintenance such as insertion/replacement of the packing, greasing of bearings, and replacement of gear oil/lubricating oil shall be carried out according to standard engineering practice/manufacturer's recommendation. The same shall be intimated to the concerned EIC well in advance.

- (d) The casing / volute cover of the pumps shall be opened twice in a year for thorough inspection of the internal parts/components ensuring smooth operation of the Treatment Units / Plants. However, the above maintenance activities in addition to the mandate above shall be carried out as and when required as per direction of EIC.
- (e) Blown out fuses, indicating lamps, contact points etc. shall be replaced by new ones as and when required.
- (f) The contractor shall cover in his quoted rates cost of replacement of chokes, switches, ballasts, igniters, son lamps, etc. as and when required. No payment shall be made to the contractor for such replacements.
- (g) Cleaning and maintaining of treatment unit and other electro-mechanical equipment shall be taken up as per standard engineering practice, operation & maintenance manual and as per the instructions of the manufacturer of the equipment.
- (h) The tightness of fasteners, bolts and nuts & terminals shall be checked at periodic intervals and necessary tightening done as per necessity.
- (i) The Contractor shall supply consumables like soaps and detergents, jute, cotton waste and cotton flame, napkins, disinfectants, sweeping accessories, polishes, rain-coats, safety shoes, gumboots, site order books with pages in triplicate, candles, torches with battery and matches, forms, log books, quarterly cleanliness log book, attendance register, pen, scale and stationeries as required for day to day O&M activities. The Contractor shall also supply tube lights, incandescent lamps, starters for tube light, indicating lamps, insulating tapes, nut and bolts, screws, cable sockets, grease, oils packing and arrange to replace or fit as per necessity.
- (j) The contractor shall maintain sufficient tools and plants at Treatment plant which shall be required for operation and maintenance. These consists of items like screw drivers, spanners, slide wrench, hammers, chisels, pliers, cutting pliers, hack saw with blade, hand drill, spirit level, measuring tape, scales, etc.
- (k) Repairing works of pumps, motors, panels, switches, circuit breakers, gates, valves and other electro-mechanical machineries of the Treatment plant shall be carried out as per direction of Engineer-in-Charge and as per standard engineering practice.
- (l) Preventive and running maintenance of pipes, valves etc.
- (m) Preventive and running maintenance of control panel, PCC, MCC, relay, etc. for smooth operation of the WTP.
- (n) Preventive and running maintenance of pumps, motors, valves, cranes etc.

Periodic maintenance of the machineries is to be ensured by deploying qualified and trained personnel

Building and Site Maintenance

The Contractor shall be responsible for:

- a) Full maintenance of building electrical, ventilation, plumbing, and drainage installations.
- b) Building and housekeeping maintenance.
- c) Full maintenance of the site, water and wastewater services, cabling and earthing system, together with the site road lighting system, boundary fencing.
- d) Site maintenance including the upkeep of landscaped areas, gardening, plantations
- e) The telephone installations in all buildings.

The building services and housekeeping maintenance shall be undertaken in all buildings and services installations created under this contract and existing. Routine housekeeping maintenance shall be carried out in accordance with the procedures specified in the Operation and Maintenance Manual.

Preventive Maintenance

The Contractor shall prepare a planning of the day-to-day maintenance and the preventive maintenance. This planning must include all equipment and the estimated necessary hours in preventive maintenance and curative maintenance. The Contractor must mention the qualification of the foreseen maintenance personnel required for each case.

The Contractor shall provide the yearly requirement of consumables needed for the operation and maintenance of all equipment. These correspond only to the day-to-day maintenance, preventive maintenance and fore-seen curative maintenance if any. The Contractor shall get the plan approved from the Engineer-in-Charge.

Maintenance of Assets Created

For the first year of maintenance period, all electro-mechanical assets (Like pumps, motors etc) that have been installed / rehabilitated shall follow routine maintenance activities.

Illumination of the WTP

The Contractor shall have to keep the illumination system of the WTP area in full working condition. The Contractor shall maintain the proper illumination level in the office room, security room, pumping stations including outdoor roads. In doing so, he must replace the defective spares like lamps, condensers, igniters, ballasts etc. in proper time for all outdoor luminaries of standard quality.

Safety Requirements at Site

The Contractor shall be responsible for safety of his staff on Site during the O&M services.

The Contractor's duties with respect to Safety shall include the following:

1. Utilize safety awareness procedures in every element of Operation and Maintenance.
2. Give emphasis to site safety including :
 - a) Safe working procedures.
 - b) Cleanliness and care of WTP as a whole.
 - c) Accident and hazardous conditions reporting.
 - d) Organise Safety discussion meeting with all the personnel weekly.

Formal discussions on safety shall be held with all concerned agencies at least once a month.

The Contractor shall provide Notice Boards/ Display Boards at appropriate location detailing precautions to be taken by Operation and Maintenance personnel in work in conformity to regulation and procedures.

The Contractor shall notify the EIC immediately, if any accident occurs, whether on-site or off-site in which the Contractor is directly involved which results in any injury to any person, whether directly concerned with the Site or a third party. Such initial notification may be verbal and shall be followed by a written comprehensive report within 24 hours of the accident.

The contractor shall have to provide and maintain a suitable First Aid Box at the office. The first aid box shall be equipped but not limited to, with following medicine and first aid materials:

- (a) Different sizes of sterilized dressings
- (b) Sterilized dressing for burns
- (c) 30ml bottle containing 2% alcoholic solution of iodine
- (d) 30gm bottle of potassium permanganate crystal
- (e) Scissors
- (f) Boric cotton
- (g) Ointment of burns
- (h) A bottle of suitable surgical antiseptic solution

Services and Facilities to be provided by Employer

The Employer shall be liable to the Contractor for the following:

- a) Provide free office accommodation space with attached toilet space for O&M personnel of the Contractor including security room within the WTP Premises.
- b) The charges for power during the O&M period shall be paid by Employer.

Special Conditions

The following special conditions shall be binding on the contractor:

- (a) **Agreement with the Contractor:** Rates for the O&M services shall be governed by the rates quoted by the bidder in Annexure Price Bid-- for due consideration of the Employer. The contractor shall sign a separate agreement with the Employer along with the contract for the main works.
- (b) **Performance Security:** The Contractor shall provide a Performance Security for O&M Services in the form of a bank guarantee for an amount of Ten percent (10%) of the contract value of the O&M services issued by a reputable bank including scheduled bank or nationalized bank located in India, acceptable to the Employer in the format enclosed. The Performance Security for O & M services contract shall have to be furnished two months prior to the commencement of the O&M services.
- (c) **Insurance Policies:** The Contractor shall undertake insurance during the operation and maintenance period :
 - (i.) For all Equipment related to the proposed new WTP. The value of the insured equipment shall be considered as 70% of the composite value of the equipment agreed in the Contract for the case of new equipment.
 - (ii.) Against Injury to Persons and Damage to Property
 - (iii.) Contractor's Personnel

The Contractor shall submit evidence of Insurance as per the provisions within 28 days from the date of commencement of the O& M services with the Employer and submit the relevant insurance policies within 45 days from the date of commencement of the O& M services with the Employer.

- (d) **Advance Payment:** No advance payment will be paid for operation and maintenance services.

Other Terms and Conditions

- (a) The personnel engaged by the Contractor shall not be absorbed by the in the Employer in any circumstances.

- (b) The Contractor shall have to ensure timely payment to their personnel and comply with the provisions of all labour legislation and rules.
- (c) In case of any difficulties faced by the Contractor in performing the operation & maintenance activities, the same shall be reported immediately to the concerned EIC for taking necessary action.
- (d) The Employer shall not be responsible for any untoward incident of accidental death, injury, and medical treatment etc. during on-duty hours. The payment of compensation if required under Workmen Compensation Act, 1923 and any other act, rules shall be borne by the Contractor. This will be statutory obligation on the part of the Contractor.
- (e) The Contractor has to ensure the payment of minimum wages to the deployed personnel as declared by the Labour Department, Govt. of CG, from time to time. Any enhancement of minimum wages during the contractual period shall be paid by the Contractor, Such additional charges shall however not be payable to the Contractor by the Employer.
- (f) The working hours of the operation & maintenance, number of shifts and timings of shift for each WTP shall be approved by the EIC. The personnel engaged by the Contractor should follow /abide by the instructions of the EIC.
- (g) The Contractor shall deploy minimum number of operation & maintenance personnel having requisite qualification on each shift of the day as specified approved by the EIC. The same shall be done in such a manner that at no point of time, the pumping station remains inoperative. The Contractor shall ensure that none of the operation and maintenance personnel leaves his duty place unless and until he is relieved by another person deployed by the Contractor for the next shift.
- (h) The O&M personnel deployed by the Contractor shall record their time of attendance and departure on every day/shift in attendance register which is to be maintained at the place of deployment. Such attendance register shall be produced before the concerned EIC for regular checking.
- (i) The Contractor shall not deploy any person as Operation & Maintenance personnel who may be found unsuitable for duty on medical ground because of illness (mental/physical), old age and or infirmity, duly certified by a registered medical practitioner.
- (j) The Contractor shall keep himself informed of the relevant and related laws & ordinances and shall conduct the work in compliance with such laws. Fees for necessary permits, licenses,& taxes required by law shall be paid by the Contractor as per GCC.
- (k) For filling the vacant position on the event of death or otherwise, the Contractor must inform and seek consent from the EIC for the appointment of new worker.
- (l) The Employer reserve the right to terminate the annual operation and maintenance contract of the plant (s) in case of non-performance of the Contractor based on report of the EIC. The termination shall however be governed by the GCC of the contract.
- (m) All other terms and conditions shall be governed by the standard practices prevalent with the Employer.
- (n) Guarantee for equipment : The contractor shall submit indemnity bond towards guarantee of equipments for second rainy season if it does not fail within 12 months after satisfactory commissioning of the Plant. The securities deducted towards this will be released on production of such bond.
- (o) Spares parts: The contractor shall give a list of spare parts/items which are essential for two years maintenance with their rates. The RAIPUR Municipal Corporation would approve the list of spares

which is to be submitted by the contractor. Operation and Maintenance for 10 Years

For repairs and proper upkeep of the WTP in case any repair to any equipment is required, no extra payment will be paid to the contractor.

For non compliance of the water quality parameter a penalty of Rs. 5000/- for one event in a day shall be levied.

i) **Residual chlorine at outlet of clear water pump house \leq 2 ppm**

(q) PERFORMANCE CAPABILITY:

For rapid gravity filters, the performance standards should be in accordance with para 6.6.8.2 of manual on water supply and treatment published by CPHEEO.

(r) Guarantee for the Equipment:

All the mechanical equipment and appurtenances supplied and erected by the tenderers shall be covered by a guarantee for satisfactory working for a minimum period of 12 months or 2 consecutive rainy season whichever is more. From the date of satisfactory commissioning of the plant. The tenderer at his own cost, such replacement being arranged by tenderer as expeditiously as may be directed by the Executive Engineer shall replace any defective parts detected during this guarantee period.

(s) The tenderer shall supply and deliver a full set of spares for working of the plant, continuously for 2 years. These spares price shall be quoted separately with full details for the parts offered.

(t) Testing and Inspection:

All pipes and other castings subjected to pressures, shall be hydraulically tested to 2 times the designed pressures as directed by the Executive Engineer.

The entire work during manufacturing and erection, shall be subjected to inspections by the departmental staff (i.e. Executive Engineer or his nominees) for which adequate facilities, shall be extended by the tenderers at his cost.

(u) Typical raw water characteristics in the annexure attached.

(v) The WTP process will have arrangement for recycling of used back wash water for its complete treatment so that it becomes Zero Liquid Discharge facility

General Terms

Payment shall be made to the contractor on monthly billing cycle for:

1. Operation of the WTP for a period of 60 months. Chlorine gas and electricity tariff will be provided by the Municipal Corporation at no cost.
2. Maintenance costs for the WTP including associated works and maintenance of existing facilities within the WTP as described for a period of 60 months, after successful completion of the defects liability period.
3. The Contractor shall submit the bill for each month within the fifth working day of the next month to the concerned Engineer-in-charge.

The Monthly Progress Report along with Staff attendance sheet, duly signed by each Staff and countersigned by the Contractor shall be submitted with the monthly bill for operating the WTP (s).

Non-Compliance

The EIC / representative designated by the Employer will make random visits to the WTP to review the operation and maintenance practices including:

- (1). Compliance to operating of the WTP as per agreement
- (2). Compliance for safety
- (3). Review of staff, attendances
- (4). Cleanliness of the Site etc

All field visits must be recorded and outcome of the visit/minutes of the meeting should be signed by Contractor and Employer for compliances.

Non-compliance to Reporting Requirements

All records shall be compiled for the monthly progress report to be submitted to the Employer. The monthly reports shall be submitted on the fifth day of the next month. The monthly report shall generally contain information in prescribed formats that shall be finalized in consultation with Employer.

The Reports shall include:

- Staff attendance for the Month
- Log Book showing Operation of Filter wash / pumps
- Cleanliness Register
- Maintenance book
- Consumption / Consumables book

Non-compliance to submission of the Monthly reports or in maintaining the records shall result in a deduction of 5% of the monthly charges.

Non-Compliance in the event of non-maintenance / repairs

The WTP shall not be operated at less than 50% of its design capacity due to maintenance and repair works. The period of such operation shall not exceed more than two consecutive days and not more than three days in a week. The maximum downtime of the WTP shall not exceed more than 8 continuous hours. The period for repairs and maintenance has to be communicated to the Engineer-in-charge (EIC) at least one month in advance.

In the event of failure to comply with the above operational requirement, the penalty shall result in deduction of 10% of the monthly charges.

Non-compliance to Staffing Requirements

At no point the staff / manpower within the pumping stations shall be less than 75% of the strength required. In no case, the absence of the Shift In-charge and Operator shall be admissible. The applicable rates for reduction on the Monthly Fees for staff / manpower on any day are as presented below:

Sl. No	Staff / Manpower attending to Staff / Manpower Required / Proposed (Whichever is higher)	Reduction in Rate
1	100%	Nil
2	90%	10% of the rates for non-compliance for each day
3	80%	25% of the rates for non-compliance for each day

4	75%	50% of the rates for non-compliance for each day
5	Less than 75%	100% of the rates for non-compliance for each day

The scope further includes on job training to the Employer's staff for the O & M of the plants & Machinery

Training Employer's Staff

Prior to and during the Trial Run and Pre-commissioning periods the Contractor shall provide classroom and on-the-job training sessions to the Employer's staff. Training shall cover the process functions and the practical aspects of operation and maintenance.

The course material shall be finalized and agreed upon by the Employer and the Contractor prior to the start of training and the Contractor shall provide the necessary trainers course material for all attendees.

The Contractor shall budget at least 6 hours of classroom training for each unit process except the filters, chemical dosing and chlorination which shall be allocated a minimum of 12 classroom hours each.

On-the-job training shall include process operation, equipment maintenance, instrumentation and control systems (training on each ICP shall be given) and the electrical systems. Training time shall be commensurate with the complexity of each system, as approved by the Employer's Representative.

The contractor shall provide a work training officer whose sole duties shall be to advise the O&M personnel on the operation and maintenance of the treatment process and to instruct, on a full time basis regarding the O&M.

The aforesaid personnel for imparting training for the operation and maintenance work, i.e. the mechanical, the electrical and chemical and the instruments and systems personnel at the cost of the agency.

Training Employer's Staff during O & M Period:

The Contractor shall be responsible for holding one training course each year during the O&M Period for duration of 5 days each year to approximately 10 trainees assigned by the Employer. The course material shall be finalized and agreed upon by the Employer and the Contractor shall provide the necessary faculty and material for all attendees.

Each course shall include both class room lectures and on-site training. The training shall be designed to enable the trainees to understand the practical aspects of satisfactory operation and preventive maintenance. Attention shall be given to any problems or quality issues that have arisen in the system over the last year of operation.

The Contractor shall also provide full on-the-job operational training to employees assigned by the Employer to be associated with the facilities on a permanent basis. The number of such employees shall be established by the Employer, but will not be expected to exceed 5 per session.

The training also includes Field testing and commissioning of meters, training of line department personnel on operation of the meter.

The Contractor shall provide on the job training on all aspects of the operation, maintenance and repair of the Plant, equipment and facilities to all personnel selected by the Employer who will ultimately be responsible for the operation, maintenance and repair of the Plant and its facilities, in accordance with the Employer's personnel schedule provided, all costs for the bidder's personnel and the training facilities required for the training, and any incidental training expenses, shall be included in the Bid Price.

Penalty for theft, Pilferage

The contractor shall be liable to compensate the Employer for any loss of property of the WTP due to theft, pilferage, damage, etc. caused as a result of negligence, mishandling, wrong operation, etc. on the part of personnel engaged by the contractor for operation and maintenance of the WTP (s). The penalty amount shall be fixed by the Employer or the same shall have to be restored in original condition to the satisfaction of the Employer.

ANNEXURE - "E-6"-

PLC SCADA, Automation & Monitoring control system covering the complete functioning and all treatment units of existing 150 MLD, 80 MLD proposed 80 MLD, all RWPS (existing & proposed) and CWPS (existing & proposed), OHSRs (level indicators & residual Cl₂ sensors), bulk flow meters, all pilot operated hydraulic water level & flow control valves complete 5 years O & M including replacement & Warranty

1.0 PLC-SCADA SYSTEM

Technical Specifications for Process Instrumentation and PLC-SCADA based Monitoring System for water supply scheme comprising PLC Panel, SCADA Workstation and Accessories and Field units is based on the functional requirements

2.0 Scope of work-

2.1 FOR RAW WATER INTAKE STATIONS

2.2. Monitoring and control facilities at raw water intake stations through Central SCADA at WTP.

- Monitoring and visualization of Raw water flow (from existing flow meter) and water level at intake well via GSM wireless data transfer at Central SCADA located at WTP
 - Monitoring, visualization of status of pumps & status and control of valve actuators via GSM wireless data transfer at central SCADA
 - Monitoring and visualization of Energy parameters via GSM wireless data transfer at central SCADA

Raw water intake locations –

1. 80 MLD INTAKE WELL
2. (150 +80) MLD INTAKE WELL

2.3 Water Treatment Plant (for all existing and proposed WTPs)

- Monitoring and visualization of WTP parameters as specified (Quality parameters, wash water tank level, filter beds level, status of valves and pumps on each filter bed)
- Monitoring and control of back wash cycles of WTP filter beds through existing valve actuators. LIST

OF WTPs

1. 80 MLD -Existing
2. 150 MLD- Existing

3. 80 MLD (NEW)

2.4 Clear Water Pump House

- Monitoring and visualization via GSM wireless data transfer of sump level, Clear water flow (flow meter not included here) at Central SCADA located at WTP
- Monitoring, visualization of status of pumps & status and control of valve actuators via GSM wireless data transfer at central SCADA
- Monitoring and visualization of Energy parameters via GSM wireless data transfer at central SCADA

LIST OF Clear water pump stations -

1. At 80 MLD
2. At 150 MLD (upgraded to 180 MLD clear water sump)
3. At 80 MLD (NEW)

2.5 Reservoirs (OHSR / ESR/ GSR) – 38 Nos.

- Wireless Monitoring and visualization of flow at OHSRs inlet & outlet (flow meter not included here)
- Wireless monitoring of status and control of valve actuator at OHSRs
- Recording of parameters and retrieval in the form of shift / day / month reports in SCADA station.

1.1 Provision of PLC- Supervisory Control and data Acquisition (SCADA) Automation system for the complete project

Intake – 2nos (80 MLD & 150 MLD), WTP-3 Nos (80 MLD, 150 MLD & 80 MLD), OHSRs-Inlet & Outlet of 38 Nos at different locations including complete instrumentation and setting up of central Server room with all necessary equipments, training to Nagar Nigam staff including 12 months trial runs.

1.1.1 SCADA at WTP

PLC - SCADA and Monitoring system at WTP envisages the following facilities:
Monitoring of inlet (Raw Water) flow, outlet flow (Clear water) and water level of each filter bed.

- a. Monitoring of water level at wash water tank and clear water sump.
- b. Back wash cycle control through electrical actuators in control valves in filter beds via local control consol (manual) and via SCADA (Automatic) at WTP control station
- c. Monitoring and data logging for water quality parameters at WTP inlet (Raw water) and Outlet (Clear Water).
- d. Transfer, Display and logging of above parameters in central SCADA at control room
- e. Recording of parameters and retrieval in the form of day / month reports

1.1.2 Monitoring system at Clear Water Pump House envisages the following facilities:

- a. Monitoring of flow, pressure and level at Raw Water intake main line.
- b. Data transfer, Display and logging of parameters in central SCADA at control room of WTP
- c. Status and command Control of (Open / Close) of electrical actuators in control valves in mains line via local control panel / from WTP control station.
- d. Status and command Control of (On/off) of electrical pumps (2 Nos working and 2 Nos stand-by) for local monitoring and control via WTP control station.

1.1.3 PLC-SCADA at OHSRs

Monitoring system at Distribution Reservoirs (OHSRs) envisages the following facilities:

- a. Monitoring of inlet & outlet flow and Pressure of water at each Reservoir (OHT), Level of Water in Reservoir and Residual chlorine of clear water at reservoir
- b. Transfer, Display and logging of parameters in central SCADA at control room of WTP via GSM / GPRS technology.
- c. Control of (Open / Close) of electrical actuators in control valves via commands from WTP control station

1.1.4 EQUIPMENT

1.1.4.1 Equipment at Raw Water Intake well

Equipment's for monitoring and data transfer at Raw water intake:

- a. Electromagnetic Flow meter for Flow measurement
- b. Pressure sensor for Pressure monitoring and Level Monitoring
- c. Cables and interconnections of central control system with all field devices with local station at Raw water station
- d. Suitably dimensioned Panel made of CRCA sheet steel powder coated to RAL-7032 housing the following:
 - e. PLC / RTU with required number of channels for data acquisition and control commands
 - f. 24VDC SMPS, Wiring and Terminals

1.1.4.2 Equipment at WTP

Equipment for monitoring and data transfer at WTP:

- a. Ultrasonic Open Channel Flow meter / Electromagnetic flow meter for clear water flow measurement.
- b. Online pH and turbidity monitor for Raw Water Intake.
- c. Online pH, Residual chlorine and turbidity monitor for clear water.
- d. Ultrasonic Level Transmitters for Filter bed level monitoring.
- e. Ultrasonic Level Transmitters for Wash water tank level monitoring
- f. Ultrasonic Level Transmitters for clear water sump level monitoring
- g. Suitably dimensioned Panel made of CRCA sheet steel powder coated to RAL-7032 housing the following:
 - PLC / RTU with required number of channels for data acquisition and control commands
 - GSM/GPRS/RF Router / Modem (separate or integral to PLC/RTU) for communication with SCADA to receive and integrate data from remote OHT stations
 - 24VDC SMPS, Wiring and Terminals
- i. SCADA and PC at control room at WTP comprises -
 - SCADA Software for Real Time Monitoring of all locations, Data Acquisition / Logging, Reports
 - Workstation PC - Commercial grade 22" Color LCD* Monitor
 - Printer
 - UPS with 4 Hrs battery backup
- j. Instrumentation, data and control cables.
- k. Necessary Hardware & software to transfer the data from WTP SCADA to Head office

computer via suitable internet protocol.

1.1.4.3 Equipment at Clear Water Pump House

Equipment for monitoring and data transfer at Clear Water Pump House:

- a. Electromagnetic Flow meter for Flow measurement
- b. Pressure sensor for Pressure monitoring
- c. Cables and interconnections of central control system with all field devices with local station at Raw water station
- d. Suitably dimensioned Panel made of CRCA sheet steel powder coated to RAL-7032 housing the following:
 - PLC / RTU with required number of channels for data acquisition and control commands
 - 24VDC SMPS, Wiring and Terminals

1.1.4.4 Equipment at Each OHSRs

Equipment for monitoring and data transfer at each Reservoir (OHSR):

- a. Electromagnetic Flow meters for Flow measurement at inlet and outlet lines
- b. Pressure sensor for Pressure monitoring at inlet and outlet lines
- c. Ultrasonic level Transmitter for reservoir water level
- d. Residual Chlorine sensors
- d. Suitably dimensioned Panel made of CRCA sheet steel powder coated to RAL-7032 housing the following:
 - PLC / RTU with required number of channels for data acquisition
 - GSM/GPRS/RF Router / Modem (separate or integral to PLC/RTU) for communication with SCADA
 - 24VDC SMPS, Wiring and Terminals

1.1.5 Water Quality Measuring System

1.1.5.1 Water quality measuring equipment's and instrumentation shall be provided to monitor following parameters: -

- i. Raw water turbidity
- ii. Raw water pH
- iii. Filtered water turbidity
- iv. Filtered water Residual chlorine
- v. Filtered water pH

1.1.5.2 All water quality measuring/ transmitting equipment shall be provided with integral LCD display and shall be designed for field mounting. The measuring /transmitting equipment shall be installed local to the respective sampling point

1.1.5.3 1 pH meters

Measurements and Ranges: 0 to 14 pH
Wetted Materials: Titanium, Polypropylene, EPDM, glass: platinum
Process Connection 1 in. MNPT front and rear facing threads
Temperature Range 0-100°C (32-212°F)
Minimum Conductivity 100 µS/cm
Power Supply requirement - 115VAC/230 VAC

Each pH-metering system shall comprise electrode assembly, pre-amplifier (if appropriate) and analyzer transmitter. The pH electrode assembly shall be of the same manufacture as the associated pre-amplifier and analyzer and, unless otherwise specified, shall be of the flow through type.

Electrode assemblies shall comprise a glass electrode, a calomel reference electrode and a resistance thermometer for temperature compensation in immersion type housing.

The measuring electrode shall be of glass and shall be designed for resistance to breakage and low electrical resistance. The flow direction in flow-through electrode assemblies shall be such as to give a self-scouring action at the electrodes.

The pre-amplifier shall, per the application, be:

- Integral with the electrode assembly; or
- In a separate enclosure mounted near the electrode assembly

The pH analyzer when mounted externally to a panel shall be housed in a watertight; housing protected to IP 54 and shall be suitable for surface/wall mounting. The analyzer shall have an integral indicator and shall produce an isolated 4-20mA output which is linear to pH. The analyzer span shall be adjustable after installation. Calibration adjustment shall be provided for each end of the measuring range. The overall accuracy of pH meter shall be better than ± 0.1 pH and the repeatability shall be better than ± 0.05 pH. The response time shall not exceed 15 seconds. Controls shall be provided on the front of analyzer or at the side of the panel mounted pull-out module for:

- Automatic/manual temperature compensation;
- Calibration adjustment.

1.1.5.4

Turbidity meters:

Ranges - 0 to 20 NTU for filtered water

0 to 1000 NTU for Raw water

Accuracy: 1% of full scale

Pressure: 30 psi maximum

Power Requirements: 10-36 VDC

Operating Temperature: 0°C to +50°C

Storage Temperature: -10°C to +60°C

Turbidity meters shall be continuous flow, continuous reading, and on-line instruments using the nephelometric principle of measurement.

A 4mA to 20mA dc output signal programmed to cover any part of the instrument range shall be

provided. Enclosures for the turbid meter and control unit for indoor use shall provide a degree of

protection against dust, falling dirt and dripping non-corrosive liquids (NEMA-12) or an equivalent

approved by the Engineer. The overall accuracy shall be better than $\pm 2.5\%$ of reading or 0.25 NTU

whichever is greater and the repeatability shall be better than $\pm 2.5\%$ of reading or $\pm 0.1\%$ NTU whichever

is greater

1.1.5.5

Online Chlorine Analyzer

1.1.6	R a w W a t e r P u m p i n g	i) SENSOR	
		Method :	Amperometric - Potentiostatic
		Electrodes :	Gold Cathode/Silver Anode
		Sensor shaft :	Glass
		Range: :	0.05 to 10 mg/ltr
		Response Time :	T90<2 min
		Temperature Sensor :	PT1000 (internal Sensor)
		Temperature :	0-50 deg.C
		Pressure :	6 Bar
		Mounting :	Flow through Assembly
		Flow rate :	30-55 l/hr max
		ii) TRANSMITTER	
		Type	Microprocessor based programmable
		Display Backlit	LCD Display
		Accuracy :	+/- 2% of Max range
		Repeatability :	1 % of Measuring range
		Resolution :	0.01 mg/lit
		Mounting :	Field mount type
Analog Output :	4 - 20 mA, 2 nos		
Temperature Compensation :	Manual/Automatic		
Enclosure Protection :	IP 67		

Station

Automatic motor controls for ON/OFF action of these raw water pumps with sensors for measuring motor bearing temperature, Over/Low voltage, current, vibration, dry run etc. Flow, Pressure transmitters, sluice valve controllers must be fixed. A local PLC will be highly recommended for the local control action and alarm actions. The output of the PLC and measuring parameters must be sent to the central control room through an appropriate communication technology like LAN/WAN/MODBUS/FIBER OPTIC CABLE/GSM/GPRS Etc. a local hooter and surveillance camera systems are highly appreciated and it can be monitored at the central control room through the same communication infrastructure without any extra cost.

1.1.7 Water Treatment Plant

Water Treatment Plant is in service for the supply of potable water in the city. To increase and control the water quality automatic chemical feeding mechanism may be installed at the chemical dosing stage at a minimal cost. Variation of chemical dosage must be done by the Laboratory report. By entering the lab result in the central control room networked computer by lab personnel the operator can regulate the dosage. Clarifoculator sludge removal can be done by fixing automatic flushing system with appropriate sensors. PH, Turbidity sensors, and the valves in filter water collection, water inlet gate, backwash water inlet valve to under drain system must be automated. The output of all sensors and all valve actuators are connected to the central control room via PLC. Appropriate cabling must be done.

1.1.8 Clear Water Pumping from proposed WTP

Automatic motor controls for ON/OFF action of pumps with sensors for measuring motor bearing temperature, Over/Low voltage, current, vibration, dry run etc. Flow, Pressure

transmitters, valve controllers must be fixed. A local PLC will be highly recommended for the local control action and alarm actions. The output of the PLC and measuring parameters must be sent to the central control room through an appropriate communication technology like LAN/WAN/MODBUS/FIBER OPTIC CABLE/GSM/GPRS Etc. a local hooter and surveillance camera systems are highly appreciated and it can be monitored at the central control room through the same communication infrastructure without any extra cost.

1.1.9 Over Head Service Reservoir (OHSRs)

All the OHSRs are provided at different location for the collection and distribution of water. The pressure, flow of each line should be measured with help of transmitters. Level of tanks must be measured continuously for effective filling and distribution of water. The motor operated valves are to be fitted and controlled as per the instruction from central control room. It is also good if we measure the PH and Turbidity, Dissolved chlorine etc to ensure quality potable water to inhabitants. The data must be communicated to the control room with the help of appropriate devices mentioned earlier.

1.1.10 SCADA Central Control Room

For operational easiness the central control room can be within the premises of WTP. The billing station can be placed at the Municipal Corporation Office (DATA CENTER). The central control room infrastructure including servers and administrative as well as operating centers are of redundant in nature. It is proposed to use internet basis control system so that any one can review from any place with authenticate user ID & password.

1.1.11 Sample list of Instrumentation at raw water intake, WTP and CWT

The entire instrumentation system is required to receive and store the information from instrumentation, electrical and mechanical equipment may vary according to degree of control strategy used.

I. Electrical systems

- a. For measuring the pump efficiency, input voltage, amperage, power consumption and power factors shall be measured using energy meters having RS485 communication feature. The data can thus be transmitted to remotely to central control
- b. Status of all circuit breakers
- c. Status of all LT motors
- d. Winding temperature and bearing temperature of motors
- e. Status of flash mixer, flocculator and bridge drive motors
- f. Status of chemical mixing motors on alum tank

II. Mechanical Equipment

- a. Status of all pumps (raw water pump, dewatering pump, backwash pump)
- b. Status of butterfly valves on individual pumps delivery
- c. Status of motorised valve and gates in the inlet system, sludge bleeding valve, valves on filter bed and so on
- d. Status of chemical feeder valve
- e. Thrust bearing temperature of raw water pumps

III. Instrumentation Equipment

- a. Electromagnetic flow meter at the raw water intake on main header line
- b. Electromagnetic flow meter at WTP inlet, on de-sludging line, inlet and outlet of backwash tank
- c. Level of water in the intake the level of water in surge control tanks
- d. Level in alum solution tank
- e. Water level of backwash tank
- f. Pressure transmitters at the delivery of each pump
- g. Differential pressure transmitters for head loss measurement at filter
- h. Vibration monitoring system for RWP, WTP and CWP
- i. Turbidity and pH measurement of raw water and treated water
- j. Residual chlorine in clear water
- k. Air flow meter on compressed air
- l. Alarm systems
- m. Alarms shall be provided for the followings:
- n. Power failures
- o. High temperature of winding and bearings
- p. Motor trip over load
- q. Pump failed to start or pump failed to stop
- r. Low differential head across filter bed
- s. High level in tanks

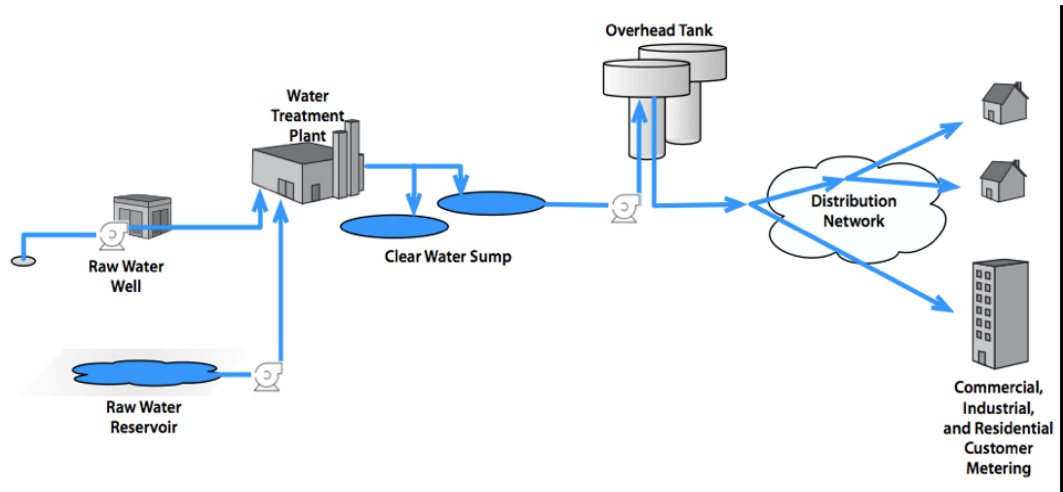


Figure: 8.1- PRESENT WATER DISTRIBUTION INFRASTRUCTURE

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

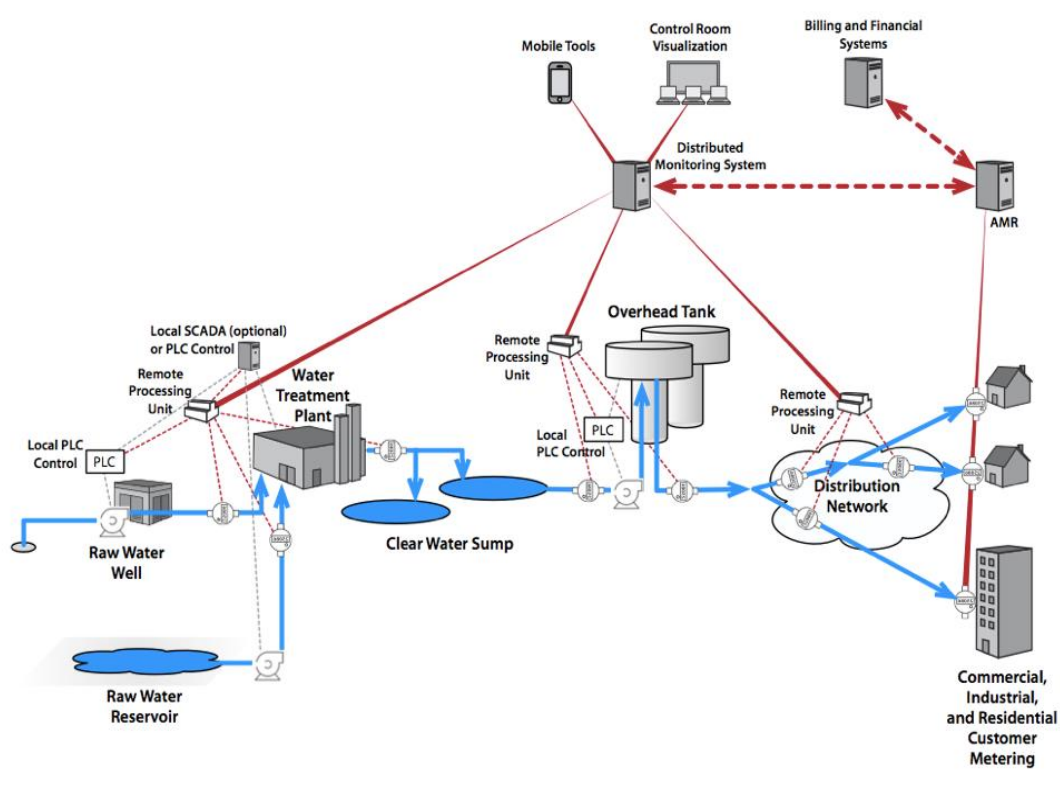


Figure 8.2- Proposed Automated 24x7 Water Supply Infrastructure

1.1.12 LIST OF EQUIPMENTS & INSTRUMENTS but not to be limited. Supply of spares & tools

Sr. No.	Equipment / Instrument
1	Servers, Computers & IT Hardware
2	Printers
3	UPS
4	Batteries
5	Programmable Logic Controller (PLC)
6	SCADA Software
7	RTU/Field Data Transmitters
8	DATA logger
9	Electromagnetic/Ultrasonic Flow meters
10	Ultrasonic Water Level Sensor
11	Pressure Sensor/ Transmitter
12	Water Quality Instruments pH, Turbidity, Residual Chlorine,
13	Instrumentation, Control & Power Cables

The scope includes supply of recommended spares and set of tools as specified in the Bid document.

1.1.13 Operation and Maintenance:

The scope also includes operation and maintenance of the scheme for a period of 5 years after successful commissioning and establishing the design parameter as per relevant IS standard. In the scope of work, attempt has been made to cover all the items of work and accessories. However, in case mention of any component or accessory is left out, which may be necessary to complete the work in full manner and commission the job Successful, the same shall be deemed to have been included in the scope of work

Item/Component	Recommended Makes
VT and Centrifugal Pumps	Kirloskar/Jyoti/Mather+Platt/WPIL/BeconWeir
Pump motors	Kirloskar/Jyoti/CromptonGreaves/ARB/Alsthom/BHEL/Siemens/BharatBijlee
Power Transformers	ABB/Crompton Greaves/Emco/Siemens/Kirloskar
DI Pipes	Electro-steel/Jindal/Tata/Electro-therm
HDPE Pipes & specials	Reliance/Duraline/JainIrrigation/Godavari/Sangir
Sluice Valves/Scour Valves	Kirloskar/IVC/VAG/IVI/Fourcss/DURGA/DALUI
Butterfly Valve	Kirloskar/IVC/VAG/IVI/Fouress/ DURGA/DALUI
Non-return Valves	Kirloskar/IVC/VAG/IVI/Fouress/ DURGA/DALUI
Kinetic Air Valve	Kirloskar/ IVC/VAG/IVI/ Fouress/ DURGA/DALUI
Valve Actuators	Auma/Rotork/Limitork
Hydraulically operated Flow-cum-Pressure control valves	VACi/Darling-Muesco/Singer
Single faced Sluice Gates	JASH/VAC1/Kirloskar
Water Hammer Control Devices	Sureseal
Electro-magnetic Flow meters	Emerson/KrohneMarshall/Yokogawa/
Woltman type Bulk flow water meters	Zenner/Itron/Elster/Mmol
WTP equipment :Flashmixers, Clariflocculators, Flocculators, Rotating bridge, Blowers etc.	Triveni/ Shivpad/Dorr-Oliver /Voltas/Reliable/KAY/AIRVAC
Chlorination equipment. Chlorinator, Chlorine leak detector, Residual Chlorine analyzer, Scrubber etc.	Pennwalt/W&T/Alldos/ CHLOROTECH
DI/C Fittings & specials	Kiswok/Electroste1/Kejriwal
Dismantling/Expansion joints	AnupEngg./ LoneStar /Vedaiita /Precise

Compression fittings, Tapping Saddles, Electro-fusion Couplets	Kimplas/,Georgeficher/Glynwed/Frialeii/Trustlene/GPS /Durafuse
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1.1.14 The scope of work includes design, supply, installation, commissioning and maintenance for 05 years of SCADA Automation of Water Supply scheme of RAIPUR consisting of proposed WTP 80 MLD capacity including clear water sump-cum pump house, Raw Water sump-cum Pump House,

The work also include supply of electromagnetic flowmeter, pressure sensors, water level sensors, depth sensors, valve actuators and for distribution outlet at OHSRs(all existing and proposed), auto-phase reversal relays including Supply of all equipment and connected hardware & software for MCS and LCS like LCD monitors, UPS and connected software & hardware, cabling and related licences if required so, complete in all respect.

PLC- SCADA Auotmation system should be able to control the functioning of all raw water pumps, all treatment units of 80 MLD WTP, Clear water pumps and the valves at the inlet and outlet valves of all connected OHSRs & their digital level indicators , FCVs, pressure gauges and all bulk flow meters

For selection of field instruments and control system or anything related to instrumentation, the Contractor shall follow the specifications contained herein. The Contractor shall be required to provide all equipment, accessories, cabling, earthing, providing necessary transducers/sensors, system hardware/software, programming logic etc. to achieve the functional requirements described herein. The civil and electromechanical work associated with installation of the instrumentation equipment shall be in the Contractor's scope.

The scope for Control Instrumentation and PLC-SCADA based automation System shall include but not limited to: PLC panel, SCADA Workstation, Control Desks, Control & Signal Cables and Accessories and associated equipments and appurtenances (Valve actuators, electric motors, blowers etc).

The specific Scope of the PLC-SCADA System for WTP shall involve:

1. Monitoring and Visualization of normal filter cycle of each bed.
2. Monitoring and Control of Backwash Cycle of each bed based on loss of head
3. Monitoring and Visualization of Water Quality and Flow parameters including recording and retrieval in the form of Shift / day / monthly reports.
4. Manual Operation through Control desks.

The Contractor shall provide on-Site training during Trial run for 06 months and commissioning to Engineers and Process Operators.

Instrumentation at new WTP (80) proposed shall include:

- Ultrasonic Level Transmitters for Filter beds level (LOH)
- Filter Control beds
- Turbidity & pH Analyzer at Raw water inlet.

- Turbidity, pH&chlorine analyzer at Clear water.
- Level transmitter at Wash water tank
- Open channel flow meter at RAW water inlet channel (Par shall flume shall be provided with Flow Vs Head Data).
- Open channel flow meter at Clear water channel (Par shall flume shall be provided with Flow Vs Head Data).
- LED Display Panel to display Parameters at office room of WTP.
- Level transmitter at clear water sump / tank

The scope includes providing SCADA software for real-time monitoring, data acquisition, data monitoring etc. Detailed Specifications are spelt herein:

General requirements

The control systems for the Water Treatment Plant (WTP) shall be based on the use of Programmable Logic Controllers (PLCs). The various modes of controls shall be Auto, Semi-automatic and Manual. Remote operation facilities shall be provided for operating the equipment from the local SCADA system.

In future, the Employer's Representative proposes to install a Master SCADA system for central monitoring and for remote operations of the WTP, CWPS, all the water-works in the water supply system and the distribution system. The local SCADA systems and the PLCs shall be capable of interfacing / networking with the future industry standard SCADA system.

In the event of failure of the automatic controls or by operator choice it shall be possible to revert to semiautomatic or manual operation of each item of Plant independent of the PLC functions. The field instruments shall also form an integral part of the control system.

Design requirements of Instrumentation and Control

General

Instrumentation and Control system shall be designed, manufactured, installed and tested and approved by engineer-in-charge by an experienced system integrator to ensure high standards of operational reliability. Instruments mounted in field and on panels shall be suitable for continuous operation. All electronic components shall be adequately rated and circuits shall be designed so that change of component characteristics shall not affect plant operation.

All I&C equipment shall be new, of proven design, reputed make, and shall be suitable for continuous operation. Unless otherwise specified, all instruments shall be tropicalised. The outdoor equipment shall be designed to withstand tropical rain and temperature variation from 0 to + 50⁰ C. wherever necessary, space heaters, dust and waterproof cabinets shall be provided. Instruments offered shall be complete with all the necessary mounting accessories. The control equipment installed inside the control room should be designed to work at 35⁰ C and the instruments in sheltered place outside the control room at 45⁰ C.

Electronic instruments shall utilize solid state electronic components, integrated circuits, microprocessors, etc., and shall be of proven design.

For transmitting instruments, output signal shall be 4-20 mA DC linear having two wire systems.

Unless otherwise stated, overall accuracy of all measurement systems shall be $\pm 1\%$ of measured value, and repeatability shall be $\pm 0.5\%$.

After a power failure, when power supply resumes, the instruments and associated equipment shall

start working automatically.

The instruments shall be designed to permit maximum interchange ability of parts and ease of access during inspection and maintenance.

Unless otherwise stated, field mounted electrical and electronic instruments shall be weatherproof to IP-65.

The instruments shall be designed to work at extremes of the ambient conditions of temperature, humidity, and chlorine contamination that may prevail. The instruments shall be given enough protection against corrosion.

Lockable enclosure shall be provided for the field mounted instruments wherever required.

All field instruments, and cabinets / panel-mounted instruments shall have tag plates / name plates permanently attached to them.

The performance of all instruments shall be unaffected for the $\pm 10\%$ variation in power supply voltage and $\pm 5\%$ variation in frequency simultaneously.

All wetted parts of sensors shall be made out of non corrosive material capable of working with chlorine content of 5 ppm.

For all instruments (transmitting analogue signals) installed in the field (outside pump house), surge protection devices (SPDs) shall be provided at both ends of the connecting cable for the protection against static discharges / lightning and electromagnetic interference.

Pressure transmitters shall be provided with two valve manifold and a test port, so that in situ calibration can be carried out.

Two wire transmitters shall be provided with on-line test terminals.

The ranges of all instruments shall be suitable for the application in the process.

Instruments of similar type shall be of same make for appropriate inventory of spares, ease of maintenance and training.

The Indian agents of imported equipment shall have establishment to provide after sales maintenance facilities.

Erection requirements

The locally mounted instruments shall be installed on appropriate rigid supports, having minimum vibrations. The instruments shall be installed away from hot objects.

The instruments shall be protected against physical damage or liquid splashing by providing metallic/ fibre glass enclosures or canopies.

All transmitters / transducers shall be installed nearest to the sensing point and at a place convenient to get access for maintenance.

The field instruments i.e. the instruments mounted outside the control panel shall be mounted at a convenient height of approximately 1.5 m above grade platform.

While installing the instrument, provision shall be made to carry out in-situ calibration Isolation valves and drain valves shall be provided to the field instruments wherever required.

Instrumentation cables shall be separately laid, away from electrical cables. The instrumentation cables from the field mounted instruments shall be terminated on the control panel without any joints.

Double compression glands shall be used for glanding the cable in field instruments and instrument control panel.

Metallic tag number plate shall be provided for each instrument.

Instrument Power Supply Cables and Instrumentation Signal Cables

Cables shall be capable of satisfactorily withstanding without damage, transportation to site, installation at site, and operation under normal and short circuit conditions of the various systems to which the respective cables are connected when operating under the climatic conditions prevailing at the site as indicated in this specification.

Cable joints in instrument signals and power supply cables shall not be permitted.

Cables shall be capable of satisfactory performance when laid on trays, in trenches, conduits, ducts and when directly buried in the ground.

Cables shall be capable of operating satisfactorily under a power supply system voltage variation of $\pm 15\%$, a frequency variation of $\pm 5.0\%$.

Laying Of Cables

A distance of minimum 300mm shall be maintained between the cables carrying low voltage AC and DC signals and a distance of minimum 600mm shall be maintained between HT cables and signal cables. In outdoor areas, the cables shall be directly buried. Each instrumentation and power supply cable shall be terminated to individual panel/ terminal box. Identification of each cable shall be by proper ferrules at each junction as per cable schedule to be prepared by Contractor.

Cables shall be laid in accordance with layout drawings and cable schedule which shall be prepared by Contractor and submitted for approval.

All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient amount for the final connection of the cable to the terminals on either end. Various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. A loop of 1 meter shall be left near each field instrument before terminating the cable. Cables shall be complete uncut lengths from one termination to the other.

All cables shall be identified close to their termination point by cable numbers as per cable interconnection schedules. Identification tags shall be securely fastened to the cables at both the ends.

Programmable Logic Controllers

Codes and Standards

The design material, construction features, manufacture, inspection and testing of Programmable Logic Controllers (PLC) shall comply with all currently applicable statutes, regulations and safety codes. The PLC shall comply with the latest applicable standards and codes. If any such standards are not applicable then the same shall comply with the available recommendations of professional institutes like NEMA, IEC, ANSI, ISA, IEEE, DIN and VDE.

Design and Installation requirements

This shall comprise of programmable systems based on operational logic for safe and automatic operation of the pumping stations and the treatment plant to produce required quantity of drinking

water of specified parameters. PLC shall be provided as a stand-alone controller to perform combinational and sequential logic functions, status monitoring and reporting functions with counter and timer facilities, for each station.

PLC shall comprise of necessary processors, Input /Output (I/O) modules, communication interface modules and man-machine interface required to perform the desired functions.

PLC shall have the following attributes as a stand-alone controller:

1. It shall carry out sequential start/stop logic implementation for operation of the pumps.
2. It shall carry out computation and interfacing for data acquisition, data storage and retrieval.
3. It shall accept downloaded program from a programmer.
4. It shall have different functional modules to perform the desired functions.
5. It shall scan the inputs in time cycles and update the status of inputs/outputs.
6. To avoid spurious output because of output module failure, all commands shall be associated with release signals. Release signals shall include information on healthiness of the hardware, software and power supply modules.
7. It shall have relays, counter/timer functions, internal registers/ flags, watch dog timer, set/reset facilities, up-down counter etc.
8. It shall have provision for spare input and output modules.

The PLC system shall be expandable and shall be modular in construction so as to carry out the future expansion without any hardware modifications.

The PLCs shall have analog and digital signal monitoring capability for checking the healthiness of the signals. In case of detection of any unhealthy signal "PLC trouble" alarm shall be generated. In case of failure of a PLC, the status of all the outputs of the PLC shall be stay put.

PLC shall be 32 bit microprocessor based with state of the art technology. System components shall be carefully chosen so that the reliability of the PLC shall be high. PLC shall use open standard bus protocols and structures for all communication within and outside the system.

In case of system failure or power supply failure all the outputs shall attain pre-determined fail safe condition. Spurious signals shall not cause equipment operation. Check back before execution features shall be incorporated.

The PLC used shall have a proven record in the type of application concerned and in the prevailing environmental conditions.

It shall be possible to perform the simulation functions and testing the program by changing the status of contacts and monitoring the output.

The PLC system shall support 'hot swapping' of I/O modules i.e., removal and insertion of I/O modules under power on condition.

The design of system configuration and development of PLC software shall be undertaken by the PLC manufacturer or System Integrator authorized by the PLC manufacturer. They shall have previous experience in similar applications and shall have a service center at a reasonable distance so as to provide services at a short notice.

Particular requirements for PLC

Sl. No	Description / Component	Requirement
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TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

Sl. No	Description / Component	Requirement
1.	Functions	As per the control logic and input/output list
2.	Expandability	50% of installed capacity
3.	Interposing relays	Shall be provided for all the digital outputs (DO) including spare DO and for digital inputs wherever required.
4.	Optical isolation for all digital inputs and outputs and galvanic isolation for analog inputs	Required
5.	Mounting	Inside the control panels with viewing glass on the door
6.	CPU and power supply module redundancy	Required (In hot standby mode)
7.	<u>Processor</u>	
a)	Diagnostic function performance	Required
b)	Minimum 32 bit performance with floating point capability	Required
c)	Memory module	To store programs, standard software to perform logic functions and diagnostic functions
8.	Inputs and Outputs	Refer I/O schedule in the respective sections of the pumping stations and WTP
9.	System Loading	Max. 60% under worst loading Conditions
10.	Power supply to sensor / transmitters	Required
11.	Type of input	Binary, analog and pulsed as required.
12.	Outputs	Binary signals (Relay outputs for driving MCC Starter coils, driving motorized valves etc.); analog and pulsed as required.
13.	Spare I/O	20% of each type, wired to terminal block
14.	Accessories	Laptop computer for programming along with all necessary adapter, laptop carrying kit, cables, connectors and accessories (1 No. common for RWPS , WTP and CWPS) Proprietary PLC programming and documentation software along with all cables

Sl. No	Description / Component	Requirement
		and connectors for loading on laptop computer and on local PC based SCADA system
15.	Interface (Hardware and Software) to Local SCADA system	Required
16.	Communication port to be provided for interface to Local SCADA system	RS 232/ RS 485 (with suitable converters as applicable)
17.	Communication port for interfacing with temperature scanners (for pumping stations)	Required
18.	Communication port for interfacing with Multifunction meters/ Motor Protection Relays	Required
19.	Communication port for interfacing with flow indicator totalisers	Required

Central Processing Unit

The Central Processing Unit (CPU) shall be high performance processor with modular configuration suitable for real time process. High inherent reliability, self checking, error-recovery and trouble-shooting features shall be source of the features of CPU.

Communication between CPU and peripherals shall be by an I/O bus. The individual device, interfaces shall be capable of being plugged into the I/O bus.

CPU shall have a real time clock capability to accept a time synchronization pulse from external communication system and adjust its internal clock with the pulse.

CPU shall have extensive self diagnostic facilities and watch dog timers to identify faults at card levels.

The CPU word length shall be 32 bit or more. The CPU shall have at least 50% spare capacity after commissioning of the application.

Automatic restart of the system on resumption of power shall be provided.

Memory Unit

Memory unit shall comprise of highly reliable memory chips which are industry standard, proven design with fast random access and suitable for operation in process environments. Main memory shall be modular and facility shall be provided for upgradation and expansion of memory to meet future demands.

Sufficient program memory and data memory space shall be provided. At least 50% extra memory space shall be provided over the actual requirements. System initialization and application software shall be stored in EEPROM or EPROM with necessary hardware. Running data shall be stored in a RAM with

internal battery back-up. The battery back-up provided shall last for at least one month with life of battery a minimum of 3 years. Appropriate programs for application software modification shall be provided.

Input Output modules

1. Standard rack mounted I/O modules with plug-in cards shall be provided. Field wiring shall be terminated in screwed terminal blocks and interconnected to the processor I/O system with pre-fabricated cables and plug in card type connectors.
2. 20% extra I/Os of installed capacity for each type shall be provided as spares and shall be wired to the terminal block of the control panel. Provision shall be made for future expansion of extra I/O modules of the installed capacity.
3. Some of the common features of the I/O modules shall be as follows:
 - (a) All inputs shall be terminated with input protective network and necessary isolating barriers.
 - (b) Filters for noise rejection.
 - (c) Provision for isolation of faulty channels.
 - (d) Input /output status shall be indicated by LEDs.
 - (e) Test points and fault indication LEDs shall be provided to carry out module testing.
 - (f) Surge withstand facility as per IEEE standards.
 - (g) All the modules shall be of addressable type.
 - (h) Protection for continuous overload upto 20% of all input ranges.
 - (i) All outputs shall be provided with fuse protection and fuse failure detection. The fuses may be mounted externally from the output module.
 - (j) All the modules shall be of addressable type.
 - (k) The I/O modules shall have diagnostic features i.e., in case of failure of any I/O channel an alarm "PLC trouble" shall be generated automatically.
 - (l) Internal battery back up.
4. Analog input modules
They shall consist of an input isolation unit, signal conditioning unit and an analog to digital converter (ADC). In addition, the following features shall be provided:
 - (a) Cross talk attenuation.
 - (b) Provision for monitoring of the ADC for overflow detection.
 - (c) Gain amplifier with high common mode rejection ratio.
 - (d) Accuracy for analog signals shall be minimum + 0.5%.
 - (e) Screwed terminals with fuse and LED for indication of 'fuse blown' shall be provided for each analog input.
5. Digital input modules
The following design features shall be provided.
 - (a) Contact bounce protection.
 - (b) Choice of type of contacts.
 - (c) Screwed terminals with fuse and LED for indication of 'fuse blown' shall be provided for each digital input.
6. Digital output modules
The digital output module shall provide contact closure output by driving relays. The features to be provided are as follows:
 - (a) Contact bounce protection.
 - (b) Relay output to operate pump motors and motorized valve actuators.

(c) Fail safe position in case of output module failure and fault indication.

The digital input and digital output modules shall not have more than 16 channels in each module.
The analog input modules shall not have more than 8 channels in each module.

Default values

Every operator selectable parameter shall be provided with a default value held in EPROM or EEPROM in the relevant PLC.

The default value shall be used if no other value has been entered through the local SCADA system or if the value entered through the local SCADA system has been lost. The default values shall be made available for interrogation by the local SCADA system at all times.

Sensible and logical default values shall be inserted prior to the start of system tests. The default values at the time of handing over the plant shall be those found operationally suitable during commissioning.

The PLCs shall make available for interrogation by the local SCADA for bits corresponding to the following PLC faults:

- (a.) Failure of PLC as indicated by the PLC watchdog relay;
- (b.) Failure of each I/O card;
- (c.) Failure of communication link
- (d.) Status of 24 V DC power supply for I&C system.

Software

The on line real time operating system supplied shall be proven for similar application and shall be able to support all the equipment/peripherals.

PLC programming shall be carried using latest available industrial standard formats for logic. The PLC programming shall be prepared using the PLC manufacturers recommended windows based PLC coding and documentation software. The PLC code shall be structured in the manner of the best industry standard and have comprehensive subroutine and rung annotation. Ladder program will be preferred.

The PLC shall be commissioned using RAM memory storage modules which shall be replaced with an Erasable read only memory (EPROM) or electrically erasable read only memory (EEPROM) when testing is complete.

Programming Unit

The Contractor shall supply a laptop computer (common for use at WTP and CWPS, ESR) preloaded with required softwares. The configuration of the laptop PC shall be latest available at the time of execution of Contract. The licensed copies of the various softwares shall be provided which will include software for programming and operating system for PLC, proprietary PLC programming and documentation, SCADA application, latest Office software, latest Antivirus, latest Adobe Acrobat Reader and Diagnostics software.

The laptop computer shall be provided with all necessary adapter, laptop carrying kit, cables, connectors and accessories.

The proprietary PLC programming and documentation software shall have facilities for:

- (a) Carrying out program revision management
- (b) Insertion of comprehensive program subroutine and rung comments
- (c) Search and find and search and replace 'contacts' and 'coils'
- (d) Simulation functions and testing of the program by changing the status of contacts and monitoring the outputs
- (e) Preparation of coil and contact list and their locations and memory maps.
- (f) Make system backup copies while the system is online
- (g) Upload and down load programs to the PLC on line
- (h) Carry out on line monitoring and fault finding on the PLC.

Operator Interface Unit

OIU shall be provided for the PLC system on the front facia of the control panel.

The OIU shall consist of panel mounted industrial grade unit with Color LCD screen and tactile key pad. It shall be environmentally protected and designed for plant room use with a 'wipe clean' finish.

The OIU shall provide facilities to:

- (a) Display status of Plant in a graphical and tabular format (i.e. running, stopped, fault etc.)
- (b) Display analog values on the appropriate graphic screen (displays shall change color when in fault conditions or when data is suspect);
- (c) Annunciate alarms associated with the area of the plant concerned including details of the time the alarm occurred
- (d) Provide facilities for the operator to:
 - adjust process set points;
 - select process modes;
 - select number of running pumps;
 - provide all other facilities required for operation of the Plant;
 - acknowledge alarms;
 - view a journal of unacknowledged alarms;
 - view a journal of the alarms acknowledged and unacknowledged.
 - Display process set points;
 - Display a total running hours log of local transmission pump drives.
 - Provide real time and historic data
 - Any additional features required to assist in the effective and efficient operation of the plants.
 - Security systems shall be provided to prevent unauthorized adjustment of process set points.

Graphic screens shall be provided as follows:

- (a) Main and subsystem menus;
- (b) Pumping system overview (i.e. providing details of Nos. of pumps running, total flows, reservoir/ sump level, power supply status etc.)
- (c) Transmission main local surge suppression equipment tabular status format screen;
- (d) Screens to permit viewing and modifying of process set points
- (e) Tabular screen of pumping plant status and values
- (f) Running hours log for pumping stations.

The screens shall display data commensurate with their size and the area of and the number of Plant items covered. The Contractor, in addition to the specific screen requirements stated above shall be responsible for providing any additional screens to ensure comprehensive coverage of the Works.

The software chosen shall have a comprehensive alarm handling capability with the ability to annunciate, acknowledge, sort and maintain a historic record of current and past alarms including details of when the alarm occurred, when it was acknowledged and when it returned to normal.

Tests for Programmable Logic Controller (PLC)

The following tests shall be carried out for the PLC

- Scanning rate check for analog signals
- Scanning rate check for digital signals
- PLC cycle time check
- Processor redundancy check
- Power supply redundancy check
- Processor failure alarm check
- Power supply failure alarm check
- Card level failure detection check
- Failsafe output check on failure of output module
- Sensor failure detection check
- Status indication check for healthiness of each input/output channel and module
- Status indication check for power supply for each module
- Isolation check for input/output module
- Input filtering check for noise level
- Processor – battery back-up check
- Controller functioning check on under voltage and over voltage
- Ladder logic program check by simulation of inputs and outputs
- Functional check of programming units.

Acceptable makes of the PLC system are Rockwell Automation, Schneider, Siemens, and Tata Honeywell or equivalent as approved by Employer's Representative.

PC Based Local SCADA

The PC based local SCADA system shall consist of an industrially rugged Personal Computer and shall be a high performance processor with modular configuration suitable for real time process applications. The SCADA system shall consist of following:

- (1) 21" (color, low radiation) VDU with rack mounted shall be latest at the time of supply
- (2) Printers
 - 1 No. 132 column printer shall be provided for on line printing of alarms and event logging.
 - 1 No. A3 size color graphic laser printer shall be provided for report generation and color screen printing.
- (3) Keyboard and Mouse

The keyboard and mouse shall be industrially rugged having built in touch pad and 3 keys for mouse functions.
- (4) 21" color monitor or better shall be provided.

- (5) A separate control desk shall be provided for the PC along with 21" color monitor, key board, mouse and 2 numbers printers.

The system shall be provided with Open system standards windows based supervisory, control and data acquisition (SCADA) software and shall support industry standard protocols for third party interfacing required in future for master SCADA system connectivity. The software package chosen shall be a market leader and have a proven record of use within the water industry for similar applications.

The PC based SCADA system shall provide facilities to:

1. Provide color graphic screen representation each plant area and system.
2. overviews
3. Display status of Plant in a graphical and tabular format (i.e. running, stopped, fault etc.);
4. display analog values on the appropriate graphic screen (displays shall change color when in fault conditions or when data is suspect);
5. Display status and values at other down stream plants as required.
6. annunciate alarms associated with the area of the plant concerned including details of the time the alarm occurred;
7. provide facilities for the operator to:
 - adjust process set points;
 - select process modes;
 - provide all other facilities required for operation of the Plant;
 - acknowledge alarms;
 - view a journal of unacknowledged alarms;
 - View a journal of the last 200 alarms acknowledged and unacknowledged.
 - display process set points;
 - provide real time and historic trending of local analogue values;
 - issue commands for start-stop operation of pumps;
 - Issue commands for opening/ closing of motorized valves;
8. provide data archiving of all local analogue values;
9. prepare daily, weekly and monthly reports (providing details of daily, monthly and weekly throughputs against numbers of pump running hours and power usage);
10. display a total running hours log of local transmission pump drives;
11. any additional features required to assist in the effective and efficient operation of the pumping station and water treatment plant;
12. Power monitoring using various analogue/ digital inputs provided from the HT switchgear as listed in the I/O list;
13. Security systems shall be provided to prevent unauthorized adjustment of process set points.
14. Provide continuous and effective monitoring and control of equipment.
15. On-line data monitoring and control
16. Database for both real time and historical data management
17. Safety tagging and interlocks operation
18. PLC program uploading and downloading
19. Interoperability with the other packages such as Geographic information system (G.I.S.), Water demand forecast, Management Information System (MIS) for effective Water Management etc.

Notes:-

- i. Graphic screens shall be provided as follows:
 - main and subsystem menus;
 - Pumping system overview (i.e. all pumping stations providing details of No. of pumps running and standby, total flows, reservoir levels, power supply status etc.);
 - Treatment plant overview (i.e. Clariflocculators in use, number of filters in operation, backwash, maintenance, recycling reservoir level and backwash reservoir level, input raw water flow to treatment plant, output flow of treated water from treatment plant and turbidity, pH of raw and clear water etc.);
 - over view of the local pumping station providing details of reservoir level, total flow and Nos. of pumps running;
 - overview of power system;
 - overview of control system;
 - screens to permit viewing of process set points;
 - tabular screen of Pumping Plant status and values;
 - The time and power frequency shall always be displayed in a corner or reserved space on the screen.
 - running hours log for Pumping.

The screens shall display data commensurate with their size and the area of and number of Plant items covered. The Contractor, in addition to the specific screen requirements stated above shall be responsible for providing any additional screens to ensure comprehensive coverage of the Works.

A comprehensive screen navigation system shall be provided giving access to all screens via a system of menus and short cuts (i.e. it shall be possible to follow the process from one screen to another by clicking the mouse cursor on screen 'hotspots' to effect the move from one screen to another).

- ii. The software chosen shall have a comprehensive alarm handling capability with the ability to annunciate, acknowledge, sort and maintain a historic record of current and past alarms including details of when the alarm occurred, when it was acknowledged and when it returned to normal.

- iii. The sample rates required for the displaying of trends shall be software settable with predefined access level and shall typically be as follows:

- One sample every 15 seconds for flow values;
- One sample every 30 seconds for levels;

The system shall be capable of storing real time data for one day and historic data for 60 days.

- iv. The sample rates for archiving shall be the same as for trending. The archives shall be stored in daily files. The system shall provide capacity to store archives for 60 days. A warning alarm shall be provided to the operator to advise that archiving to disk should take place or archived data will be overwritten. It shall be possible to:

- Reintroduce the data derived from archiving to the PC based local SCADA system and the archived data viewed using the trend facility;
- Display the data using industry standard spread sheet or database software in tabular format on a third party machine.

- v. The Contractor shall provide latest technology (at the time of supply) based industrial Magneto-Optical (MO) disc drive or DAT drive with the PC based SCADA system in order to download archive data or to upload previously stored archive data onto electronic storage media. The MO or DAT disc drive shall be suitably protected against the environment. It shall be built as an integral part of the industrial PC offered for the local SCADA system.

- i. Design requirements of the system shall take into consideration following criteria:

- (1) Fail Safe Design
- (2) System Availability
- (3) Equipment Reliability
- (4) Expandability
- (5) User friendly to operate and maintain
- (6) Fault Monitoring and Diagnostic Capability

ii. Time Stamping and Synchronization

- i) Real time clocks shall be provided in all PLCs as well as in the local SCADA stations.
- ii) The local SCADA system and PLCs shall be synchronized. Further facility shall be provided in local SCADA system to synchronize its time with Master SCADA system time (in future).
- iii) Time Synchronization with all PLCs in a plant (e.g. WTP) shall be done at start-up and periodically. Contractor shall indicate the corresponding period.
- iv) The maximum time error at any time between PLCs and the local PC based SCADA system shall not exceed 5 m-sec.
- v) The time stamping of PLC shall be made available to the local SCADA system for the data, alarms, events etc. logged in database.

iii. Test on local SCADA

The following tests for various items of local SCADA system including power supply system shall be carried out as a part of FAT in addition to other tests indicated by Contractor in FAT document.

iv. Functional

All cubicles shall be energized and the power supplies tested on the panel and internal lighting arrangements examined.

The boards shall be examined to check that there are no Status Error LEDs lit.

The peripherals like printers etc. shall be energized and proper operation of peripheral checked by self tests on equipments which have the facilities and others like VDUs, by connecting them to the system.

The system I/O shall be simulated and checked upto LOCAL SCADA system database.

By varying the different inputs at random and checking to ensure that right status reporting is done on the LOCAL SCADA system, the healthiness of all channels shall be checked with rated load connected.

Displays : The following shall be functionally checked

Mimic display: Symbols, colors, for correct/ approved format etc.

Control Operations: Simulated command operations from SCADA without any malfunctioning.

Status changes: Representation of open/close facility and mode of operation

Variables: Engineering units, updating representation

Events and alarms: Generating of alarms, events by verifying inputs at random, color code, formatting, and printing

Trend: proper selection, presentation under different time scales and printing

Reports: Reports shall be checked for correct/ approved format, logging intervals, printing intervals, data accuracy etc.

Response Time Checking:

System response time shall be tested after simulating the full I/O and Man machine interface system.

Time taken from object status change to the presentation of object status on the display.

Time taken to generate and display single alarm and multiple alarms (upto 50) from the time of alarm condition.

Time taken to display a complex picture with all variables from the time of calling the display.

The accuracy of alarms on VDU and printer.

Time stamping accuracy between LOCAL SCADA and PLC times.

Other Tests on local SCADA

Fail safe operation of local SCADA system during total (including battery) backed power failure and restoration.

Fail-safe operation during on-line connection and removal of hand held maintenance unit, if any.

Check of detecting and reporting of failure of subsystem connected to the network on VDU status display.

Check of error free data transfer on Communication system along with modems/communication interfaces.

Check of hard copy unit functions by printing of process pictures.

Check of maintenance, backup (logic/programs, IO database, historical database, system configuration etc.) functions by connecting them to the system.

Acceptable makes of the Local SCADA System are Rockwell Automation, Schneider, Siemens, and Tata Honewell or equivalent as approved by Employer's Representative.

Instrument Control Panel

General

Control Panel shall be CNC machine prefabricated out of CRCA sheet steel of thickness not less than 2 mm, modular in construction, properly reinforced, powder coated and having rigid frame structure. Internal mounting plate including the gland plate shall be 3 mm thick. The control panel shall have dimensions as per system requirement. However, the control panel height shall not exceed 2200 mm.

The exterior corners and edges shall be rounded to give a smooth overall appearance with projections kept to a minimum.

Lifting lugs shall be provided for installation purposes and shall be replaced with corrosion resistant bolts after installation.

Control Panel shall be completely metal enclosed and shall be dust, moisture and vermin proof. Control Panels and instrument enclosures shall provide a degree of protection as follows:

- Indoor Installation : IP 52
- Outdoor Installation : IP 65

Control Panel shall be free standing type. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation.

Metal sills in the form of metal channels properly drilled shall be furnished along with anchor bolts and necessary hardware for mounting the control panels. These shall be dispatched in advance so that they may be installed and leveled when concrete foundations are poured.

Cable entries to the panels shall be from the bottom with fire retardant spray compound sealing. Control panels shall be provided with louvers along with washable micron filters AIRIN – AIROUT fans. The control panels shall be designed for front as well as rear access.

The CP shall provide separate areas for the PLC, internal power distribution, instrumentation, field cabling termination and for Surge protection devices (SPDs).

Mounting

All equipments on front of panel shall be mounted flush or semi-flush. In case of semi-flush mounting, only flange or bezel shall be visible from the front. Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent equipment.

Equipment mounted inside the panel shall be so located that terminals and adjacent devices are readily accessible without the use of special tools. Terminal markings shall be clearly visible. Cut-outs and wiring for free issue items, if any, shall be according to corresponding equipment manufacturer's drawing. Cut-outs, if any, provided for future mounting of equipment shall be properly blanked-off. Wherever required, panels/desks shall be matched with other adjacent panels/desks in respect of dimensions, color, appearance and arrangement of equipment on the front.

Earthing for Instruments

The panel shall be equipped with an earth bus securely fixed along the inside base of panel.

All metallic cases of relays, instruments and other panel mounted equipment shall be connected to the instrument earth bus.

Looping of earth connections which would result in loss of earth connection to other devices when the loop is broken shall not be permitted. However, looping of earth connections between equipment to create alternative paths to earth bus shall be provided.

A separate instrument earth bus will be created which will be floating and all the cable shields will be terminated onto this bus. This bus will be connected to an electronic earth pit.

Frame Earthing

All metal parts other than those forming part of an electrical circuit shall be connected to a copper earth bar run along the inside bottom of the panel. The minimum section of the earth bar shall be 25 mm x 3 mm. A 15 mm diameter hole is to be provided at each end of the bar. Connection of the earth bar to the station earth shall be carried out by Contractor.

Space Heater

Strip type space heaters of adequate capacity shall be provided inside control panels to prevent moisture condensation on the wiring and panel mounted equipment when the panel is not in operation. The heaters shall operate on 230 V AC. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. The operation of heaters shall be controlled by thermostats.

Interior Lighting and Receptacles

Each panel shall be provided with a LED lighting fixture rated for 20 watt, 230V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The illumination lamp shall be operated by door switch or manual switch. Each panel section shall be provided with separate lighting.

Each panel shall be provided with 230V, 1 phase, 50 Hz, combined 5 amps and 15 amps, 3 pin receptacle with a switch and neon indication. The receptacle with switch shall be mounted inside the panel at a

convenient location. If the panel has front and rear doors then maintenance socket shall be provided at both locations.

Voltage Level and Power Supply Units

The incoming power supply to the control panel shall be 230 VAC, 50 Hz. Contractor shall provide necessary transformers, converters, inverters and other associated hardware required to generate the requisite power supply. Generally, voltage levels for control schemes and power supply for instruments shall be 24 V DC. Power supply to all the instruments mounted outside the control panel shall be provided from the power supply units in the control panel. In case the instruments require power supply other than 24 V DC, the Contractor shall provide the necessary convertors. The power supply to all the instruments shall be without interruption and shall be continued even in case of failure of 230 V A.C. power supply. The battery and battery charger shall be provided for this purpose and sizing of the same shall be based on the entire load of instrumentation system.

Level measuring system

Level measurement system shall consist of level transducer, level transmitter, digital level indicator and any other items required to complete the level measuring system.

To reduce the effect of water turbulence in reservoirs / tanks, averaging facility should be provided in the transmitter unit for providing steady readings. Stilling pipe shall be provided for level electrodes.

The design and application of the level measuring system shall take into account the reservoir construction, the material, size, shape, environment, process fluid or material, the presence of foam, granules, size etc.

For ultrasonic type and radar level transducers, the design and installation shall avoid any degradation of instrument performance due to spurious reflections, absorption, sound velocity variations, sensor detection area, temperature fluctuations, specific gravity changes and condensation. Facilities shall be provided for rejection of spurious reflection.

The level transmitters shall be mounted in suitable weatherproof lockable pedestal enclosures near the level sensor.

On-line pH Measuring System

- (a) The pH measuring system shall consist of a pH electrode, pH transmitter, digital pH indicator, electrode holder assembly and any other item required to complete the pH measuring system.
- (b) The pH transducer shall be rugged in construction and shall be suitable for continuous operation. pH transducer shall include measuring electrode, reference electrode, and a temperature compensator electrode. All wetted parts of the transducers shall be of non-corrosive material.
- (c) The pH transmitter output shall be isolated, and shall be suitable for transmitting over long distances.
- (d) The electrode holder assembly shall be of such a design that it contains some water even when sampling pump is cut off and shall be provided with flow regulating device.
- (e) A sampling system consisting of sampling pump / pressure reducing valves, flow regulator, rotameter, filter assembly etc. shall be provided. The sample water will be connected to a cabinet containing pH analyzer equipment and pH transmitter.

<u>D) General</u>		
1	Overall accuracy of measurement loop	±1% of measured value
2	Standard pH solutions for on site calibration	For pH 4,7 and 10 shall be provided
<u>II) pH Sensor</u>		
1	Type	Encapsulated combined electrode

2	Mounting	On flow through assembly
3	Automatic temperature compensation	Required
4	Standard cable for connecting sensor and transmitter	Required
III) pH Transmitter		
1	Type	Indicating type with Back-lit LCD / LCD display
2	Mounting	Field
3	Input	From pH electrodes and temperature compensator
4	Zero and span Adjustment	Required
5	Enclosure material	Non corrosive
6	Enclosure Protection	IP-65 of IS 13947 Part I
7	Output	4 to 20 mA(Isolated) for connecting to pH indicator
IV) Digital pH Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

The acceptable makes are HACH, Emerson Process Management or equivalent as approved by Employer's Representative.

Online Residual Chlorine meter

Residual chlorine (RCI) measuring system shall consist of RCI transducer, RCI transmitter, digital RCI indicator and any other item required to complete the RC measuring system.

RCI transducer shall be rugged in construction and shall be suitable for continuous operation. RCI transducer shall work on Amperometric/ Colorimetric Principle. It shall also consist of an integral pH sensor for compensating against pH changes and integral temperature sensor for compensating against temperature changes.

A sampling system consisting of sampling pump / pressure reducing valves, flow regulator, rotameter, filter assembly etc. shall be provided. The sample water will be connected to a cabinet containing RCI analyzer equipment and RCI transmitter.

The RCI sensor enclosure shall be of such a design that it contains some water even when sampling pump is cut off and shall be provided with flow regulating devices.

The RCI transmitter output shall be suitable for transmitting over long distance.

I) General		
1	Overall accuracy of measurement loop	± 5% of measured value
II) Residual Chlorine Sensor		
1	Type	Amperometric/ Colorimetric
2	Automatic Temperature Compensation electrode	Required
3	Automatic pH compensation electrode	Required
4	Range	Adjustable over full span
5	Sensitivity	0.1 mg/Lit
6	Standard Cable Connecting sensor and Transmitter	Required

<u>III) Residual Chlorine Transmitter</u>		
7	Type	Indicating type having back-lit LCD/LED display
8	Mounting	Field
9	Input	From Residual chlorine sensor
10	Output	4-20 mA (Isolated)
11	Zero and Span Adjustment	Required
12	Enclosure material	Non corrosive
13	Enclosure Protection	IP-65 of IS 13947 Part I
<u>IV) Digital Residual Chlorine Indicator</u>		
Specifications shall be as given under 'Digital Panel Meters'.		

The acceptable makes are Hach, Emerson Process Management or equivalent as approved by Employer's Representative.

Online Turbidity Measuring System

Turbidity measuring system shall consist of turbidity detector assembly, turbidity transmitter, digital turbidity indicator, and any other item required to complete the turbidity measuring system

Turbidity detector shall operate on Nephelometric measurement principle. Turbidity detector shall have ratio-metric measurement system and shall be suitable for insertion / flow through type mounting. It shall be possible to calibrate the turbidity meter at site, with a formazine standard or a glass cube.

Turbidity detector shall be rugged in construction and shall be suitable for continuous operation. It shall have an integral bubble trap arrangement.

Turbidity transmitter output shall be isolated and shall be suitable for transmitting over long distances.

A sampling system consisting of sampling pump / pressure reducing valves, flow regulator, rotameter, filter assembly etc. shall be provided. The sample water will be connected to a cabinet containing Turbidity analyzer equipment and turbidity transmitter.

<u>I) General</u>		
1	Overall accuracy of measurement loop	±2%
<u>II) Turbidity Sensor</u>		
1	Type	Optical sensor
2	Material For Wetted Parts	Non corrosive
3	Cleaning Facility	Required
4	Bubble Trap	Required
5	Measuring Principle	Ratio-metric
6	Color Compensation	Required
7	Range setting	Selectable
8	Calibration Standard	Required, Standard Formazine solution or Glass cube.
9	Accessories Standard cable for connecting sensor and transmitter Standard Glass cube or formazine solution for calibration	Required Required

III) Turbidity Transmitter		
1	Type	Indicating with back-lit LCD /LED display
2	Mounting	Field
3	Input	From Turbidity sensor
4	Output	4-20 mA DC (Isolated)
5	Zero and Span Adjustment	Required
6	Enclosure material	Non corrosive
7	Enclosure Protection	IP-65 of IS 13947 Part I
IV) Digital Turbidity Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

The acceptable makes are HACH, Emerson Process Management, Sigrist or equivalent, as approved by Employer's Representative

Drawings for Instrumentation and SCADA

The following drawings for the instrumentation and control, SCADA and associated communication and power supply systems covered under this specification shall be submitted for review and approval:

Sr. No.	Description
1.0	P&I Diagram
2.0	Instrument list with tag numbers, range, sizes, makes and model numbers
3.0	Data sheets and catalogues for all instruments, alarm annunciator and instrumentation and control cables
4.0	<u>Control Panel</u>
4.1	Overall dimensional drawing, fabrication details and Bill of material for the instruments mounted on the front facia and inside the control panel.
4.2	Front facia layout showing all instruments with cut-outs and bezel dimensions, construction details and interior G.A. drawings for control panels/ consoles
4.3	Wiring diagram with terminal details of each component, terminal block details, power supply distribution scheme with loads and bill of quantities of all panel mounted instruments for control panels/ consoles.
4.4	Bill of material for the instruments mounted on the front facia and inside the control panel.
5.0	Loop diagrams for all field mounted instruments. (The loop diagram shall contain tag numbers, terminal number, I/O address, cable no. etc.)
6.0	List of alarms provided on alarm annunciator
7.0	<u>PLC System</u>
7.1	Input / Output list for PLC indicating grouping of various signals in each module
7.2	PLC system configuration indicating interfacing
7.3	PLC block logic diagram with descriptive control logic write-up and software program listing
7.4	System hardware details along with bill of material for PLC system
7.5	Screens of Operator Interface Unit (OIU)

Sr. No.	Description
8.0	Installation sketches of instruments
9.0	Battery and Battery Charger
9.1	Front facia layout, overall dimensions, wiring diagram, indicating terminal details and bill of quantities for battery charger panels
9.2	Calculation of Ampere Hour capacity for the battery backup.
9.3	Catalogues and Data sheet
10.0	I&C system configuration drawing indicating instruments, PLCs and PC based local SCADA system.
11.0	Functional Design Specification containing summary of the Contractor's proposal for the sequence of operation and design intent (For CWPS and WTP, ESR)
12.0	<u>PC based local SCADA system</u>
12.1	Data sheet and catalogues for PC, printers and DAMS software
12.2	Details of communication protocol and data structure
12.3	Screens of the PC based local SCADA system
13.0	Catalogues, data sheet and sizing calculations for UPS and battery for PC based local SCADA system
14.0	Detailed cable installation layout drawings indicating route of cables, type of laying, etc.
15.0	Cable Schedules and Interconnection cable schedules
16.0	Operation and maintenance manuals for PLCs, local PC based SCADA system, battery and battery charger panel, UPS and all instruments
17.0	Control room layout drawing
18.0	Data sheets, catalogues, control wiring drawings with terminal details for motorized valve actuators.
19.0	List of spares for I&C system, PC based local SCADA system including power supply systems
20.0	Operation and Maintenance and Instructions Manuals
21.0	As built drawings
22.0	Documents for system training

Inspection requirements

All tests as required, both at the factory i.e. Factory Acceptance Test (FAT) before dispatch, and at site after installation i.e. Site Acceptance Tests (SAT), shall be carried out. Detailed Test reports and certificates shall be submitted. Test reports and test certificates for bought out components shall be submitted for approval by engineer-in-charge. These components shall also be included in the integrated FAT.

The list of tests to be carried for both FAT and SAT along with test instruments to be used shall be furnished with the Bid for review by the Employer's Representative. Contractor shall indicate the place of FAT and the test facilities available.

Prior to testing, all relevant documentation and sufficient briefing about the tests shall be given to Employer's Representatives who would witness the testing.

In addition, testing done during manufacturing and assembly in the factory such as heat run, component testing, circuit testing etc. For similar equipment shall be demonstrated to the Employer's Representative.

Instrumentation and Control

To ensure that a well engineered and contractually compliant system is delivered by the Contractor, the Factory Acceptance Tests (FAT) shall be performed

Factory Acceptance Test (FAT-Applicable For Inspection Category A)

- (a) A Factory Acceptance Test, which shall be witnessed by Employer's Representative, is required for the system. No equipment shall be shipped without written confirmation by the Employer's Representative that the system has successfully passed its factory acceptance test.
- (b) The purpose of the FAT is to qualify the system as meeting all contractual requirements. The test shall verify the performance and functional integrity of the individual subsystems, including active interfaces between subsystems and shall demonstrate the proper operation of equipment/systems.
- (c) Factory Acceptance Tests shall be conducted according to test plan with detailed test procedures. The test plan and procedures shall be submitted by the Contractor for review and shall be subject to approval by the Employer's Representative.
- (d) In order to ensure that the FAT will be successfully and expeditiously completed, it shall commence only after the successful completion of a preliminary FAT (Pre FAT). The intent is for the Contractor to detect and correct most design, integration and performance problems before the Employer's Representative come to the factory for the FAT. The Pre FAT shall be supervised by the person designated to serve later as the Contractor's Inspector of the FAT, and each test shall be formally signed off by that person. The signed off test results shall be sent to the Employer's Representative for review before the Employer's Representative comes to Contractor's factory for FAT.
- (e) A complete set of system documentation, including design and maintenance documents, user manuals and the test plan and procedures shall be available during the FAT.
- (f) The list of tests to be carried for both Factory Acceptance Test (FAT) along with test instruments to be used shall be furnished for review by the Employer's Representative. Contractor shall indicate the place of inspection and the test facilities available.
 - i) The testing of all the equipment and accessories shall be carried out as per latest applicable Indian/International standards recommendations.
 - ii) Prior to testing, all relevant documentation and sufficient briefing about the tests shall be given to Employer's Representative's who would witness the testing.
 - iii) The FAT to be performed in the factory shall include but not be limited to following:
 - a) Tests for guaranteed technical parameters
 - b) Integrated functional tests
 - c) Burn-in tests
 - d) Hydrostatic tests
 - e) Calibration tests
 - f) Power supply variation test
 - g) Alarm/Diagnostic check

Tests on Instrumentation System

(1) Type Tests

The Contractor shall submit the test certificates for the 'Type Tests' to the Employer's Representative for approval. The type tests (as applicable) for the instruments shall be as follows:

- 'Burn In' test for electronic components

- Humidity test for electronic instruments
- Weather protection as per IS 13947
- Hysteresis test
- High voltage test
- Short circuit protection test
- Material test

(2) Routine Tests

All instruments shall be subjected to the routine tests (as applicable) mentioned below at the manufacturers works (Factory Acceptance Tests) to ensure correct functioning.

i. Calibration of the instruments

All the instruments shall be calibrated for accuracies as per applicable standards. The calibration shall be carried out at 0%, 25%, 50%, 75% and 100% of the range of the instrument in both increasing and decreasing directions. The instrument shall be acceptable if the accuracy and repeatability are better than those specified. The instrument used for testing shall hold a valid calibration certificate from a recognized laboratory.

(3) Over range protection test

All transmitters, digital panel meters, digital flow indicator cum integrator shall be subjected to the over range protection test.

(4) Performance test

All the instruments shall be tested by connecting to the specified power supply for the performance test.

(5) Power supply variation test

All the instruments shall work satisfactorily for the specified power supply variation. Accuracy and linearity shall not change.

(6) Hydrostatic test

All flow sensors and pressure sensors shall be tested to withstand 150% of the rated pressure. The sensitivity, accuracy and calibration of the sensors shall not deteriorate at this over-range. There shall not be physical damage.

(7) Repeatability test

All instruments shall be subjected to repeatability test over the full range at 0%, 25%, 50%, 75% and 100 % of the full range in both increasing and decreasing directions. Readings for each measurement mentioned above shall be taken for establishing the repeatability.

(8) Dimensional check

The dimensions of all the instruments shall be checked thoroughly and shall be tabulated in a good format.

i. Wherever applicable, following dimensions shall be checked/ noted

- Total length
- Insertion length
- Diameter
- Mounting head
- Process connection size etc.

ii. For panel mounted instruments and transmitters following dimensions shall be checked

- Width
- Height
- Depth

Bezel dimensions and cut-out dimensions for panel mounted instruments etc.

Uninterruptible Power Supply

The Contractor shall provide Uninterruptible Power Supply (UPS) unit for providing power supply to the local SCADA system.

- The UPS shall be sized to **provide 4 hours of full load.**
- The UPS shall have the following features:
- The UPS shall be on-line type and shall be microprocessor controlled. It shall contain a static bypass switch which shall operate in the event of UPS failure, overload or manual initiation in order to transfer the load to mains without interruption to power supply..
- The door of the enclosure shall be in the front.

Items for Instrumentation / Automation / SCADA

Item / Component	Recommended makes
Programmable Logic Controllers (PLC)	Rockwell (<i>Allen Bradley</i>) / Siemens / Honeywell
Moulded Case Circuit Breaker (MCCB)	Siemens / Schneider M.G. / Jyoti / L&T
Relay and Contactors	Siemens / Alstom / Jyoti / ABB / L&T
Cables	Tropodur / Finolex / Asian / Gloster / Incab / Universal / Polycab
Panel Enclosures and Consoles	Rittal / President / Cutler Hammer
Switch fuse Disconnecter	L & T, FN Type, Siemens 3 KL Type, GEPC
Multi-Function Energy Meters	Enercon, L & T, SOCOMEC
Capacitor bank	Crompton Greaves, Khatau Junker, Malde, L & T
Cable Termination kit	Raychem, Denson, M-Seal
Battery	HBL NIFE, Exide, RMCo
Battery Charger	Chaabi Electrical, Masstech
Ultrasonic Type Level Measurement Device	Endress+Hauser / Krohne Marshall / Hycontrol UK.
Pressure switch	Indfoss, Switzer, Tag Process Instruments
Pressure gauge	WAREE, WIKA, AN Instruments, Guru, Hitek

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

Flow switch	Switzer, General Instrument, Forbes Marshall
Pressure Transmitter	Emerson, Foxbro, Druck, Endress – Hauser, ABB, Honeywell Automation
Engineering cum Operator work Station	IBM, Compaq, Dell
Local Supervisory Station	IBM, Compaq, Dell
HMI Software	Wincc, Rs View, Monitorpro, Intellution, Indusoft
Alarm Annunciator	Minilec, Peacon, ICA, APLAB
Uninterruptible Power Supply	HI-Real, Pulse, Tata Libert, APC, APLAB
Lightening Protection Unit	MH Inst, Crompton Greaves, MTL, Pepper & fuchs, Rittmeyer, Cirprotec
Instruments & Control Cables	Delton, Asian, Serval, TCL, Thermopad
Receiver Indicator/Digital panel meter	Masibus, Yokogawa, Lectrotek, NISHKO, SaiTech, MTL INSTS
Conductivity level switch	Pune techtrol, SBEM, Krohne Marshall, E+H, NIVO
Computer (Servers & Workstation)	HP-Compaq / IBM / Dell
Laptop	HP / Dell / Sony / Toshiba
Printer	Samsung, HP, CANNON

ANNEXURE - "E-7"- Ancillary civil works

- A. Provision of Miscellaneous works for Construction of internal Roads of Proposed WTP complex, Compound wall with Gate at Proposed seven nos. OHSR sites. **including trial run period of 12 months etc & 05 years of Operation & Maintenance including replacement & warranty complete and as instructed by Engineer in Charge**

Scope of Work-The scope of work includes but not limited to as listed below:

- 1) Boundary wall & Steel gate including all related works for Construction of internal Roads of Proposed WTP complex, Compound wall with Gate at Proposed five nos. OHSR sites Compound Wall (2.1 m high above GL)
 - (i) Amaseoi Proposed OHSR-----260 m
 - (ii) Kachana Proposed OHSR----240 m
 - (iii) Jora Proposed OHSR---350 m
 - (iv) Deopuri Proposed OHSR----400m
 - (v) Boriya Khurd Proposed OHSR---400 m

1. GENERAL :

- 1.1 Design and Drawings: The contractor shall have to submit his own design for all works under this sub work showing plan elevation and section and the design of compound wall Cement concrete Road and landscaping drawing and items it wants to incorporate in the said works and execution thereof. Detailed calculations and drawings shall have to be submitted by him for scrutiny within a month from the date of issue of work order. Detailed designs shall include calculations for foundation for RCC work and for other structures provided in the drawings. The responsibility for the designs, constructions structural stability shall however rest solely with the contractor and he shall have to make good any damage or loss to the govt. due to defects if any in the above mentioned or any other work carried out by him. The contractor shall submit four sets of completion drawings immediately after completion of the work.
- 1.2 The complete guidance as to the pattern of landscaping shall be obtained from Engineer-in-charge who will earmark the positions of structures in available land in consultation of all concern and the available space left for landscaping and area beautifications fall under this sub work, which is binding to the contractor.
- 1.3 The Design of compound wall will be on framed column structure with necessary plinth beam and panel with BB Masonry or RCC will be the sole prerogative of the contractor. The safety of the wall and protection available due to the compound wall in the enclosed area is the base of designing. Sufficient weep holes and drainage arrangement for free flow of storm water from the enclosed area shall also be considered. Minimum height of compound wall shall not be less than 2100 mm. Suitable and easy operational MS gate with GI pipe where necessary shall also be

provided with adequate locking system and provision for barring the entry of stray animals in the enclosed area shall also be the deciding factor for the complete work of Compound Wall.

- 1.4 Design of RCC road approach at (i) the WTP site(ii) connecting the Canal intake and raw water sump-cum pump house shall be structurally designed for a minimum motor-able width of 3500 mm. The drawing for the same shall also be provided by the contractor. The necessary strengthening of foundation course shall also be considered for designing.

SPECIFICATIONS GOVERNING BUILDING WORKS AND COMPOUND WALL

ITEM OF EXCAVATION IN ALL TYPES OF SOFT AND HARD STRATA

GENERAL

The Excavation shall be applicable for all types of strata by manual / machine means. The item will also include bailing out of water by manually or pumps to keep the trenches reasonably dry for all further works of foundation.

The item includes all shoring and strutting that may be required during as per drawing excavation, and for this purpose shoring and strutting shall also be carried out by the contractor.

ITEM OF PLAIN / REINFORCED CEMENT CONCRETE

PROPORTIONS OF CONCRETE FOR TYPES OF WORK

M-100 – For leveling course and foundation of building footing etc.

- ii) M-200 RCC Road work
iii) M-250 for Construction of foundation in framed structure of Quarters and Compound Wall

GENERAL SPECIFICATIONS OF THIS WORK SHALL BE AS PER STANDARD SPECIFICATION OF PUBLIC WORKS DEPARTMENT

SAND AND METAL

All fine aggregate shall conform to IS 383 and test for conformity shall be carried out as per IS 2386 (Part I to VIII). The fineness modulus of fine aggregate shall neither be less than 2 nor be greater than 3.5.

Well graded B. T. metal conforming to IS 383 shall be used. Tests for conformity shall be carried out as per IS 2386 (Part I to VIII).

CEMENT

Ordinary Portland Cement of Ultratech, Vikram, Ambuja, ACC, Birla Gold, JK make or equivalent conforming to IS of 43 grade / 53 grade shall only be used. 43 grade cement shall be as per IS 8112-1989 and 53 grade shall be as per IS 12269 – 1987. Every batch of cement delivered at site should accompany the manufacturer's test certificate. In addition to this, cement samples from each batch shall be got tested by Engineer at cost of contractor from approved testing laboratory.

REINFORCEMENT

The contractor has to procure the M.S. reinforcement bars from open market at his cost. Re-rolled steel bars will not be accepted. The bars shall be scrapped thoroughly for removing any scale, rust,

etc. before use in work. Bars that may be found defective in any way shall not be allowed to be used. The reinforcement is to be fabricated and placed in position as per the approved design

COVER BLOCKS

For bottom covers of beams, slabs etc. separators or cover blocks of precast cement mortar of suitable size with wire embedded as directed will be used and tied to the reinforcement bars between layers of reinforcement.

CONCRETE

The PCC / RCC works shall be as per IS 456-2000. Design mix M-20 and M-25 shall be used for construction as specified. Minimum cement consumption for M-20 and M-25 concrete shall be 350 Kg/Cum and 375 Kg/Cum respectively. Mix design shall be prepared by the contractor and got approved from Proof Consultants or approved testing laboratory. **Rapid Mix Concrete shall be used for all concrete works irrespective of what is specified anywhere in the Bid Document.**

WATER

The water shall be used as per clause IS 456-2000. The pH of water shall be in the range of 6.5 to 8.00

MIXING

Normally the standard cement consumption will be as under for one cum of concrete with finishing.

1:3:6(M-10)	1:2:4 (M-15)	1:1.5:3 (M-20)	1:1:2 (M-25)
4.40 bags	6.40 bags	7.9 bags	8.90 bags

For any other mix the cement consumption shall be decided by the Engineer. The consumption is mentioned above shall be for the gross RCC work actually cast. The cement required for finishing, rendering cement wash etc. should be in addition to above.

CONCRETE LAYING

The forms shall first be lightly moistened before laying concrete. The concrete shall be placed in position within 20 minutes after adding water to the mix and shall be slowly deposited in its place and not thrown or dumped from a height shall be placed in uniform layers. For vertical wall of water retaining structure, water stoppers shall be provided.

TAMPING, RAMMING AND CONSOLIDATING

For all R.C.C. works, which are considered by the Engineer to be important mechanical vibrators, shall be invariably used by the contractor at his cost. The contractor shall provide at least 2 vibrators in good working condition, so as he has one as a stand by and to prevent interruption in work. The concrete being laid shall be vigorously vibrated during laying and also rodded by bars where vibrator can not reach so that dense and complete fillings are assured. The contractor shall make his own arrangement for procuring vibrators at his cost.

CURING

All R.C.C. work will be watered and kept constantly wet for 28 days after initial set casting by means of wet gunny bags and ponding as directed by the Engineer-in-charge. This operation shall start immediately after initial set of the concrete. Should the contractor fail to water the concrete continuously it may be done by the department immediately at contractor's cost. Any defect observed due to lack of proper curing of concrete shall be rectified / work redone by the Contractor at his cost.

REMOVAL OF FORM

It shall be generally as under subject to the written approval and modification by the Engineer-in-charge.

Vertical form works to walls, beams	16-24 hours
Soffit form works to slabs (prop.to be refixed immediately after removal of formwork)	3 days
Soffit form works to beams (prop.to be refixed immediately after removal of formwork)	7 days
1. Spanning up to 4.5 m.	7 days
2. Spanning over 4.5 m.	14 days
1. Spanning up to 6.0 m.	14 days
2. Spanning over 6.0 m.	21 days

ITEM OF TOR STEEL REINFORCEMENT FOR RCC WORKS

1. The item provides for supply of **Tor Steel bars**, cutting, bending, binding with wire and placing in position.

2. For plain and reinforced cement concrete works, the reinforcement steel shall consist of following grades of reinforcing bars.

Grade Designation	IS Specification	Strength(Mpa)	Elastic Modulus
T.M.T.	I.S.1786	500	200

3. The binding wire shall conform to Specification A-15 of Standard Specification of Public Works Department, Latest Edition.

4. Bending reinforcement confirm accurately to the dimensions and shapes in the details drawings (approved) or as directed by the Engineer-in-charge.

5. Bars shall be bend cold only. In no way bending by heat will be allowed.

Bard with kinks, bends or cracks shall not be used.

Details of length, size, laps and bending diagram shall be got approved from the Engineer.

As far as possible full length of bars shall be placed as per drawing details. When full lengths are not available, bars with short lengths be supplies only after written permission of the Engineer. Bars shall be lapped as specified in IS : 456-2000 with due regards to the grade of concrete. Welding may be used for large diameter of bar only after permission of Engineer.

Welding, if permitted shall conform to PWD specifications.

All reinforcement shall be accurately placed in position with spacing and cover shown in detailed drawing and firmly held during the placing and setting of concrete. Bars shall be tied at all intersections. Binding wire of 1.63 mm or 1.22 mm diameter (about 16 or 18 gauge) shall be used.

Spacing of the bars shall be maintained by means of stays, blocks, ties, spacers, hangers or other approved supports at sufficient close intervals so that bars will not be displaced during placing. Vibrating or compacting concrete, placing bars for reinforcement on a layer of fresh concrete, as the work progress will not be permitted. The use of pieces of broken stones or bricks or wooden blocks for maintaining spacing or cover shall not be permitted. Layers of bars shall be separated by precast cement blocks, spacer bars or other devices.

Full details of numbers, sizes, lengths, weights, laps, welds, spacing of bars placed in position in different parts of the work shall be recorded by the contractor and furnished to the Engineer or his representative to show that all reinforcement has been placed correctly as per sanctioned drawing or as directed by the Engineer in writing before placing concrete. No concrete shall be placed in position until the correctness of reinforcement is checked by the Engineer and has given permission in writing to place concrete. Even after approval of reinforcement as above, it will be the contractor's responsibility to seal that the spacing of reinforcement and arrangements are not tampered with in any way before or during concreting.

The contractor has to supply required steel. He shall produce the test certificate. In addition, actual test shall be carried out according to IS : 432 – 1982 in an approved Proof Consultants or test laboratory and the cost of test shall be borne by the Contractor including all transport etc.

The items includes ...

- a) Cost of labour materials, use of tools, plant and tackle and other incidental items to complete the work satisfactorily.
- b) Supplying, conveying, cleaning, cutting, bending, binding with (1.63 mm or 1.22 mm diameter – 16 to 18 gauge) wire on spot welding and placing reinforcement in position and maintaining it clean and in position till the concrete is laid.
- c) Cost of sampling and testing as required.

14. In no case, any foreign material e.g. oil, grease, etc., which prevent bonding between steel and concrete, shall remain on steel on steel bars during placing of concrete.

ITEM OF REFILLING

- 8.1** After concreting work refilling with available excavated stuff shall be done.

The available excavated stuff shall be laid in layers of 15 cm to 20 cm. Each layer shall be watered and compacted before the upper layer is laid till the required level is reached.

The filling shall be done 30 to 40 cms above natural ground level.

Sinking below the road or ground level, if noticed till the completion of work, shall have to be levelled by the Contractor at his cost.

This item includes....

- a. Cleaning useful excavated material, braking of clods, Removal of stone. Etc.
- b. Conveying the useful excavated material up to 200 M and filling in layers, watering and compacting.

- c. All labour, equipment and other arrangements necessary for the satisfactory compaction and completion of the item.

Surplus excavated material is the property of RMC. Therefore the contractor is not empowered to sell this excavated material to any other agency. However, as per instructions of the Engineer, the Contractor at the place indicated by the Engineer shall dispose off such surplus material.

This disposal will not be considered for initial 200 M lead and so will not be paid for.

The material shall be conveyed by means of suitable devices/manner.

The material conveyed to the place of disposal shall either be stocked or spread as directed by Engineer-in-charge or his representative.

ITEM OF M. S. GRILL WORK

1 GENERAL

The item provides for mild steel grill prepared to the designs shown in the drawings or as directed by the Engineer, for fixing to windows, ventilators, gates etc., including the specified mild steel sections, fabrication, fixing in the frame, fixtures and painting with three coats of oil paint of approved shade.

2 MATERIALS

The mild steel sections as mentioned in the item shall comply with the relevant PWD specifications. The sections shall be squares, flats, rounds, etc. of the specified dimensions shown in the drawings or as directed by the Engineer. Standard screws, rivets, welding rods etc. shall be used.

Oil paint shall comply with the PWD specifications. The priming coat shall be of red lead and the other two coats shall be of a shade approved by the Engineer.

a. CONSTRUCTION

The fabrication of the specified sections of mild steel shall be according to the PWD specifications.

The grill shall be fabricated to the designs and patterns shown in the drawings or as directed by the Engineer, the weight corresponding to that mentioned in this item and the joints shall be riveted and welded as directed by the Engineer. The grill so formed shall be fixed into the frames of windows, ventilators, etc., before they are erected in position. The out side strip frame of the grill shall be housed to its full thickness into the recess cut into the frame of the windows, ventilators etc. The grill shall be fixed to the frame with screws at the rate of 1 screw per 30 cm of the length of the outer strip subject to a minimum of 2 nos. in each side of the frame or as indicated in the drawings. The screws shall be countersunk and shall be fixed with the tops of their heads flush with the outer face of the frame strip.

The grill shall be painted with one coat of red lead oil paint and 2 coats of oil paint of approved shade when the entire work is completed. Painting shall conform to the PWD specifications

b. ITEM TO INCLUDE

- All materials such as mild steel sections of specified sizes, oil paints, screws, rivets, welding rods etc. including wastage for completing the item satisfactorily.

- All labour for cutting grooves in the frame fabrication of the grill by riveting and welding, fixing the grill into the frame, painting, hoisting, erection etc. for completing the item satisfactorily.
- Use of tools and equipments necessary for the job.

ITEM OF B. B. MASONRY IN SUPERSTRUCTURE

DESCRIPTION

This work shall consist of construction of structures with bricks jointed together by cement mortar in accordance with the details shown on the Drawings or as approved by the Engineer.

APPLICABLE CODES

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable.

In all cases, the latest revision of the codes shall be referred to:

IS - 1077 Specifications for common burnt clay building bricks

IS - 1200 Measurements for Building works

IS - 1725 Specifications for solid cement blocks used in general building construction

IS - 1905 Code of practice for structural safety of buildings: Masonry walls.

IS - 2116 Sand for masonry mortars

IS - 2180 Specification for heavy duty burnt clay building bricks

IS - 2185 Specification for concrete masonry units: Hollow and solid concrete blocks

IS - 2212 Code of practice for brick work

IS - 2222 Specification for burnt clay perforated building bricks

IS - 2691 Specification for burnt clay facing bricks

IS - 3115 Specification for lime based blocks

IS - 3414 Code of practice for design and installation of joints in buildings

IS - 3466 Specification for masonry cement

IS - 3861 Method of measurement of plinth, carpet and rentable areas of buildings.

IS - 3952 Specification for burnt clay hollow blocks for walls and partitions

IS - 4098 Specification for lime-pozzolana mixture

IS - 4139 Specification for sand lime bricks

IS - 4441 Code of practice for use of silicate type chemical resistant mortars.

IS - 4442 Code of practice for use of sulphur type chemical resistant mortars

Others I.S. Codes not specifically mentioned here but pertaining to the use of bricks for structural purposes form part of these Specifications.

MATERIALS

All materials to be used in the work shall conform to the standard requirements laid down in PWD Specifications.

PERSONNEL

Only trained personnel shall be employed for construction and supervision.

CEMENT MORTAR

Cement and sand shall be mixed in specified proportions given in the Drawings. Cement shall be proportioned by weight, taking the unit weight of cement as 1.44 tonne per cubic metre. Sand shall be proportioned by volume taking into account due allowance for bulking. All mortar shall be mixed with a minimum quantity of water to produce desired workability consistent with maximum density of mortar.

The mix shall be clean and free from injurious type of soil/acid/alkali/organic matter or deleterious substances.

The mixing shall preferably be done in a mechanical mixer operated manually or by power. Hand mixing can be resorted to as long as uniform density of the mix and its strength are assured subject to prior approval of the Engineer. Where permitted, specific permission is to be given by the Engineer. Hand mixing operation shall be carried out on a clean water-tight platform, where cement and sand shall be first mixed dry in the required proportion by being turned over and over, backwards and forwards several times till the mixture is of uniform colour. Thereafter, minimum quantity of water shall be added to bring the mortar to the consistency of a stiff paste. The mortar shall be mixed for at least two minutes after addition of water.

Mortar shall be mixed only in such quantity as required for immediate use. The mix which has developed initial set shall not be used. Initial set of mortar with ordinary Portland Cement shall normally be considered to have taken place in 30 minutes after mixing. In case the mortar has stiffened during initial setting time because of evaporation of water, the same can be retempered by adding water as frequently as needed to restore the requisite consistency, but this re-tampering shall not be permitted after 30 minutes. Mortar unused for more than 30 minutes shall be rejected and removed from site of work.

SOAKING OF BRICKS

All bricks shall be thoroughly soaked in a tank filled with water for a minimum period of one hour prior to being laid. Soaked bricks shall be removed from the tank sufficiently in advance so that they are skin dry at the time of actual laying. Such soaked bricks shall be stacked on a clean place where they are not contaminated with dirt, earth, etc.

JOINTS

The thickness of joints shall not exceed 10 mm. All joints on exposed faces shall be tooled to give concave finish.

LAYING

All brickwork shall be laid in an English bond, even and true to line, in accordance with the Drawing or as directed by the Engineer, plumb and level and all joints accurately kept. Half and cut bricks shall not be used except when necessary to complete the bond. Closer in such cases shall be cut to the required size and used near the ends of the walls. The bricks used at the face and also at the angles forming the junction of any two walls shall be selected whole bricks of uniform size, with true and rectangular faces.

All bricks shall be laid with frogs up on a full bed of mortar except in the case of tile bricks. Each brick shall be properly bedded as set in position by slightly pressing while laying, so that the mortar gets into all their surface pores to ensure proper adhesion. All head and side joints shall be completely filled by applying sufficient mortar to brick already placed and on brick to be placed. All joints shall be properly flushed and packed with mortar so that no hollow spaces are left. No bats or cut bricks shall be used except to obtain dimensions of the different courses for specified bonds or wherever a desired shape so requires.

The brick work shall be built in uniform layers, and for this purpose wooden straight edge with graduations indicating thickness of each course including joint shall be used. Corners and other advanced work shall be raked back. Brickwork shall be done true to plumb or in specified batter. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. Vertical joints in alternate courses shall come directly one over the other. During construction, no part of work shall rise more than one metre above the general construction level, to avoid unequal settlement and improper jointing. Where this is not possible in the opinion of the Engineer, the works shall be raked back according to the bond (and not toothed) at an angle not steeper than 45 degrees with prior approval of the Engineer. Toothing may also be permitted where future extension is contemplated.

Before laying bricks in foundation, the foundation slab shall be thoroughly hacked, swept clean and wetted. A layer of mortar not less than 12 mm thick shall be spread on the surface of the foundation slab and the first course of bricks shall be laid.

JOINTING OLD AND NEW WORK

Where fresh masonry is to join the masonry that is partially/entirely set, the exposed jointing surface of the set masonry shall be cleaned, roughened and wetted, so as to effect the best possible bond with the new work. All loose bricks and mortar or other material shall be removed.

In the case of vertical or inclined joints, it shall be further ensured that proper bond between the old and new masonry is obtained by interlocking the bricks. Any portion of the brickwork that has been completed shall remain undisturbed until thoroughly set.

In case of sharp corners specially in skew bridges, a flat cutback of 100 mm shall be provided so as to have proper and bonded laying of bricks.

CURING

Green work shall be protected from rain by suitable covering and shall be kept constantly moist on all faces for a minimum period of seven days. Brick work carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period. Top of the masonry work shall be left flooded with water at the close of the day. Watering may be done carefully so as not to disturb or wash out the green mortar.

During hot weather, all finished or partly completed work shall be covered or wetted in such a manner as will prevent rapid drying of the brickwork.

During the period of curing of brick work, it will be suitably protected from all damages. At the close of day's work or for other period of cessation, watering and curing shall have to be maintained. Should the mortar perish i.e., become dry, white or powdery, through neglect of curing, work shall be pulled down and rebuilt as directed by the Engineer. If any stains appear during watering, the same shall be removed from the face.

SCAFFOLDING

The Scaffolding shall be sound, strong and safe to withstand all loads likely to come upon it. The holes which provide resting space for horizontal members shall not be left in masonry under one metre in width or immediately near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled with dense concrete and made good. Scaffolding shall be got approved by the Engineer. However, the Contractor shall be responsible for its safety.

EQUIPMENT

All tools and equipment used for mixing, transporting and laying of mortar and bricks shall be clean and free from set mortar, dirt or other injurious foreign substances.

FINISHING OF SURFACES

General

All brickwork shall be finished in a workmanlike manner with the thickness of joints, manner of striking or tooling as described in these above Specifications.

The surfaces can be finished by "jointing" or "pointing" or by "plastering" as given in the Drawings.

For a surface which is to be subsequently plastered or pointed, the joints shall be squarely raked out to a depth of 15 mm, while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

The mortar for finishing shall be prepared as per PWD specifications.

Jointing

In jointing, the face of the mortar shall be worked out while still green to give a finished surface flush with the face of the brick work. The faces of brick work shall be cleaned to remove any splashes of mortar during the course of raising the brick work.

Pointing

Pointing shall be carried out using mortar not leaner than 1:3 by volume of cement and sand or as shown on the Drawing. The mortar shall be filled and pressed into the raked joints before giving the required finish. The pointing shall be ruled type for which it shall, while still green, be ruled along the centre with half round tools of such width as may be specified by the Engineer. The super flush mortar shall then be taken off from the edges of the lines and the surface of the masonry shall be cleaned of all mortar. The work shall conform to IS: 2212.

Plastering

Plastering shall be done where shown on the Drawing. Superficial plastering may be done, if necessary, only in structures situated in fast flowing rivers or in severely aggressive environment.

Plastering shall be started from top and worked down. All putlog holes shall be properly filled in advance of the plastering while the scaffolding is being taken down. Wooden screeds 75 mm wide and of the thickness of the plaster shall be fixed vertically 2.5 to 4 meters apart, to act as gauges and guides in applying the plaster. The mortar shall be laid on the wall between the screeds using the plaster's float and pressing the mortar so that the raked joints are properly filled. The plaster shall be finished off with a wooden straight edge reaching across the screeds. The straight edge shall be worked on the screeds with a small upward and

sideways motion 50 mm to 75 mm at a time. Finally, the surface shall be finished off with a plasterer's wooden float. Metal floats shall not be used.

When recommencing the plastering beyond the work suspended earlier, the edges of the old plaster shall be scrapped, cleaned and wetted before plaster is applied to the adjacent areas.

No portion of the surface shall be left unfinished for patching up at a later period.

The plaster shall be finished true to plumb surface and to the proper degree of smoothness as directed by the Engineer.

The average thickness of plaster shall not be less than the specified thickness. The minimum thickness over any portion of the surface shall not be less than the specified by more than 3 mm.

Any cracks which appear in the surface and all portions which should hollow when tapped, or are found to be soft or otherwise defective, shall be cut in rectangular shape and re-done as directed by the Engineer.

Curing of Finishes

Curing shall be commenced as soon as the mortar used for finishing has hardened sufficiently not to be damaged during curing. It shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages.

Scaffolding for Finishes

Stage scaffolding shall be provided for the work. This shall be independent of the structure.

ACCEPTANCE OF WORK

All work shall be true to the lines and levels as indicated on the Drawing or as directed by the Engineer, subject to tolerances as indicated in these Specifications.

Mortar cubes shall be tested in accordance with IS: 2250 for compressive strength, consistency of mortar and its water retentivity. The frequency of testing shall be one sample for every 2 cubic metres of mortar, subject to a minimum 3 samples for a day's work.

Sand Faced plaster comprises of a mixture of sand and gravel in specified proportions dashed over a freshly plastered surface.

SCAFFOLDING

For all exposed brick work or tile work, double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

PREPARATION OF SURFACE

The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scrapping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced. In case of concrete surface if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

MORTAR

Mortar of specified mix using the type of sand described in the item shall be used, where coarse sand is to be used, the fineness modulus of the sand shall not be less than 2.5 mm.

APPLICATION OF PLASTER

The plaster base over which rough cast finish is to be applied shall consist of two coats, under layer 12 mm thick and top layer 10 mm.

Ceiling plaster shall be completed before commencement of wall plaster.

Plastering shall be started from the top and worked down towards the floor. All put-log holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 x 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be beaten with thin strips of bamboo about one metre long to ensure through filling of the joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or sandy granular texture is required. Excessive troweling or over working the float shall be avoided. During this process, a solution of lime putty shall be applied on

the surface to make the later workable.

All corners, arrises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arrises, provision of grooves at junctions etc., where required shall be done without any extra payments. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to properly joint together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arrises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arrises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages.

No portion of the surface shall be left out initially to be patched up later on.

Top layer

The top layer shall be applied a day or two after the under layer has taken initial set. The latter shall not be allowed to dry out, before the top layer is laid on. The mortar used for applying top layer shall be sufficiently plastic and of rich mix 1:3 (1 cement, 3 fine sand) or as otherwise specified so that the mix of sand and gravel gets well pitched with the plaster surface. In order to make the base plastic, about 10 % of finely grinded hydrated lime by volume of cement, shall be added when preparing mortar for the top layer.

FINISH

It shall be ensured that the base surface which is to receive cast mixture is in plastic state. The rough cast mixture shall consist of sand or gravel or crushed stone of uniform colour from 2.36 mm to 12.5 mm or as specified and in the proportions as specified accurately to the effect required. The mixture shall be wetted and shall be dashed on the plaster base in plastic state by hand scoop so that the mix gets well pitched into the plaster base. The mix shall again be dashed over the vacant spaces if any so that the surface represents a homogeneous surfaces of sand mixed with gravel. A sample of rough cast plaster shall be got approved by the Engineer.

PRECAUTIONS

Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer.

When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitable tool when plaster is being done. Similarly when the wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6 mm drawn with any suitable method with the wall while the plaster is green.

To prevent surface cracks appearing between junctions of column/beam and walls, 150 mm wide chicken wire mesh should be fixed with U nails 150 mm centre to centre before plastering the junction. The plastering of walls and beam/column in one vertical plane should be carried out in one go. For providing and fixing chicken wire mesh with U nails payment shall be made separately.

ITEM OF WHITE CEMENT BASED MARBLE MOSAIC TILE FLOORING

GENERAL

This specification lays down the requirement of applying cement-based paint in specified coats to concrete or masonry surface.

MATERIALS

Cement paint with a base of white Portland cement of approved manufacture. Colour and shade shall be used. Approval quality cement based paint shall be brought to site in original air tight containers with seal intact.

SCAFFOLDING

Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being white washed.

For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

For white washing the ceiling, proper stage scaffolding shall be erected.

PROTECTIVE MEASURES

Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed, shall be protected from being splashed upon. Splashing and droppings, if any shall be removed by the Contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the Contractor.

PREPARATION OF SURFACE

The surface to be painted shall be cleaned of all loose dust, and dirt paints and all cracks, holes and surface defects shall be repaired with cement plaster cured and allowed to set hard. Before the painting is commenced the surface is wetted well and water is allowed to run off. Any grease, oil paint, shall be removed by approved methods.

APPLICATION OF PAINT

Mixing of paint and procedure of painting shall be as specified by the manufacture when no specification are following specification shall be generally apply.

The dry cement shall be thoroughly mixed with clean fresh water to produce paint of required consistency (normally that of ordinary paints). The paint shall be kept stirred and used within one hour of mixing hardened or damaged paint shall not be used. Brushes in the manner specified by the manufacturer shall apply the paint.

The number of coats are specified elsewhere of the item. When more than one coat is to be given the subsequent coats shall be applied after the preceding coat has thoroughly hardened inspected and approved.

CURING

Each application of paint should be wetted at the end of the day with a fine water spray, depending on climatic conditions. Wetting shall be done only after an interval of at least 6 to 8 hours after the applications. In dry weather the painted surfaces shall be kept damp for at least two days and provided from direct sun.

ITEM OF WASHABLE OIL BOUND DISTEMPER

GENERAL

This is specification lay down the requirements of applying oil bound distemper in specified coat to concrete or masonry surface.

MATERIAL

Oil emulsion (Oil Bound) washable distemper (IS: 428) of approved brand and manufacture shall be used. The primer where used as on new work shall be cement primer or distemper primer as described in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day's works shall be prepared.

The distemper and primer shall be brought by the Contractor in sealed tins in sufficient quantities at a time to suffice for a fortnight's work, and the same shall be kept in the joint custody of the Contractor and the Engineering-in-charge. The empty tins shall not be removed from the site of work, till this item of work has been completed and passed by the Engineer.

PREPARATION OF THE SURFACE

For new work the surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry.

Pitting in plaster shall be made good with plaster of Paris mixed with the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patches surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

APPLICATION OF PRIMING COAT

The priming coat shall be with distemper primer or cement primer, as required in the description of the item. The application of the distemper primer shall be as described in Clause 12.18.2.2.

Note: If the wall surface plaster has not dried completely, cement primer shall be applied before distempering the walls, but if distempering is done after the wall surface is dried completely, distemper primer shall be applied.

APPLICATION OF DISTEMPER COAT

1. For new work, after the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. One coat of distemper properly diluted with thinner (water or other liquid as stipulated by the manufacturer) shall be applied with brushes in horizontal strokes followed immediately by vertical ones which together constitutes one coat.
2. The subsequent coats shall be applied in the same way. Two or more coats of distemper as are found necessary shall be applied over the primer coat to obtain as an even shade.
3. A time interval of at least 24 hours shall be allowed between successive coats to permit proper drying of the preceding coat.
4. 15 cm double bristled distemper brushes shall be used. After each days work, brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

ITEM OF ALUMINUM WINDOWS AND VENTILATORS

ALUMINIUM WINDOWS AND VENTILATORS Aluminum Windows and ventilators shall conform to IS:733, IS 1948, IS:1949, and IS:1081 shall be as per drawings issued by the Engineer. The contractor shall submit for EIC’s approval the shop drawings covering all dimension details of fabrication, construction and installation. After approval of shop drawings the contractor shall submit one or more samples of the fabricated item of each type for the EIC’s approval before mass fabrication.

6.1 Material Aluminum Alloy Extruded Sections Aluminum alloy used in the manufacture of doors, windows and ventilators shall conform to IS designation HE 9-WP of IS:733 or HV9-WP of IS 1285. Aluminum Alloy AA 6063 of hardness T5 or T3 which has the following properties is also acceptable,

Density, kg/mm ³	Modulus of Elasticity	Mpa Ultimate Tensile Strength	Mpa Coefficient of Linear Expansion	0.2% Proof Stress, Mpa
2.7 x 10 ⁻⁸	69 x 10 ³	185	23 x 10 ⁻⁸	110

The sectional properties of extruded sections shall be as given in IS 733 or as manufactured by Jindal, Hindalco or Boruka. The section shall be uniform in appearance, free from die lines and handling marks

Glass panes

Glass panes shall be annealed or float glass as specified in the drawing and shall weigh at least 7.5 kg / m². Glass panes shall also be free from flaws, specks or bubbles. All panes shall have properly squared corners and straight edges. The sizes of glass panes for use shall be in accordance with Table I of IS:1948.

Thickness of glazing to be used for various pane sizes shall be as follows:

Size of Pane Thickness of glazing

up to 1.2 sq.m 4 mm float glass

1.2 sq.m to 2.0 sq.m 5.5 mm float glass

above 2.0 sq.m 8 mm float glass

twin style entrance door 12 mm float glass

Heat strengthening or Toughening of glass wherever required shall be as indicated on drgs.

Screws, Fasteners

Screws and fasteners shall be of Aluminum alloy or brass oxidized. Screw thread of machine screws used in the manufacture of Aluminum doors, windows and ventilators shall conform to the requirement of IS:4218. For opaque portion of shutters panels can be of 12 mm thk marine ply clad on both sides with 24 gauge Aluminum sheet. 6.2 Standard sizes, tolerances and design

Size

Overall dimension of windows, doors, ventilators, shall be derived from masonry opening minus an allowance of 1.25 cm clearance on all sides for the purpose of fitting. However, type and overall sizes shall be in accordance with IS:1948.

Tolerances

The sizes for doors, windows or ventilator frames shall not vary by more than ± 1.5 mm from overall size as specified in drawing.

Designation

windows and ventilators shall be designated by symbol denoting their width, type and height in succession as per IS : 1948.

Sectional dimensions and weights

Sectional dimensions and weights per unit length of the section shall conform to design drawing. However, uses of specific sections for specified units as per manufacturers' standard may be used with prior approval of Engineer.

Fabrication

Frames

Frames shall be square and flat, the corners of frame being fabricated to a true right angle. Both the fixed and opening frames shall be constructed of sections which have been cut to length, mitered and screwed at the corners.

Shutters

All hinges, pivots, etc. shall be provided and fabricated in accordance with provisions given in IS:1948. However, reference standards and drawings are also to be read in conjunction with the IS code.

Finishing

The aluminum sections to be used shall be properly buffed, cleaned by using mild acids and water. Then the same shall be anodised to have average anodic film thickness of 25 microns. To prevent damage to metal surfaces, a protective tape shall be applied after manufacturing and same shall be removed at site only after completion of rough trades.

Handling, Storage

The extruded section or the fabricated windows/doors shall be protected against abrasions, waterstains and any other damages caused by acids or alkaline chemicals. Cold metal shall preferably be placed in a dry storage area avoiding contact between it and other metals. Use of wood face shelving racks is recommended. It shall also be kept away from caustics, nitrates, phosphates, acids and cement.

Installation

The fabricated and assembled windows or door units (without glazing) shall be installed in accordance with IS 1081 being fixed in masonry opening properly plastered and finished. Straightness and diagonal dimensions of the opening shall not have tolerance more than ± 2 mm. Aluminum screws or bolts are to be used with teak wood block on the back of the sections to avoid dents and other mechanical damages during tightening of screws/bolts. All gaps between the Aluminum section and the masonry surface must be sealed with gun grade polymer based sealant viz., silicone compound, Poly-sulphide compound.

Cement mortar grout or cement mortar finishing of gaps after installation of Aluminum units shall strictly be restricted to protect the surface treatments given to the Aluminum like anodized , pre-coating, etc.

All glass panes shall be fixed only after major activities are over in the area. Glazing gaskets for doors and frames shall be EPDM elastomeric extrusions. All screws and miscellaneous fasteners shall be Aluminum, stainless steel or zinc plated.

Hardware

Necessary hardware for Aluminum doors and windows shall be compatible with the basic material and shall be provided along with the doors, windows and ventilators. Minimum hardware necessary to be provided shall be as specified in Table

Drawings/Documents

Prior to fabrication, Contractor shall submit shop drawing indicating details of all members, sections and hardware for EIC's approval. All certificates against tests for anodising and other physical properties of material shall be produced to the Engineer for acceptance.

Fitting	Casement Windows	
	Single Shutter	Double Shutter
300mm 1 3 - - Butt Hinges (heavy)	2	4

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

Two point nose handle with striking plate	1	2
Peg Stay 300mm	1	2

The Contractor shall carry out confirmatory Topographic survey including trial trenching (For location of existing utilities), before commencement of the works. In case, the shifting of any existing, water pipe line/ utility is considered necessary by the Department /Municipal Corporation, such service lines will have to be shifted by the contractor for which the payment shall be made for the actual work done as per approved rate.

The contractor shall set up an office with an access to RAIPUR Municipal Corporation (RAIPUR MUNICIPAL CORPORATION) official with proper seating arrangements.

During the Contract period, the contractor has to procure and install informatory board displacing Name of work (and specific details) at the location given by RAIPUR MUNICIPAL CORPORATION at his own cost.

The trial pits/ trenches shall be excavated by the Contractor after mutual agreement and approval of the Engineer along the alignment of the proposed pipelines. The trial pits / trenches including utility survey shall be carried out in advance of the topographic survey for the purpose of satisfying himself as to the location of underground obstructions or conditions.

Necessary permission from the competent authority/ police shall be obtained by the RAIPUR MUNICIPAL CORPORATION prior to digging up trial trenches/ pits. For this purpose the contractor has to pursue with the relevant authority. The Employer may render necessary assistance for getting permission from the different authorities/ police for such excavation. The Contractor shall proceed with caution in any excavation and shall use all means to determine the exact location of underground utilities / structures like water line, sewer lines, conduits and other utilities etc, in the immediate vicinity thereof prior to excavation. The Contractor shall be solely responsible for the cost of protections or repair or replacement of any structure, water line, sewer line, conduit etc, above or below ground which may be broken or otherwise damaged by these operations.

Trial trench/ pits once excavated shall not be left unattended. Once the underground utilities are identified, the trench and pit shall be filled up and compacted to its original level. Any subsequent depression at this location due to vehicular movement shall have to be made good by the Contractor by filling additional borrowed earth. In any case, no inconvenience is to be caused to the vehicular and pedestrian traffic due to such trial trench excavation. Payment shall be made as per relevant items of the BOQ.

The depth of the trial pit/ trench shall be determined by the invert level of the pipeline as given in the data sheet issued by the Engineer in line with the Tender Drawings or as further instructed by the Engineer. A detailed sketch showing plan and sectional elevation view of the existing underground services, depth of sub-surface water level, type of soil based on visual inspection etc. shall be prepared for each pit/ trench and the same shall be submitted to the Engineer within 7 days. This information will form an input for the selection of alignment of proposed pipeline and production of Construction Drawing by the Contractor for approval by the Engineer-in-charge.

The lighting, barricading, guarding of the trenches and the provision of watchman shall be done by the

Contractor. Some of the roads may be too narrow to provide barricade along the trenches. In such case the location of the barricades etc. shall be finalized by the Contractor in consultation with the Engineer-in-charge.

Necessary arrangements such as cranes, tripods, chain pulley block for lowering pipes into trench shall be made by the Contractor at his own cost. In no case pipes shall be dropped from a height. All posts and sight rails shall in no case be removed until the trench is excavated, the pipelines are laid and the Engineer gives permission to proceed with the backfilling.

The bedding for pipeline shall be provided as specified in the drawings, standard specifications and or as per direction of the engineer-in-charge.

The placement of bought out items and other construction materials during transit and during placement near the alignment shall be done with utmost care so that they are not damaged. Any damage due to these reasons shall be the Contractor's liability.

All the water lines are to be laid perfectly true to alignment and gradient specified. In case of spigot and socket pipes, the socket end of the pipe line shall face upstream. Properly fitted temporary wooden stoppers shall be provided to close the ends of incomplete water lines. The stoppers shall be removed when pipes are being laid and jointed. Open end of water line at the end of day's work shall be capped and sealed.

Water pipe laying and jointing shall be started and completed only section-wise as per instruction of the Engineer. Hydro-testing / Pressure testing of pipeline shall be done section-wise and as directed by Engineer. The water lines shall be secured in place with approved backfill material tamped under it and proper care shall be taken during tamping at the socket end of the pipe to ensure that it is not damaged.

Backfilling of the trenches and temporary road restoration shall be taken-up immediately after laying of pipes for which payment shall be made as per contract provision. In case work needs to be suspended after excavation of trenches for any reason, the trench shall be backfilled immediately and re-excavated prior to re-commencing the work. No payment shall be made for backfilling/ excavation under such situation. If any portion of the trench needs to be kept open as per instruction of the Engineer-in-charge, same shall be suitably barricaded.

Installation of valves and pipeline appurtenances shall be taken-up simultaneously with the progress of pipe laying work.

The restoration of road/ footpath shall be done as specified and as per the requirements of the local authorities.

The excess excavated material shall be carried away from the site of works as specified, failing which, in view of public safety and traffic convenience, the Engineer-in-charge may carry out the work by any other agency at the Contractor's risk and cost.

The inspection and testing of all the bought out items (Pipes, Valves, Flow-meters etc), both at factory and

site shall be carried out in presence of the Employer/ Engineer-in-charge or his representative unless otherwise directed by the Engineer-in-charge.

In the case of tanks whose external faces are submerged and are not accessible for inspection, such as underground tanks, the tanks shall be filled with water and after the expiry of seven days after the filling; the level of the surface of the water shall be recorded. The level of the water shall be recorded again at subsequent intervals of 24 hours over a period of seven days. The total drop in surface level over a period of seven days shall be taken as an indication of the water tightness of the tank. The Engineer-in-charge shall decide on the actual permissible nature of this drop in the surface level, taking into account whether the tanks are open or closed and the corresponding effect it has on evaporation losses. For many purposes, however, underground tanks whose top is covered may be deemed to be water-tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

If the structure does not satisfy the conditions of test, and the daily drop in water level is decreasing, the period of test may be extended for a further seven days and if specified limit is then reached, the structure may be considered as satisfactory.

In the rare event that the water retaining structure fails to pass the water tightness test satisfactorily, the Contractor will have to provide a comprehensive plan to identify the leakage areas and plug it by grouting the area with approved water proofing compound and shall demonstrate the water tightness test successfully. The entire operation shall be got done by the Contractor at no extra cost.

The Contractor shall provide for the hydraulic test 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 tendered rates for hydraulic structures shall include all costs incurred by the Contractor for water tightness test.

10% of the amount reserved for each Civil (Water Retaining) Structure shall be retained for failure to comply with water tightness test.

Applicable Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the materials and other supplies to be furnished, and work performed or tested, the edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to the date of bid submission shall apply, unless otherwise expressly stated in the Contract.

Where such standards and codes are national, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be accepted subject to the Engineer-in-charge prior review and written approval.

Differences between the standards specified (In the contract / codes) and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineers approval. In the event the Engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the

standards specified in the contract documents (or relevant codes as mentioned in the contract documents and or as decided by the Engineer-in-charge).

Quality Control on Works and Materials

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.

Quality Control and Tests

The Engineer-in-charge or his representatives shall inspect the work from time to time during and after construction and ascertain the quality of the work tested (by himself, or by his Testing and Quality Control Units or by any other agency deemed fit by him) generally as per the requirements (outlined in the QA / QC manual). Additional tests may also be conducted where, in the opinion of the Engineer-in-charge, need for such test exists. In the absence of clear indications and frequency of tests for any item in the above mentioned publication, procedures and tests as directed by the Engineer-in-charge shall be followed.

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.

Quality Assurance Plan

The Contractor shall provide Quality Assurance Plan adhered by the manufacturing units for production of Electro-mechanical components (like Pipes, Specials, Valves, Flow-meters, EOT Cranes, pumps, motors, drives etc) as required prior to the procurement. If required Engineer-in-charge may inspect through self (or designated representative or Third Party Inspector) all manufactured items at the vendor's workshop / factory. After delivery of materials, the same should be visually inspected at site. The Contractor shall supply samples of the material / units, for testing as per the frequency and number of tests specified in the Quality Control Manual and get it tested by independent agency.

All equipments required shall be duly inspected by DGS&D/SGS/RITES.

Unacceptable Works

All defective / deficient Works are liable to be demolished, rebuilt, and defective materials replaced by the Contractor at his own cost. In the event of such Works being accepted by carrying out repairs etc. as specified by the Engineer-in-charge, the cost of repairs will be borne by the Contractor. Defective / deficient works shall also imply non-confirmation to quality standards and mandatory tests that shall

guarantee successful completion.

No payment shall be made for rectification / repairs done on account of deficient in quality of materials or service.

Rates of Work items

In the absence of any directions to the contrary, the rates are to be considered as full inclusive rate for finished works covering all labour, materials, wastage, transportation, temporary work, plant, equipment, testing, overhead charges and profit as well as the general liabilities, obligations, insurance and risks. The rates quoted by the contractor shall, unless otherwise specified, also include compliance the activities stated below:

- 1 General works such as survey and setting out, clearance of site before setting out and clearance of works after completion; carrying out soil investigation works, condition assessment reports etc.
- 2 Preparation and submission of detailed Work Program for the construction and completion of the works (using CPM/PERT techniques) giving, in addition to construction activities, detailed network activities for the submission and approval of materials, procurement of critical materials and equipment, fabrication of special products/equipment and their installation and testing, and for all activities of the Employer that are likely to affect the progress of work, etc., including updating of all such activities on the basis of the decisions taken at the periodic site review meetings or as directed by the Engineer-in-charge.
- 3 Tests to ensure that the material for construction are as per the relevant provisions contained in the Specifications including carrying out necessary test at Works on samples of various materials as proposed to be used on the Work and conducting tests thereon as required as per the provisions of the Contract and or as per codal provisions.
- 4 Design of mixes as per the relevant Clauses of the Specifications giving proportions of ingredients, sources of aggregates and binder along with accompanying trial mixes as per the relevant clauses of the Specification to be submitted to the Engineer-in-charge for his approval before use on the Works.
- 5 Testing of various finished items and materials including cement, concrete, bearings as required under these Specifications and furnishing test reports/certificates;
- 6 Cost of in-built provisions for Quality Control and Quality Assurance activities including of safeguarding/protection of the environment, as required from time to time.
- 7 Cost of Designs, Documents, drawings including necessary as-built drawings and other submittals as required under the specifications. Cost for procurement for necessary software (like Auto-CAD) required for preparation / updating the water supply network drawings, including finalisation of as-built drawings shall be considered to be included within quoted rates.
- 8 Cost incurred on Traffic management plan, including diversion works, accommodation of traffic, including erecting barricading, caution signs, project sign boards, and safety tapes to ensure protection at site.
- 9 Cost of all taxes, duties and royalties, site commissioning and all incidental costs.
- 10 Cost of all operations like storing, erection, moving into final position, etc. necessary to complete and protect the work till handing over to the Employer; and

- 11 Cost for storage of tools, plants and equipment's including office operations, as required from time to time.
- 12 Any other data which may be required as per these Specifications or the conditions of Contract or any other annexes/schedules forming part of the contract;
- 13 Any other items of works which is not specifically provided in the Schedule of Quantities but which is necessary for complying with the provisions of the Contract.

Should there be any detail of construction or materials which have not been referred to in the specifications or in the bill of quantities and drawings but the necessity for which may be implied or inferred wherefrom, or which are usual or essential to the completion of the work in the trades, the same shall be executed and if such work becomes an extra item of work, in the opinion of the Engineer, then it shall be analyzed by the Engineer-in-charge and got approved by the Employer for payment to the Contractor.

General Requirements for building works

Unless otherwise specified, all the building works shall generally comply with the following Employer's Requirements:

- (i) All buildings shall have reinforced concrete framework.
- (ii) 75 mm thick RCC Damp Proofing Course in M15 shall be provided to all building walls.
- (iii) Anti-termite treatment as per IS: 6313 part-III – 1971 with injection of chloropyriousemulsifiable concrete (1%) timber care ground treatment chemically emulsion 1:3 and creating a chemical barrier under and around the column pits, wall trenches, basement excavation, top surface of plinth filling, junction of wall and floor along the external perimeter of building, expansion joints, surrounding of pipes and conduits etc.
- (iv) All external walls shall be in 230 mm thick brick masonry built in cement mortar in (1:4). Transoms and mullions shall be of 115 mm x 230 mm size of cement concrete in M15 with four numbers 6 mm bars and 6 mm links at 150 mm c/c shall be provided to form panels not exceeding 3500 mm x 3500 mm in size.
- (v) All internal partition walls except for toilets shall be in 230 mm thick brick masonry built in cement mortar 1:4 with transoms and mullions as stated above. Toilet partition walls shall be in 115 mm thick brick masonry built in cement mortar 1:4 and shall have transoms and mullions as stated above to form panels not exceeding 1200 mm x 1200 mm size.
- (vi) All internal masonry surfaces shall be finished with 12 mm thick smooth faced cement plaster in cement mortar (1:4).
- (vii) All external masonry surfaces shall be plastered in two coats with sand faced cement plaster in cement mortar (1:4) and shall have total thickness of 20 mm. Waterproofing compound of approved make and quality shall be added to the cement mortar in proportions as specified by the manufacturer.
- (viii) Bathroom/ W.C. floor slab shall be sunk and filled with brickbat coba (broken bricks set in lime) and provided with waterproofing as per the specifications of an approved specialist waterproofing company. The finished floor level in Bathroom / W.C. areas shall be normally 12 mm below the finished floor level on the outer side.
- (ix) The toilet facilities shall include at least:

- 1 No. Water closet with white porcelain Orissa pan minimum 580 mm long with PVC flushing cistern of 10 liters capacity.
 - 1 No. Urinal of sizes 600 mm x 400 mm x 300 mm flat back type in white porcelain separated by a kota stone partition of size 680 mm x 300 mm shall be provided outside toilet.
 - 1 No. Wash basin of size 510 mm x 400 mm in white Porcelain with inlet, outlet with bottle trap.
 - 1 No. Mirror of size 400 mm x 600 mm PVC moulding wall mounted type fitted over washbasins.
 - 1 No. Plastic liquid soap bottles
 - 1 No. Chromium plated brass towel rails minimum 750 mm long.
 - All stopcocks, valves and pillar cocks shall be of chromium-plated brass, heavy duty.
 - All fittings such as 'P' or 'S' traps, floor traps, pipes, down-take pipes etc.
 - The sewage from toilet blocks shall be led to a septic tank with soak pit. The Contractor, at a suitable location, shall provide a septic tank having appropriate capacity, as per specifications.
- (x) Wherever specified, staircases shall be finished with 25 mm thick Kota Stone treads and 20 mm thick Kota Stone skirting or equivalent as approved by Engineer. The rise of stairs shall not exceed 170 mm and minimum width of the tread shall not be less than 275mm. All steps shall have 20mm nosing. R.C.C. stairways shall be provided to permit access between different levels within buildings. All roof tops and tops of overhead tanks shall be made accessible with ladder provision. Vertical ladders fitted with landing point extensions will be permitted where considered appropriate by the Engineer or Engineer's authorized Representative to access areas not frequently visited.
- (xi) All floor cutouts and cable ducts, etc. shall be covered with pre-cast concrete covers in outdoor areas and G.I. chequered plates of adequate thickness in indoor areas. All uncovered openings shall be protected with Stainless Steel hand railing fixed with two rails. Top railing and vertical of the Stainless Steel hand railing shall be 40 mm dia. The lower railing shall be 32mm dia. Stainless Steel (SS 316).
- (xii) All staircases shall be provided with Stainless steel railing . The reinforced concrete roofs shall be made waterproof by application of approved cement/ lime based waterproofing treatment, guaranteed for 10 years. The finished roof surface shall have adequate slope to drain quickly the rainwater to R.W down-take points.
- (xiii) For roofing drainage, cast iron rainwater down-takes with khurra and door bend with C.I. grating at top shall be provided. For roof areas up to 40 sqm minimum two nos. 100 mm diameter down-take pipes shall be provided. For every additional area of 40 sqm or part thereof, at least one no. 100 mm dia. down take pipe shall be provided. The RW pipes shall be concealed.
- (xiv) Top surfaces of chajjas and canopies shall be made waterproof by providing a screed layer of adequate slope or application of an approved roof membrane and sloped to drain the rainwater.
- (xv) Building plinth shall be minimum 450 mm above average finished ground level around building and shall not be less than plinth level of existing buildings.

- (xvi) All buildings shall have a minimum 1.0 m wide, 100 mm thick plinth protection paving in M15 grade concrete finished with stone slabs/ tiles. All plinth protection shall be supported on well-compacted stratum.
- (xvii) All concrete channels and ducts used for conveying liquid shall have smooth finish from inside. The width of concrete channels shall not be less than 500 mm. All open channels shall be provided with Stainless Steel (SS 316) hand railings.
- (xviii) Kerbs to be provided below the hand railing on the catwalks/pathways should be as per relevant sections of the Factory Act.
- (xix) All rooms in the treatment plant buildings shall be provided with appropriate signboards indicating the function of the rooms involved.
- (xx) Wherever equipment and machinery is required to be moved for inspection, servicing, replacement etc., suitable movable gantry of required capacity shall be provided.
- (xxi) The design of buildings shall reflect the climatic conditions existing on site. Process buildings shall as far as possible permit the entry of natural light.
- (xxii) Emergency exit doorways shall be provided from all buildings in order to comply with local and international regulations. Stairways and paved areas shall be provided at the exit points.
- (xxiii) Toilet blocks in process building shall be provided with two drinking water taps of 12 mm size and sink with appropriate drainage.
- (xxiv) All chequered Plates shall be hot dip galvanized.
- (xxv) Glass shall be minimum 5 mm thick, pin headed or opaque.

Excavation

The depth of excavation will be guided by requirement of stability of foundation, and the hydraulic levels of the various units. The contractor should himself verify this for design of foundation of structure and other hydraulic designs. The foundation shall be filled with bed concrete (leveling course) in 1:3:6 (M 100) with 40 mm gauge graded metal or by the prescribed mix as proposed by the contractor in his design. But it should not be weaker than 1:3:6. The average plinth level shall be at least 1.0 m above general G.L. The difference of level between the floor of pump house and invert of sump well shall not be more than 2.50m in any case. The proposed treatment plant is having exposed moorum strata.

Foundation for Structures

The minimum depth of foundations for all structures, equipments, buildings and frame foundations and load bearing walls shall be as per IS: 1904.

Care shall be taken to avoid the interference of the foundations or any other component of the new building with the foundations of adjacent buildings or structure. Suitable adjustments in depth, location and sizes may have to be made depending on site conditions. The Engineer or Engineer's authorized Representative shall accept no extra claims for such adjustments. Special attention is drawn to danger of uplift being caused by the ground water table. Base raft for underground structure shall be designed for uplift forces that are likely to be developed.

Where there is level difference between the natural/ existing ground level and the foundations of structure

or floor slabs, this difference shall be filled up in the following ways:

- (i) In case of non-liquid retaining structures the natural top soil shall be removed till a firm stratum is reached (minimum depth of soil removed shall be 500 mm.) and the level difference shall be made up by compacted backfill as per specifications. However, the thickness of each layer of the backfill shall not exceed 150 mm. The area of backfilling for floor slabs shall be confined to prevent soil from slipping out during compaction. The safe bearing capacity of this well compacted backfilled soil for design calculations shall not exceed 100 KN/sqm.
- (ii) In case of liquid retaining structures, the natural top soil shall be removed as described above and the level difference shall be made up with Plain Cement Concrete (1:5:10)

All materials used on civil works should be of quality approved by the Engineer-in-charge. Rejected material shall be removed from the site immediately.

Plinth level of Buildings

The average plinth level of all major buildings within the treatment plant area shall be 0.6m above the natural ground level.

The average plinth level of chemical house, filter house and the pump house shall be at least 1.0 m above general ground level. The entry in pump house shall with suitable approach ramp to enable machineries to be transported inside the building by trucks.

Brick Masonry

Brick work shall be done in C.M. 1:3 richer mix in masonry shall be done only if the structural design requires so and with prior approval of the Engineer-in-charge. The width of all walls done with brick-masonry shall be minimum 250mm for all buildings.

Flooring

The flooring of chemical house (Ground floor) shall be done with 40 mm thick Kota stone and that of first floor shall be done with 30 mm thick kota stone.

Floor around chemical tanks should have acid proof treatment. The floor of pump house portion shall be in M-30 mix with 150 mm thickness having specifications for Industrial use.

The flooring of Administrative Building, Staff quarters, sanitary block shall be of vitrified tiles. Rest of the floors in building shall also be done with 30 mm thick kota stone.

Plastering

The brick masonry walls of building should be plastered with 1:3 cement mortar. The thickness of plaster from outer face of wall should be 20 mm and on inner face the thickness of plaster should be 13 mm. In chlorine room, sump well and wash water tank, due consideration shall be given to provide protective measures in R.C.C. work plastering etc. to prevent the corrosive effect of chlorine.

Doors and Windows

The opening area (for doors/windows/ventilators) for chemical stores and chlorine tonner storage room

shall be 20% of the floor area. For rest of the units this area shall be 30%.

Painting and Colour Washing

Doors and windows except shall be painted inside and outside in two coats after priming coat as per the directions of the Engineer-in-charge. The wall shall be provided with two coats of approved quality of oil bound distemper on the inside and snowcem or durocem painting on the outside as per the direction of the Engineer-in-charge.

Roofing

The roof shall be casted in R.C.C. M-20 mix with 20 mm gauge graded metal as per thickness and reinforcement, details to be shown in the drawings and designs. All roofs and civil structures would be guaranteed for leakages as per relevant I.S.S. suitable treatment for water proofing shall be provided for roof slab.

Fire Extinguishers

Fire extinguishers for each building at every floor shall be provided, and fixed as per the relevant IS Specification.

Minimum Size of Buildings

The minimum area requirement for each of the buildings within the treatment Plant shall be as stated below:

Sl. No	Building Description	Minimum Area Requirement
1	Chemical House (Two storey)	Ground Floor to accommodate 7 days alum requirement and First floor to accommodate alum and lime tanks
2	Store House	Suitable for alum storage of three months with 10% extra capacity (Calculations to be provided)
3	Administrative Block to accommodate Office room, Laboratory, toilets (ladies and gents)	600 Sqm
4	Staff Quarters (Two storied),	600 Sqm ie. 300 sqm + 300 sqm
5	Guard room including Sanitary Block	25 Sqm with separate units for ladies and Gents

Horticulture and landscaping

Horticulture and Landscaping shall be done according to the topography of the area and should be planned so as to make the treatment plan area a focal point. The open areas leaving expansion requirements must either be covered by tree plantation or must be suitably grassed. Shadow trees must be planted at a maximum distance of 15 m c/c along the periphery of the campus area and along the roads. The campus must be provided with gardens, with seasonal flowerbeds and decorative plants.

Horticulture operations shall be started on ground previously levelled and dressed to require formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or replaced or it shall be covered over to a thickness decided by Engineer-in-charge or Engineer's authorized Representative with good earth.

Tree guard

The concrete tree guard of 5' height shall be provided as specified by the Engineer-in-charge or Engineer's authorized Representative.

The planted trees, garden etc. so developed shall be maintained in good condition during the execution and maintenance period of the Contract without any additional costs. The Contractor shall ensure the safety of plants and shall take all the activities such as re-plantation, manuring, use of pesticides, mulching, cutting etc. for growth of trees / plants and maintenance of plants.

Grassing

The area from where the grass roots are to be obtained shall be specified by the Engineer-in-charge or Engineer's authorized Representative at the time of execution of the work. The soil shall be suitable moistened and then the operation of planting grass shall be commenced. Generally planting in either direction at 15 cm, 10 cm spacing is done in the case of large open spaces, at 7.5 cm spacing in residential lawns.

Miscellaneous requirements

Roads and Pathways

Contractor shall construct new Service road of 3.75m wide carriage way and 7.5m total width within the WTP connecting all important buildings, units and connecting the same to the main roads connecting to the premise with all associated CD and other necessary works

The works for roads shall cover site clearance, construction/ preparation of earthen embankment, subgrade, sub-base (granular), base course, pre mix carpet surfacing, Cross Drainage (CD) works, pipe culverts, shoulder construction, road markings, Arboriculture and other associated civil works

The new road shall have 225mm Granular sub-base, 150mm WBM topped with Bituminous Macadam (50mm) and a wearing course (Seal coat). The Contractor shall also provide MS gate at the entry point, as approved by the Engineer-in-charge for stopping unauthorized entry of personnel.

Nameplates and Signboards

Each item of the plant shall have permanently attached to it in a conspicuous position a nameplate, on which shall be engraved or stamped the manufacturer's name, type and serial number, year of manufacture, details of the design capacity etc. Such labels shall be of non-hygroscopic material to be approved by the Engineer or Engineer's authorized Representative. Near by or on each item of the plant, shall be fixed a plate with the name and nomenclature (code) of the item according to the project nomenclature. It shall be visible from a distance of several meters.

The Contractor shall also provide bilingual signboards and instruction tables of durable material, throughout the plant, for the purposes of operation, maintenance and security:

- Danger and caution signs (English and local language)
- Preventive maintenance schedules (local language)
- Operating instructions (local language)
- Unit names (English and local language)
- Nameplates at the doors to the units (English and local language)

Signboards and plates shall be appropriately sized in relation to the relevant item and its surroundings. Details of the proposed inscription, size, material and colours shall be submitted to the Engineer or Engineer's authorized Representative for approval before any signboards or plates are manufactured. They shall be compatible with the instructions in the operation manual.

All cables shall be provided with clip-on identification numbers on both ends and at all terminations in between, for identification. The nomenclature shall correspond to the electrical as-built drawings.

The nomenclature and labelling of the plant shall be decided in close co-operation with the Engineer-in-charge or Engineer's authorized Representative.

First Aid kits

The first aid kit shall consist of all materials, medicines necessary for treatment of cuts, wounds, burns bad effects of inhalation of chlorine, bad effects on skin due to contact of chemicals acids etc. Following materials in general in sufficient quantities shall be provided.

- (i) Medical cotton, sterile cotton pads
- (ii) Cotton Bandages, elastic bandages
- (iii) Pair of scissors, packet of new shaving blades
- (iv) Sticking plaster for medical use.
- (v) Band aid stripes

Following chemicals/medicines shall be provided in sufficient quantities:

- (i) Tinctures iodine and mercury chrome
- (ii) Burnol ointment
- (iii) Bottles of spirit and of Dettol
- (iv) Toilet soaps

To be procured under medical advice

- (i) Tablets for bad-effects of chlorine inhalation
- (ii) Skin lotions and ointments for burns, acid effects
- (iii) Eye drops for soothing effects

Separate First Aid Kits shall be provided in Raw Water Pump House, Workshop, and Clear Water Pump House. Fire extinguisher and first aid kits shall be provided for the end of the commissioning period only. They shall not be used before and shall be complete.

Waste-water drainage

The foul drainage system shall accept discharge from toilets, washrooms, offices and the laboratory. The foul drainage system shall discharge to a septic tank of appropriate capacity and the supernatant shall discharge into a soak pit.

Safety Requirements at Site

The Contractor shall be responsible for safety of his staff on Site during the execution and O&M services.

The Contractor's duties with respect to Safety shall include the following:

- 3. Utilize safety awareness procedures in every element of Operation and Maintenance.
- 4. Give emphasis to site safety including :
 - e) Safe working procedures.
 - f) Cleanliness and care of site as a whole.
 - g) Accident and hazardous conditions reporting.
 - h) Organise Safety discussion meeting with all the personnel weekly.

Formal discussions on safety shall be held with all concerned agencies at least once a month.

The Contractor shall provide Notice Boards/ Display Boards at appropriate location detailing precautions to be taken by Operation and Maintenance personnel in work in conformity to regulation and procedures.

The Contractor shall notify the EIC immediately, if any accident occurs, whether on-site or off-site in which the Contractor is directly involved which results in any injury to any person, whether directly concerned with the Site or a third party. Such initial notification may be verbal and shall be followed by a written comprehensive report within 24 hours of the accident.

The contractor shall have to provide and maintain a suitable First Aid Box at the office. The first aid box shall be equipped but not limited to, with following medicine and first aid materials:

- a) Different sizes of sterilized dressings
- b) Sterilized dressing for burns

- c) 30ml bottle containing 2% alcoholic solution of iodine
- d) 30gm bottle of potassium permanganate crystal
- e) Scissors
- f) Boric cotton
- g) Ointment of burns
- h) A bottle of suitable surgical antiseptic solution

Services and Facilities to be provided by Employer

The Employer shall be liable to the Contractor for the following:

- b) Provide free office accommodation space with attached toilet space for O&M personnel of the Contractor including security room within the WTP Premises.
- c) The charges for power during the O&M period shall be paid by Employer.

Special Conditions

The following special conditions shall be binding on the contractor:

- (e) **Agreement with the Contractor:** Rates for the O&M services shall be governed by the rates quoted by the bidder under Bill No.: (In Volume-II of the bid document) for due consideration of the Employer. The contractor shall sign a separate agreement with the Employer along with the contract for the main works.
- (f) **Performance Security: The Contractor shall provide a Performance Security for O&M Services in the form of a bank guarantee for an amount of Ten percent (10%) of the contract value of the O&M services issued by a reputable bank including scheduled bank or nationalized bank located in India, acceptable to the Employer in the format enclosed. The Performance Security for O & M services contract shall have to be furnished two months prior to the commencement of the O&M services.**
- (g) **Insurance Policies:** The Contractor shall undertake insurance during the operation and maintenance period :
 - (i.) For all Equipment related to the proposed new WTP. The value of the insured equipment shall be considered as 70% of the composite value of the equipment agreed in the Contract for the case of new equipment.
 - (ii.) Against Injury to Persons and Damage to Property
 - (iii.) Contractor's Personnel

The Contractor shall submit evidence of Insurance as per the provisions within 28 days from the date of commencement of the O& M services with the Employer and submit the relevant insurance policies within 45 days from the date of commencement of the O& M services with the Employer.

- (h) **Advance Payment:** No advance payment will be paid for operation and maintenance services.

Other Terms and Conditions

- (n) The personnel engaged by the Contractor shall not be absorbed by the Employer in any circumstances.
- (o) The Contractor shall have to ensure timely payment to their personnel and comply with the provisions of all labour legislation and rules.
- (p) In case of any difficulties faced by the Contractor in performing the operation & maintenance activities, the same shall be reported immediately to the concerned EIC for taking necessary action.
- (q) The Employer shall not be responsible for any untoward incident of accidental death, injury, and medical treatment etc. during on-duty hours. The payment of compensation if required under Workmen Compensation Act, 1923 and any other act, rules shall be borne by the Contractor. This will be statutory obligation on the part of the Contractor.
- (r) The Contractor has to ensure the payment of minimum wages to the deployed personnel as declared by the Labour Department, Govt. of CG, from time to time. Any enhancement of minimum wages during the contractual period shall be paid by the Contractor, Such additional charges shall however not be payable to the Contractor by the Employer.
- (s) The working hours of the operation & maintenance, number of shifts and timings of shift for each WTP shall be approved by the EIC. The personnel engaged by the Contractor should follow /abide by the instructions of the EIC.
- (t) The Contractor shall deploy minimum number of operation & maintenance personnel having requisite qualification on each shift of the day as specified approved by the EIC. The same shall be done in such a manner that at no point of time, the pumping station remains inoperative. The Contractor shall ensure that none of the operation and maintenance personnel leaves his duty place unless and until he is relieved by another person deployed by the Contractor for the next shift.
- (u) The O&M personnel deployed by the Contractor shall record their time of attendance and departure on every day/shift in attendance register which is to be maintained at the place of deployment. Such attendance register shall be produced before the concerned EIC for regular checking.
- (v) The Contractor shall not deploy any person as Operation & Maintenance personnel who may be found unsuitable for duty on medical ground because of illness (mental/physical), old age and or infirmity, duly certified by a registered medical practitioner.
- (w) The Contractor shall keep himself informed of the relevant and related laws & ordinances and shall conduct the work in compliance with such laws. Fees for necessary permits, licenses, & taxes required by law shall be paid by the Contractor as per GCC.

- (x) For filling the vacant position on the event of death or otherwise, the Contractor must inform and seek consent from the EIC for the appointment of new worker.
- (y) The Employer reserve the right to terminate the annual operation and maintenance contract of the plant (s) in case of non-performance of the Contractor based on report of the EIC. The termination shall however be governed by the GCC of the contract.
- (z) All other terms and conditions shall be governed by the standard practices prevalent with the Employer.

Payment Terms

General Terms

Payment shall be made to the contractor on monthly billing as per measurement:

Penalty for theft, Pilferage

The contractor shall be liable to compensate the Employer for any loss of property of the WTP due to theft, pilferage, damage, etc. caused as a result of negligence, mishandling, wrong operation, etc. on the part of personnel engaged by the contractor for operation and maintenance of the WTP (s). The penalty amount shall be fixed by the Employer or the same shall have to be restored in original condition to the satisfaction of the Employer.

Environmental Monitoring Plan

Mitigation measures	Location	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring
Pre- Construction				
Air Quality		SPM and RSPM, NOx, CO	Once prior construction	AMC-PHE
Noise	At two locations along the rising main alignment and two locations where WTP is proposed and networks to be developed	Decibels	Once prior construction	AMC-PHE
Water Quality	At water source	Surface water quality	Once prior to construction	AMC-PHE
Site for quarries and borrow pits	All sites identified for quarries, borrow pits, waste and construction labour camps and offices	The site situation- for rehabilitation, photographs	Once prior to construction	AMC-PHE
Vegetation removal	Locations that are to be cleared off trees for construction activities	Vegetative survey to identify type and amount of vegetation that requires to be replaced	Once prior to construction	AMC-PHE
Construction				
Air Quality	along the rising main alignment and two locations – at	SPM and RSPM, NOx, CO The monitoring results shall be compared with	Thrice annually	AMC-PHE

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	WTP and where networks to be developed	baseline values (prior to start of construction) of respective parameters; this will be threshold and any increase of value requires a corrective action by contractor		
Noise	At two locations along the rising main alignment and two locations – at WTP and where networks to be developed	Decibels The monitoring results shall be compared with baseline noise levels (prior to start of construction); this will be threshold and any increase of value requires a corrective action by contractor	Thrice annually	AMC-PHE
Water Quality	At two water body locations along the rising main	Surface water quality The monitoring results shall be compared with baseline values (prior to start of construction) of respective parameters;	Thrice annually	AMC-PHE

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

		this will be threshold and any increase of value requires a corrective action by contractor		
Site for borrow pits, construction camps	Quarries, borrow pits, labour camps and office sites	Post construction – After construction activity over – if rehabilitated	After completion of construction activities at site	AMC-PHE
following activities in order priority: <input type="checkbox"/> Utilise for filling of deep borrow- pits of road section. Utilize for raising the ground- level of construction sites <input type="checkbox"/> Provide to local people for filling up lowlying areas.	Rising main, Supply & distribution network sites	Observations on- site/offsite;	Weekly	AMC-PHE
Water accumulation in trenches during rains and related impacts <input type="checkbox"/> Avoid scheduling of excavation work during monsoon <input type="checkbox"/> Complete work in excavated stretches before monsoon <input type="checkbox"/> Regulate drainage by	All construction sites	Observations on- site/offsite;	Weekly	AMC-PHE

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

<p>earthen bunds, if required</p> <p><input type="checkbox"/> Cover or damp down soil mounds to control dust</p> <p><input type="checkbox"/> Apply water prior to leveling/ any earth moving activity</p> <p><input type="checkbox"/> Bring the material (aggregate) as and when required</p> <p><input type="checkbox"/> Ensure speedy completion of work</p> <p><input type="checkbox"/> Use tarpaulins to cover loose material in transport</p> <p><input type="checkbox"/> In case of surplus soil is provided for other departments or private persons, it will be the responsibility of contractor to ensure that it proper handling, transport & utilization</p> <p><input type="checkbox"/> Use tarpaulins to cover loose material/soil that is transported to and from the site by truck</p> <p><input type="checkbox"/> Control dust generation while unloading the loose material</p>				
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particularly aggregate) at the site by sprinkling water and unloading inside the barricaded area <input type="checkbox"/> Clean wheels and undercarriage of haul trucks prior to leaving construction site where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a			
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1.0 Special Conditions

1.1 Services and Facilities to be provided by Employer

The Employer shall be liable to the Contractor for the following:

- a) Provide free office accommodation space with attached toilet space for O&M personnel of the Contractor including security room within the WTP Premises.
- b) The charges for power during the O&M period shall be paid by Employer.
- c) The following special conditions shall be binding on the contractor:
 - i. **Agreement with the Contractor:** Rates for the O&M services shall be governed by the rates quoted by the bidder under Bill No.: for due consideration of the Employer. The contractor shall sign a separate agreement with the Employer along with the contract for the main works.
 - ii. **Performance Security:** The Contractor shall provide a Performance Security for O&M Services in the form of a bank guarantee for an amount of Ten percent (10%) of the contract value of the O&M services issued by a reputable bank including scheduled bank or nationalized bank located in India, acceptable to the Employer in the format enclosed. The Performance Security for O & M services contract shall have to be furnished two months prior to the commencement of the O&M services.
 - iii. **Insurance Policies:** The Contractor shall undertake insurance during the operation and maintenance period :

- (i.) For all Equipment related to the proposed new WTP. The value of the insured equipment shall be considered as 70% of the composite value of the equipment agreed in the Contract for the case of new equipment.
- (ii.) Against Injury to Persons and Damage to Property
- (iii.) Contractor's Personnel

The Contractor shall submit evidence of Insurance as per the provisions within 28 days from the date of commencement of the O& M services with the Employer and submit the relevant insurance policies within 45 days from the date of commencement of the O& M services with the Employer.

- iv. **Advance Payment:** No advance payment will be paid for operation and maintenance services.

1.2 Other Terms and Conditions

- (a) The personnel engaged by the Contractor shall not be absorbed by the Employer in any circumstances.
- (b) The Contractor shall have to ensure timely payment to their personnel and comply with the provisions of all labour legislation and rules.
- (c) In case of any difficulties faced by the Contractor in performing the operation & maintenance activities, the same shall be reported immediately to the concerned EIC for taking necessary action.
- (d) The Employer shall not be responsible for any untoward incident of accidental death, injury, and medical treatment etc. during on-duty hours. The payment of compensation if required under Workmen Compensation Act, 1923 and any other act, rules shall be borne by the Contractor. This will be statutory obligation on the part of the Contractor.
- (e) The Contractor has to ensure the payment of minimum wages to the deployed personnel as declared by the Labour Department, Govt. of CG from time to time. Any enhancement of minimum wages during the contractual period shall be paid by the Contractor, Such additional charges shall however not be payable to the Contractor by the Employer.
- (f) The working hours of the operation & maintenance, number of shifts and timings of shift for each WTP shall be approved by the EIC. The personnel engaged by the Contractor should follow /abide by the instructions of the EIC.
- (g) The Contractor shall deploy minimum number of operation & maintenance personnel having requisite qualification on each shift of the day as specified approved by the EIC. The same shall be done in such a manner that at no point of time, the pumping station remains inoperative. The Contractor shall ensure that none of the operation and maintenance personnel leaves his duty place unless and until he is relieved by another person deployed by the Contractor for the next shift.

- (h) The O&M personnel deployed by the Contractor shall record their time of attendance and departure on every day/shift in attendance register which is to be maintained at the place of deployment. Such attendance register shall be produced before the concerned EIC for regular checking.
- (i) The Contractor shall not deploy any person as Operation & Maintenance personnel who may be found unsuitable for duty on medical ground because of illness (mental/physical), old age and or infirmity, duly certified by a registered medical practitioner.
- (j) The Contractor shall keep himself informed of the relevant and related laws & ordinances and shall conduct the work in compliance with such laws. Fees for necessary permits, licenses, & taxes required by law shall be paid by the Contractor as per GCC.
- (k) For filling the vacant position on the event of death or otherwise, the Contractor must inform and seek consent from the EIC for the appointment of new worker.
- (l) The Employer reserve the right to terminate the annual operation and maintenance contract of the plant (s) in case of non-performance of the Contractor based on report of the EIC. The termination shall however be governed by the GCC of the contract.
- (m) All other terms and conditions shall be governed by the standard practices prevalent with the Employer.

1.3 Payment Terms -

Payment shall be made to the contractor on monthly billing as per measurement:

1.4 Penalty for theft, Pilferage

The contractor shall be liable to compensate the Employer for any loss of property of the WTP due to theft, pilferage, damage, etc. caused as a result of negligence, mishandling, wrong operation, etc. on the part of personnel engaged by the contractor for operation and maintenance of the WTP (s). The penalty amount shall be fixed by the Employer or the same shall have to be restored in original condition to the satisfaction of the Employer.

Annexure-“F” - (Main): Price Schedule

Item No..	Component of Integrated Water Supply Scheme	Percentage Payment on quoted lump sum (without O&M) offer to the Contractor
1	<p><u>Rising Mains:</u> Supply,laying,jointing,hydro-static testing of Water Rising Main DI (class K-9) / MS pipe including excavation,ancillary civil works,valves,DI specials,DI fittings,surge protection devices,road resurfacing complete and 12 months of trial run for following dia and lengths.</p>	
	a) 150 mm dia, DI (class K-9) -----105 m	0.036%
	b) 200 mm dia, DI (Class K-9) pipe -----462 m	0.152%
	c) 250 mm dia, DI (Class K-9)pipe -----5027 m	1.738%
	d) 300 mm dia,DI (Class K-9)pipe-----7627 m	3.248%
	e) 350 mm dia,DI (Class K-9)pipe-----1315 m	0.755%
	f) 400 mm dia,DI (Class K-9)pipe-----2444 m	1.482%
	g) 500 mm dia,DI (Class K-9)pipe-----5300 m	4.212%
	h) 700 mm dia,DI (Class K-9)pipe-----116 m	0.189%
	i) 900 mm dia,DI (Class K-9)pipe-----78 m	0.202%
	j) MS pipe , DIA 300 mm -----100 m (As a casing pipe)	0.021%
	k) MS pipe , DIA 600 mm -----100 m (As a casing pipe)	0.067%
	j) MS pipe , DIA 1000 mm -----400 m (As a casing pipe)	0.466%
2	<p><u>OVERHEAD SERVICE RESERVIORS</u> Provision of 5 nos RCC Overhead Reservoir with inlet,outlet,wash out and over flow pipe,digital level indicator with sensor including water tightness test,installation & commissioning complete with 12 months of trial run as follows</p>	
	a) 3 No. OHSR of 1000 KL capacity @ 18 m Staging	1.936%
	b) One OHSR of 2000 KL capacity @ 20m Staging	0.922%
	c) One OHSR of 2500 KL capacity @ 20 m Staging	1.042%

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

3(A)	<u>DISTRIBUTION NETWORK;:-</u> Provision of Distribution Network consisting of DI (Class K-7) /MS pipeline including excavation, supply, laying, jointing with EPDM rubber gasket with suitable surge protection devices, DI specials, fittings, valves, chamber, road resurfacing complete and allied works of following diameters and length with 12 months trial run complete as given below:-	
	a) 100 mm dia DI (Class K-7) pipe -----125708 m	19.548%
	b) 150 mm dia DI (Class K-7) pipe -----19159 m	4.053%
	c) 200 mm dia DI (Class K-7) pipe -----10014 m	2.785%
	d) 250 mm dia DI (Class K-7) pipe -----5406 m	1.589%
	e) 300 mm dia, DI (Class K-7) pipe -----3144 m	1.151%
	f) 350 mm dia, DI (Class K-7) pipe -----1523 m	0.694%
	g) 400 mm dia, DI (Class K-7) pipe -----240 m	0.189%
	h) 500 mm dia, DI (Class K-7) pipe -----1411 m	0.942%
	i) 600 mm dia, DI (Class K-7) pipe -----33 m	0.050%
	(j) 200 Mm DIA MS Pipe [for casing purpose only]--200 m	0.014%
	(k) 300 Mm DIA MS Pipe [for casing purpose only]--50 m	0.035%
	(l) 400 Mm DIA MS Pipe [for casing purpose only]--200 m	0.043%
	(m) 600 Mm DIA MS Pipe [for casing purpose only]--50 m	0.033%

3(B)	<p><u>HOUSE SERVICE CONNECTION</u></p> <p>With House Service Connection with AMR Compatible water meter, GIS Mapping, Consumer survey & Billing App including Earth work, filling, Providing, Supply laying, installation of G.I pipe 15mm dia for House Service with clamp saddle, Polyethylene Aluminium composite (PL-AL-PE) pressure pipes, brass stop cock, MS/PP Meter Box of required Size, of Multi Jet, dry dial, inferential type, horizontal, Magnetically coupled, class 'B' water meters Conforming to IS- 779 : 1994 and ISO 4064: 1993 standard with EEC/ MID certification mark , with IP 68 protection class with Digitization of satellite image, Carrying out consumer survey, Provision for customer facilitated center with redressal facilities and collection center Provision for Billing software with creating mobile application and training to RMC staff and providing 20 smart phones with above application including trial run period of three months etc. complete and as instructed by Engineer in Charge) 15 mm Dia-7560 Nos. With 12 months trial run complete :</p>	3.376%
	ii) 20 mm Dia-30 Nos	0.023%
	iii) 25 mm Dia-14 nos	0.007%
3(C)	<p><u>BILLING SOFTWARE</u></p> <p>Provision for Billing software with creating mobile application and training to AMC staff and providing 20 smart phones with above application including trial run period of twelve months etc. complete</p>	0.145%
3(D)	<p><u>CUSTOMER FACILITATION CENTRE</u></p> <p>Provision for customer facilitation centre with redressal facilities and collection center complete</p>	0.036%
3(E)	<p><u>CONSUMER SURVEY</u></p> <p>Carrying out consumer survey in order to collect identification details, socio economic characteristics details of consumers connection details of consumption of water usage, preparing database systems including all the attribute tables of consumers data, matching of consumer survey data with billing data, integration of consumer survey with GIS layer, showing coverage of water supply scheme on digitised map complete.</p>	0.026%
3(F)	<p><u>DIGITIZATION OF SATELLITE IMAGERY</u></p> <p>Digitization of satellite imagery including collection of DGPS points of important level marks geo referencing of satellite image, creation of base map by interpretation & digitization from the satellite data creating road network, rivers, water bodies, building land use etc in different layer cleaning of digitized map topology building overlaying of water supply features incld submission of deliverable in shape file format etc complete.</p>	0.016%

4	<p><u>RAW WATER PUMPS</u> Supply, fixing of 6 Nos Water lubricated Verticle Turbine Pumps each 2705 cum/hr discharge @45 m head (4W+2S) with HT motor, Foundation, Pipes, with specials, Dismanteling joints, Sluice valve, reflux valve, Auto Transformer Starter, H.T. Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit brakers, single phasing preventer water level guard, capacitor etc, Cable (XLPE Armoured cable), Earthing, Pressure gauging, Tools, Spares and lifting arrangement(for 02 Years), Lighting/lighting arrestor in pump house, EOT Crane (Capacity -7 Ton) etc complete including installation and commissioning duly approved by Third Party Inspection (RITES/SGS) with 12 months trial run. Painting of entire installation within the pump house with 2 coats of super enamel paint as per direction of Engineer-in charge of works</p>	9.264%
5(a)	<p><u>WATER TREATMENT PLANT(80 MLD CAPACITY)</u> Provision of Construction of 80 MLD Water Treatment Plant, conventional type, having cascade aerator, flash mixer, Clariflocculator, Rapid Gravity filter beds, Clear Water sump along with recirculation of wastewater etc as per specifications of Including sludge recycling plan Designing (structurally, hydraulically & aesthetically), providing and constructing and commissioning Conventional Water Treatment Plant consisting of Civil Works(including jungle clearing), including cost of providing and applying Epoxy paint to inside surface of water retaining structures in contact with Chlorine and providing anti-termite treatment to entire structure below ground level, Mechanical and Electrical components of various sub-works as given below : including necessary hydraulic testing, structural testing, equipment testing and trial run for 12 months, etc. complete as directed by Engineer-in-charge .</p>	9.334%
5(b)	<p>Including Construction of Recirculation system including Sludge Sump, Thickeners, Thickner feed pumps, Thickened Sludge sump, Centrifuges, Centrifuge feed pumps, Supernatant and Centrate collection sump and recycle pumps, DWPE dosing system, centrifuge building, etc. for 230 MLD (150 + 80) existing WTPs with 12 months of trail run</p>	4.161%

6(a)	<p><u>CLEAR WATER PUMPS</u> Supply installation, testing and commissioning of 6 Nos (4W+2S) Horizontal Split Case Centrifugal Pumps, (Impeller Stainless steel & Stainless Steel Shaft) suitable for pumping Clear water of capacity and minimum combined efficiency 75% coupled with flexible coupling to TEFC Squirrel cage Induction HT motor (Degree of protection IP 44) complete with discharge 2046 cum/hr @ 65 m head with Base Frame, foundation bolts etc. all as required & directed. (Pumps with higher efficiency shall be preferred) and also including foundation, Pipes, with specials, Dismantling joints, Sluice valve, reflux valve, Auto Transformer Starter, H.T Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit breakers, single phasing preventer water level guard, capacitor etc, Cable (XLPE Armoured cable), Earthing, Pressure gauges, Tools, Spares and lifting arrangement for 02 years, Lighting/lighting arrestor in pump house, EOT Crane (Capacity -7 Ton) complete and s Painting of entire installation within the pump house with 2 coats of super enamel paint as per direction of Engineer-in charge of works including installation and commissioning and Third Party Inspection (SGS/RITES) followed by 12 months of trial</p>	8.350%
6(b)	<p>Supply installation, testing and commissioning of 4 Nos Horizontal Split Casing Centrifugal Pumps, (Impeller Stainless steel & Stainless Steel Shaft) suitable for pumping Clear water of capacity and minimum combined efficiency 75% coupled with flexible coupling to TEFC Squirrel cage Induction HT motor (Degree of protection IP 44) complete with discharge 995 cum/hr @ 45 m head with Base Frame, foundation bolts etc. all as required & directed. (Pumps with higher efficiency shall be preferred) and also including foundation, Pipes, with specials, Dismantling joints, Sluice valve, reflux valve, Auto Transformer Starter, H.T Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit breakers, single phasing preventer water level guard, capacitor etc, required cable (XLPE Armoured cable), Earthing, Pressure gauges, Tools, Spares and lifting arrangement for 02 years, Lighting/lighting arrestor in pump house, EOT Crane (Capacity -7 Ton) complete and s as directed including Third Party Inspection by SGS/RITES. Painting of entire installation within the pump house with 2 coats of super enamel paint as per direction of Engineer-in charge of works including 12 months trial run</p>	1.959%

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

6(c)	Supply installation, testing and commissioning of 6 Nos Horizontal Split Casing Centrifugal Pumps, (Impeller Stainless steel & Stainless Steel Shaft) suitable for pumping Clear water of capacity and minimum combined efficiency 75% coupled with flexible coupling to TEFC Squirrel cage Induction HT motor (Degree of protection IP 44) complete with discharge 620 cum/hr @ 60 m head with Base Frame, foundation bolts etc. all as required & directed. (Pumps with higher efficiency shall be preferred) and also including foundation, Pipes, with specials, Dismantling joints, Sluice valve, reflux valve, Auto Transformer Starter, LT Panel board incorporating ammeter voltmeter, switches, starter, earth leakage circuit breakers, single phasing preventer water level guard, capacitor etc, required cable (XLPE Armoured cable), Earthing, Pressure gauges, Tools, Spares and lifting arrangement for 02 years, Lighting/lighting arrestor in pump house, EOT Crane (Capacity -7 Ton) complete and s as directed including Third Party Inspection by SGS/RITES. Painting of entire installation within the pump house with 2 coats of super enamel paint as per direction of Engineer-in charge of works including 12 months trial run	1.754%
6(d)	<u>SHIFTING AND REFIXING OF EXISTING TRANSFORMERS</u> Installation, Testing, Commissioning and shifting to old Transformer, Cable and Pole etc. From Existing 47.5 MLD WTP to Prop. 80 MLD WTP complete as instructed by Engineer in charge.	0.0362%
7	<u>SHIFTING OF PUMPS INCLUDING ACCESSORIES:</u> Provision of Dismantling of Existing Pumping Machinery & Installation of same including all electrical equipment, Panel, Breaker cable etc in a planned manner (To be approved by Engineer -in-Charge) including suction and delivery side valves, pipes & special, shifting of all these items out side the pump house up to the store and including all civil works as directed by Engineer -in-Charge including installation and commissioning with 12 months trial run for followings:	
7(a)	Dismantling of existing pumping sets (for 6 Nos, VT Pump of 150 MLD Intake and 6 Nos, of 80 MLD Intake well) including all electrical equipment, Panel, Breaker cable etc in a planned manner----- ---12 No.	0.080%
7(b)	Shifting of existing pumping sets (for 6 Nos, VT Pump of 150 MLD Intake well) including all electrical equipment, Panel, Breaker cable etc in a planned manner-----6 No.(to 80 MLD Intake well)	0.019%
7(c)	Shifting of existing pumping sets (for 6 Nos, VT Pump of 80 MLD Intake well) including all electrical equipment, Panel, Breaker cable etc in a planned manner-----6 No.(to be handed over to RMC Raipur)	0.019%
7(d)	Installation, and operating, commissioning of existing 80 MLD (6 Nos, VT Pump) Intake well pump house equipments including all electrical equipment, Panel, Breaker cable etc in a planned manner	0.062%

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

7(e)	Dismantling of existing pumping sets (for 6 Nos, HSC Pump of 150 MLD.(to be handed over to RMC Raipur) WTP and 6 Nos, HSC Pump of 80 MLD Clear water Pump house) .(to be handed over to RMC Raipur) including all electrical equipment, Panel, Breaker cable etc in a planned manner-----12 No.	0.019%
8	<p><u>ELECTROMAGNETIC BULK FLOW METERS</u> Supply of Electromagnetic full bore meter complete as per specification , installation, testing, commissioning, making connections with existing pipe line, including excavation at site, cuts in the existing pipe system, dewatering and reinstating the same after completion of installation as per specification and drawings including. Accuracy of meter + 0.3% of measured value, Flange connection as per AWWA & IS, Liner: Hard Rubber, Fully welded sensor housing complying to IP 68 standard, Electrodes SS 316, Sensor housing SS 304, Cable gland 1/2" NPT, Sensor housing fully welded SS 304 housing with protective Polyurethane paint, Flow Transmitter/ Converter : Microprocessor based, modular design display 2 line back lit LCD for indication of actual flow rate, forward, reverse, sumtotalizer, Perfection category : IP 65 Output : One current output (4-20 mA) one scalable pulse output with remote reading facility including 05 years guarantee with replacement as given below(including fixing of flanges, and provision of Valve chambers as per enclosed drawings complete)</p>	
	(i)100 mm DIA-----2no.	0.028%
	(ii) 150 mm DIA----6 No.	0.110%
	(iii) 200 mm DIA-----3 No.	0.063%
	(iv) 250 mm DIA-----3 No.	0.070%
	(v) 300 mm DIA-----10 No.	0.248%
	(vi) 400 mm DIA-----28 No.	1.018%
	(vii) 500 mm DIA-----10 No.	0.469%
	(viii) 600 mm DIA-----2 No.	0.141%
	(ix) 900 mm DIA----1 No.	0.131%
	(x) 1000 mm DIA-----1 No.	0.142%
	(xi) 1200 mm DIA-----1 No.	0.182%

9	<p><u>PILOT-OPERATED, HYDRAULIC WATER-LEVEL AND FLOW CONTROL VALVE:</u> Supply and fixing including installation and commissioning of Pilot-operated, hydraulic water-level and flow control valve. The valve will Maintain a maximal water level in the elevated reservoir, stopping the inflow of water when the level reaches the maximal-allowed level. The valve will stay closed until the water level drops to a preset minimal value, and then open fully. While the valve is in opened position it will regulate the water flow rate to the tank. The rate of flow should be regulated within the whole range of potential flows. This will be provided with 05 years guarantee (from an internationally acclaimed manufacturer having a service centre in India) with replacement. Following dia will be provided:</p>	
	(i) 250 mm DIA----1 No.	0.034%
	(ii) 300 mm DIA-----5 No.	0.225%
	(iii) 400 mm DIA-----23 No.	1.628%
	(iv) 500 mm DIA-----8 No.	0.947%
	(vi) 600 mm DIA-----1 No.	0.122%
10	<p><u>PLC- SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) AUTOMATION Monitoring and Control SYSTEM</u> Provision of PLC- Supervisory Control and data Acquisition (SCADA) Automation system for the complete project Intake – 2nos (80 MLD & 150 MLD), WTP-3 Nos (80 MLD, 150 MLD & 80 MLD), OHSRs-Inlet & Outlet of 38 Nos at different locations including complete instrumentation and setting up of central Server room with all necessary equipments, training to Nagar Nigam staff including 12 months trial run.</p>	7.128%
11	<p>MISCELLANEOUS WORKS FOR CONSTRUCTION OF INTERNAL ROADS OF PROPOSED WTP COMPLEX, COMPOUND WALL WITH GATE AT PROPOSED SEVEN NOS. OHSR SITE COMPOUND WALL (2.1 m high above GL)</p>	
11(a)	Amaseoi Proposed OHSR-----260 m	0.127%
11(b)	Kachana Proposed OHSR----240 m	0.118%
11(c)	Jora Proposed OHSR---350 m	0.172%
11(d)	Deopuri Proposed OHSR----400m	0.196%
11(e)	Boriya Khurd Proposed OHSR---400 m	0.196%

11(f)	<p><u>80 MLD Proposed WTP:</u> 500 m x 4.5 m RCC Road including jungle clearing, construction of embankment with soil (CBR .5) including spreading, levelling & compaction and provision of GSB (table 400-I:Construction of granular sub-base by providing graded Material, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface watering, rolling and compacting with vibratory power roller at OMC to achieve the desired density, complete as per clause 401 ; Aincluding provn of Dry Lean Cement Concrete Sub base over a Subgarde with coarse & fine aggregate , concrete Strength . 10 MPa at 07 days mixed in a batching plant , using Paver with elctronic sensor , compacting with 8-10 ton Vibratory roller , finishing and curing complete including provision and laying of reinforced cement concrete , formwork, shiuttering complete (Design Concrete Mix-M30).</p>	0.226%
	Total	100 %

O & M for 5 years including replacement and warranty of after successful completion of trial run of 12 months

S.No.	Description	O&M in Lakhs
1	<p>(i)80 MLD proposed WTP including the Clear water Pump House of 30 MLD capacity including PLC SCADA automation, Monitoring and Control System (ii) Clear Water Pumps (4W +2s) to be replaced in 150+50 MLD CWPB including PLC SCADA automation, Monitoring and Control System (iii) Raw water Pumps to be replaced in 150 MLD Intake Well including PLC SCADA automation, Monitoring and Control System (iv) PLC SCADA Automation, Monitoring and Control System covering all the existing and proposed raw water pumps, clear water pumps,Pilot-operated, hydraulic water-level and flow control valves (38 no.) , digital water level indicators, residual chlorine sensors in existing and proposed OHSRs, Bulk Flow Electro-magnetic Flow Meters and existing 150 MLD and 80 MLD WTPs (v) Recirculation of waste water and sludge in existing 150 and 80 MLD WTPs</p>	

Note – O&M cost for 05 years including replacement and warranty of all the components executed under this contract shall be paid as per offer for O&M quoted by Contractor. Percentage Breakup for payments is given in Annexure F-5

Annexure - "F-1 (Clear water Pumps, Raw water Pumps and Electric Sub-Stations)" : Price Schedule

BROAD BREAK-UP SCHEDULE

FOR

STAGE WISE PAYMENT OF WORK

BREAK UP OF PAYMENT

- A. On supply of equipment at site [duly approved by Third Party Inspection as per QAP]-----75%
B. On erection of equipment at site - -----20%
C. On testing and commissioning and trial run of 12 months ---- 05%
Total:- -----100%

Annexure - "F-2 (OHSR)" : 5 nos OHSRs-3.899 % of Lump-Sum offer

Break up of Payment Schedule for Individual OHSR-

Sl. No	Description	Percentage Payment admissible	Cumulative Percentage Payment
1	Geotechnical investigations for determination of SBC including approval of Design and Drawings and construction of of levelling course of PCC(1:4:8) for foundation of OHSR complete	05%	5%
2	After casting of foundation including columns upto GL	10%	15%
3	After casting of 50% of RCC complete staging	12%	27%
4	After completion of casting of complete RCC staging	13%	40%
5	After completion of castin of Ring Beam & Bottom Slab	15%	55%
6	After completion of casting of vertical walls of reservoir/container complete	15%	70%
7	After completion of casting of staircase , top dome /slab	10%	80%
8	On supply and fixing of pipes & specials , valves , water level indicators, railing , lightening arrestor & Earthing (as per IS-3043) complete at site including approval by the Third Party Inspection.	15%	95%
9	After finishing, distempering and painting & successful hydrotesting of work and commissioning.	05%	100%

Annexure - "F-3 (Raw Water , Clear Water Rising Mains, and Distribution Network including House Service Connections)" : Price Schedule

Payment Terms:

For Supply,Laying, Hydrostatic -testing including Backfilling and Road Restoration complete of DI (K-9) & DI (K—7) water pipeline:

- A. Provision of Distribution network /rising mains/gravity feeders
 - i. Earthwork in excavation for pipe trench including dressing , watering , ramming & disposal of earth, pumping out water including dewatering (in laterite soil, soft rock, hard rock) taking width of trench as OD+30 cm.
 - ii. Provision of 10 cm thick sand bedding layer
 - iii. Supply, laying [IS-12288-1987] , jointing socket and spigot centrifugally cast DI pipe (Class K-7 or Class k-9) conforming to IS-8329 with EPDM rubber gasket joints [IS -5382] including hydro-testing [USOR , 6.1 , p-74]
 - iv. Provn and fixing of DI fittings and DI specials complete.
 - v. Supply & fixing of sluice valves [IS-3896 Part-2], DI dismantling joints with MS nuts, DI double flanged scour valves, Single chamber D I Air valves [IS-3896, Part-2],CI butterfly valves,
 - vi. Provision of RCC [M-20 concrete Mix] , valve chambers, thrust blocks & pie pedestals complete.
 - vii. Backfilling of trenches in layers not exceeding 20 cm thick including consolidation of layers , ramming & watering [USOR, 2.10.1, p-20].
 - viii. Conducting Ground Penetrating radar Survey using 500 MHz antenna
 - ix. Carrying out surge analysis using Standard approved Software [for rising mains only].
- B. At road crossings and other places:
 - i. Supply & laying & jointing NP-2 RCC socket & spigot pipes with EPDM rubber gasket including testing of joints [USOR, 5.1, p-194]
 - ii. Provision and laying of MS pipe using HDD trenchless technology .[IndSTT : 101 : Code of Practice for HDD technique].
 - iii. For crossing the nullahas etc, provision and fixing of MS Structural works fabricated including painting with two coats of enamel paint and two coats of primer .
- C. Surface Resurfacing:
 - i. Bituminous Road:
 - Cutting bituminous road incld disposal
 - Cutting of WBM including disposal
 - Excavation and construction of GSB & spreading with motor graders , watering , rolling , compaction with vibratory power roller at OMC [PWD SOR Roads, 4.1(iii) , p-15]
 - Construction of WMM at OMC in Mechanical Mix Plants , laying in layers with paver & compaction with vibratory roller [PWD SOR, Roads , 4.10, p-16].
 - Supply & spraying primer coat with oil based bitumen emulsion [SS-1, grade conforming to IS-8887]on granular base by mechanical means @ 0.85 kg/sq-m [PWD, SOR, Roads, 5.1, p-19].
 - Applying tack coat with bitumen emulsion[RS-1, grade IS-8887]using emulsion pressure distributor @ 0.25 kg/sq-m [PWD, Roads, 5.2, p-19].
 - Provision of bituminous macadam prepared in hot mix plant and laid using paver finisher [19 mm nominal max size, bitumen content 3.4 %].
 - Provision & laying of semi dense bituminous concrete with hydrostatic paver finisher with sensor controlled smooth wheeled, vibratory & tandem rollers.[MORT & H clause 508] –10 mm nominal size with bitumen 5.0 % [PWD SOR, Roads , 5.20 (b) (iii) , p-24].
- D. Road resurfacing for Concrete Roads
 - Cutting of stone rubble masonry /brick masonry.
 - Provision & laying of cement concrete roads(M-20 Concrete Mix).

E. Interconnection between existing and newly laid pipelines.

Note :The approved Lump Sum offer of the Contractor for work portion shall be compared with the PAC and percentage at PAR ,BELOW OR ABOVE shall be calculated . Running account bills payment of works of DI pipeline (Class K-9& class K-7) shall be paid at PHE SOR 2013 +/- (with all amendments upto date of issue of NIT) PERCENTAGE of LUMP SUM OFFER as compared to PAC.The Road Restoration payment shall be made at PWD SOR of ROADS 2015 +/- PERCENTAGE of LUMP SUM OFFER as compared to PAC.The final payment shall be equal to the percentage of this work of total LS offer for works as given in Annexure F

Payment Terms For AMR compatible System

The entire cost of the AMR compatible metering project shall be borne by the bidder and shall be completed in (12) months just after completing the laying of entire Distribution Network. Payment for the AMR compatible metering project Capital Cost and on site Comprehensive annual maintenance Cost for five years as quoted by the bidder subject to satisfactory performance as per contract conditions.

Note: The date of commissioning of the project would be for the supply, erection, testing of 7604 nos AMR compatible meters including deployment of software and completion of all related civil & mechanical works then completion report given by the project executing authority Engineer-in-charge.

- a) 60% of lump sum offer of the cost component (AMR compatible water meters for 15 mm, 20mm & 25 mm dia) will be paid after supplying, installing, testing & commissioning of AMR compatible meters and after satisfactory performance observation period for twelve months from the date of commissioning period on prorata basis.
- b) 8% of lump sum offer of the cost component (AMR compatible water meters for 15 mm,20mm & 25 mm dia) will be paid after successfully completion of first year on site comprehensive annual maintenance period from the date of commissioning.
- c) 8% of lump sum offer of the cost component of (AMR compatible water meters for 15 mm,20mm & 25 mm dia) will be paid after successfully completion of second year on site comprehensive annual maintenance period from the date of commissioning.
- d) 8% of lump sum offer of the cost component of (AMR compatible water meters for 15 mm,20mm & 25 mm dia) will be paid after successfully completion of third year on site comprehensive annual maintenance period from the date of commissioning.
- e) 8% of lump sum offer of the cost component of (AMR compatible water meters for 15 mm,20mm & 25 mm dia) will be paid after successfully completion of fourth year on site comprehensive annual maintenance period from the date of commissioning.
- f) Balance 8% of lump sum offer of the cost component (AMR compatible water meters for 15 mm,20mm & 25 mm dia) will be paid after successfully completion of fifth year on site comprehensive annual maintenance period from the date of commissioning.

Various Activities to be performed for clear water Rising mains but not limited to the followings

S.No	Description of item	Unit
1	Cutting of bituminous road portion and making good the same including supply of extra quantities of materials i.e. aggregate, moorum screening and labour required.	Sqm
2	Demolishing of C.C./ R.C.C. work by mechanical means including stacking of serviceable material and disposal of unserviceable material with in 50m, lead.	Cum
3	Providing & laying mechanically mixed cement concrete 20 mm maximum size graded crushed stone excluding cost of centring & shuttering.	Cum
	M-10	
4	Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications.(For Village roads)	Cum
	P.C.C. M-30	
5	Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering and ramming and disposal of excavated earth lead upto 50 meters and lift upto 1.5m, disposal earth to be levelled, neatly dressed.	cum
	Dia of pipe in mm	
6	Extra for every additional lift of 1.5m or part thereof for For all kind of soils.	Cum
	For pipe dia. in mm beyond 1.50 mtr. depth.	
	500	
	700	
	900	
	1000	
7	For muddy area	Cum
8	Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of useful material and disposal of unserviceable one up to 50 m lead and lift up to 1.5 m.	
	a) Soft rock with or with out blasting or bituminous pavement / cement concrete road.	Cum
	b) Hard rock requiring chieseling/ blasting prohibited	Cum
	c) Extra for every additional lift of 1.5m or part there of	
	for Oridnary Soft & Hard Rock	Cum
9	Pumping out water caused by springs, tides or river seepage, broken water mains or drains or well or the like.	KL
10	Filling with murum/river sand for pipe bedding or over the pipe including supply .	
	Dia of pipe in mm	
	150	Cum
	200	Cum

**TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH**

	250	Cum
	300	Cum
	350	Cum
	400	Cum
	500	Cum
	700	Cum
	900	Cum
	1000	Cum
11	Providing, laying and jointing socket & spigot centrifugally cast (Spun) Ductile Iron pressure pipes with inside cement mortar lining (class K-9) Conforming to IS 8329/2000 with suitable Rubber Gasket (Pushon) joints as per IS : 5382/85 including testing of joint (laying Conforming to IS 12288 : 1987)	
	Dia of pipe in mm	
	150	RM
	200	RM
	250	RM
	300	RM
	350	RM
	400	RM
	500	RM
	700	RM
	900	RM
	1000	RM
12	Providing and supplying DI specials and fittings for all types of specials, bends, tees etc.	
	80mm to 300mm dia	Kg.
	350mm and above dia	Kg.
13	Supply of DI D/F Sluice Valves / Scour Valve Slanted/Straight seated with metallic, corrosion proof and wear resistant seat faces, body and disc of ductile cast iron GGG 50/SG Iron 420/12 or equivalent grade as per IS 3896 (part-2) - 1985 and subsequent revisions. Shafts of stainless steel, shaft bearing of zinc free bronze and seat faces with nickel weld over lay, micro finished. All the inside and outside of the body is to be coated with double coating of Epoxy liquid. Drilled as per IS:1538. PN-1.6	
	Dia of pipe in mm	
	150	No.
	200	No.
	250	No.
	300	No.
	350	No.
	400	No.
	500	No.
	700	No.
	900	No.

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	1000	No.
14	Labour for laying & fixing of cast iron valves including jointing & testing but without cost of jointing materials	
	Dia of pipe in mm	
	150	No.
	200	No.
	250	No.
	300	No.
	350	No.
	400	No.
	500	No.
	700	No.
	900	No.
	1000	No.
15	Supply of DI Dismantling joint with MS. Nut Stud & washers coated for rust prevention & internal rubber rings etc. complete assembly set as per type design inclusive of all taxes and duties, insurance, loading/ unloading & stacking FOR at site complete.	
	150	Each
	200	Each
	250	Each
	300	Each
	350	Each
16	Providing & fixing cast iron butterfly valves including jointing & testing with cost of jointing material such as bolts, nuts and rubber insertion all complete as per IS:13095-1991. (Valves above 200 mm dia should be gear operated)	
	Dia of pipe in mm	
	350	Each
	400	Each
	500	Each
	700	Each
	900	Each
17	Supply of DI Dismantling joint with MS. Nut Stud & washers coated for rust prevention & internal rubber rings etc. complete assembly set as per type design inclusive of all taxes and duties, insurance, loading/ unloading & stacking FOR at site complete.	
	Dia of pipe in mm	
	350	Each
	400	Each
	500	Each
	700	Each
	900	Each

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

18	Supply of Single Chamber D.I. Air valve with body and cover in ductile iron of grade SG 50 or equivalent grade as per I.S. 3896-part2- 85 and sub sequent revisions. All internal parts such as float shell etc. all cover bolts of stainless steel and gaskets and seals of EPDM. Epoxy powder coating (EP-P) inside and out side colour blue. Drilled as per IS:1538.	
a)	50 mm diameter (PN 1.0)	Each
b)	80 mm diameter (PN 1.0)	Each
c)	100 mm diameter (PN1.0)	Each
d)	150 mm diameter (PN1.0)	Each
e)	200 mm diameter (PN1.0)	Each
19	Labour for laying and fixing of Cast Iron / DI double airvalves, flanged without in-built isolating valve.(PN- 1.0/ PN-1.6)	
a)	50 mm diameter (PN 1.0)	Each
b)	80 mm diameter (PN 1.0)	Each
c)	100 mm diameter (PN1.0)	Each
d)	150 mm diameter (PN1.0)	Each
e)	200 mm diameter (PN1.0)	Each
20	Construction of RCC Valve Chambers for valves, flow meters etc. including cost of PCC and RCC work, cost of supply and bending and binding of reinforcement steel with required shuttering, cost of precast RCC slabs with lifting arrangement, bailing out/ dewatering (by pumps or otherwise) of water and supply and installation of frame and covers wherever required, including supplying and fixing polypropylene coated foot-rests, conforming to ASTM D 4101 specification, injection moulded around a 16 mm steel reinforcing bar of grade Fe 415, IS:1786 (approx. wt. 900 gm each), and all the miscellaneous items of work as per drawing and specifications, but excluding the supply and installation of pipes and specials, valves etc. The item shall be as per specification, drawing and as directed by the Engineer-in-charge. for respective sizes of the following Items.	
	Chamber for Sluice Valve - S1	Each
	Chamber for Sluice Valve - S2	Each
	Chamber for Butterfly Valve - B1	Each
	Chamber for Butterfly Valve - B2	Each
	Chamber for Butterfly Valve - B3	Each
	Chamber for Washout Valve - W1	Each
	Chamber for Air Valve - A1	Each
	Chamber for Air Valve - A2	Each
	Chamber for Air Valve - A3	Each
21	Providing & laying mechanically mixed cement concrete 20mm maximum size graded crushed stone excluding cost of centring & shuttering (For Valve Chambers, Thrust Blocks & Pipe Pedestals)	Cum
22	Supplying, Fitting and placing un-coated HYSD bar reinforcement in foundation complete as per drawing and technical specification and relevant clauses of section.	Kg

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

23	Providing and fixing form work i/c centring shuttering, strutting, staging, propping, bracing etc. complete and i/c/removal of formwork.	Sqm
	Foundation/footing/column base/plinth beam of any shape and size up to plinth level.	
24	Chamfering ductile iron pipes of all types and classes to make suitable for tyton joints.	
	150	Per End
	200	Per End
	250	Per End
	300	Per End
	350	Per End
	400	Per End
	500	Per End
	700	Per End
	900	Per End
	1000	Per End
25	Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20cm. In depth including consolidation of each layer by ramming watering, lead upto 50m and lift up to 1.5m in all kinds of soils	
	Dia of pipe in mm	
	150	Cum
	200	Cum
	250	Cum
	300	Cum
	350	Cum
	400	Cum
	500	Cum
	700	Cum
	900	Cum
	1000	Cum
27	Excavation for roadway in soil using including loading in tipper for carrying of cut earth to embankment site and unloading with all lifts and lead upto 1000 meters as per relevant clauses of section 300.	
	excavation for temporarily filling of available excavated earth for road restoration	
	150	
	200	
	250	
	300	
	350	

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	400	
	500	
	700	
	900	
	1000	
	Net excavation for roadway	Cum
28	Providing & laying precast interlocking concrete blocks of minimum compressive strength of 300 kg/sq.cm and approved size , shape/ pattern over coarse sand bed of thickness upto 40 mm and joints thick filled with fine sand including leveling with surface vibrator, temping and sweeping etc. complete as per IRC-SP-63-2004	
	B) 80mm thick Plain precast interlock concrete block	Sqm
29	Providing & Supplying M.S. Pipe as per IS Specifications with inside & outside epoxy coating as per relevant IS code, duly tested for usage in Drinking Water inclusive of all materials, central, state and municipal taxes and duties inspection charges, transit insurance, loading/unloading for site unloading & stacking etc. complete as per direction of Engineer-in-charge.	
	Dia. of pipe 300.00 mm (I. D.) Thickness of pipe :6.00 mm	Rm
	Casing pipe	
	[Item no.-17.2.5 in USOR-PHED,	
	Dia. of pipe 600.00 mm (I. D.) Thickness of pipe :8.00 mm	Rm
	Dia. of pipe 1000.00 mm (I. D.) Thickness of pipe :8.00 mm for inter connection of raw water rising main	Rm
30	Labour only lowering & laying of M.S. Pipe & M.S. Specials such as distance pieces, straps etc. including all site arrangements complete	
	Above 250 mm.Upto 500 mm. dia. 5 mm to 8 mm thick.	Rm
	Above 500 mm.Upto 750 mm. dia. 5 mm to 8 mm thick.	Rm
	From 750 mm. Upto1000 mm. dia 8 mm to 12 mm thick.	Rm
31	Welding in all positions M.S.Pipes,	
	Butt Joints : Plate Thickness	
	6 mm	Rm
	8 mm	Rm
	10 mm	Rm

**TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH**

32	Providing and fixing M.S. structural work fabricated from standard sections, (MS rounds, angles, channels etc.) including cutting to size, drilling welding including cost of steel fasteners, clamp in RCC structural members as directed, including two coat of enamel painting over one coat of red oxide primer complete to be erected along the culverts for laying pipes, making pipe racks over the nallah for pipe laying etc. as directed by the Engineer-in-charge	Kg
33	Ground Penetrating Radar Survey	
	Conducting Ground Penetrating Radar Survey in a corridor of 4-6 meter width to detect buried utilities like pipes, cables, etc. in such corridor. Marking of the detected utilities on the map of corridor with information of locations and depths to the top of various utilities detected. Work to be conducted using 500 MHz and 300 MHz antenna for best possible resolution and penetration.	Each
34	Installation of Steel product pipe by HDD method including preparing and setting up the plant and equipment, preparing new pipe work material, installing new pipe-work and commissioning by HDD operation including all related civil and mechanical works like excavation, shoring / strutting etc drilling, stinging, reaming and pulling back the new pipe-work on the designed bore path alignment proper disposal of drilling fluid and back fill of site after completion all inclusive as per IndSTT:101, Code of Practice for Horizontal Directional Drilling Technique	
	In Hard Soil, 300mm to 600mm	Each

Activities for Distribution Networks, House connections, AMR compatible meters and allied works but not limited to the followings

S.No	Description of item	Unit
1	Cutting of bituminous road portion and making good the same including supply of extra quantities of materials i.e. aggregate, moorum screening and labour required.	sqm
	Dia of pipe in mm	
	100	
	150	
	200	
	250	
	300	
	350	
	400	
	450	
	500	
	600	
2	Demolishing of C.C./ R.C.C. work by mechanical means including stacking of serviceable material and disposal of unserviceable material with in 50m, lead.]	Cum
	Dia of pipe in mm	
	100	

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

		150	
		200	
		250	
		300	
		350	
		400	
		450	
		500	
		600	
3	Providing & laying mechanically mixed cement concrete 20 mm maximum size graded crushed stone excluding cost of centring & shuttering.		Cum
	M-10		
		Dia of pipe in mm	
		100	
		150	
		200	
		250	
		300	
		350	
		400	
		450	
		500	
		600	
4	Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications.(For Village roads)		Cum
	P.C.C. M-30		
		Dia of pipe in mm	
		100	
		150	
		200	
		250	
		300	
		350	

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

		400	
		450	
		500	
		600	
5	Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering and ramming and disposal of excavated earth lead upto 50 meters and lift upto 1.5m, disposal earth to be levelled, neatly dressed.		
	Dia of pipe in mm		
		100	Cum
		150	Cum
		200	Cum
		250	Cum
		300	Cum
		350	Cum
		400	Cum
		450	Cum
		500	Cum
		600	Cum
			Cum
6	Extra for every additional lift of 1.5m or part thereof for For all kind of soils.		Cum
	For pipe dia. in mm beyond 1.50 mtr. depth.		
		500	
		600	
7	For muddy area extra rate for Item No. 2.1 (The extra percentage rate is applicable in respect of each item but limited to quantities of works executed in these difficult conditions).]		Cum
8	Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of useful material and disposal of unserviceable one up to 50 m lead and lift up to 1.5 m.		
	a) Soft rock with or with out blasting or bituminous pavement / cement concrete road.		Cum

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	b) Hard rock requiring chieseling/ blasting prohibited	
	c) Extra for every additional lift of 1.5m or part there of	
	for Oridnary Soft & Hard Rock	Cum
9	Pumping out water caused by springs, tides or river seepage, broken water mains or drains or well or the like.	KL
10	Filling with murum/river sand for pipe bedding or over the pipe including supply .	
	Dia of pipe in mm	
	100	Cum
	150	Cum
	200	Cum
	250	Cum
	300	Cum
	350	Cum
	400	Cum
	450	Cum
	500	Cum
	600	Cum
		Cum
11	Providing, laying and jointing socket & spigot centrifugally cast (Spun) Ductile Iron pressure pipes with inside cement mortar lining (classK-7) Conforming to IS 8329/2000 with suitable Rubber Gasket (Pushon) joints as per IS:5382/85 including testing of joint (laying Conforming to IS 12288 : 1987)	
	Dia of pipe in mm	
	100	RM
	150	RM
	200	RM
	250	RM
	300	RM
	350	RM
	400	RM

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

		450	RM
		500	RM
		600	RM
12	Providing and supplying DI specials and fittings for all types of specials, bends, tees etc.		
	80mm to 300mm dia		Kg.
	350mm and above dia		Kg.
13	Supply of DI D/F Sluice Valves / Scour Valve Slanted/Straight seated with metallic, corrosion proof and wear resistant seat faces, body and disc of ductile cast iron GGG 50/SG Iron 420/12 or equivalent grade as per IS 3896 (part-2) - 1985 and subsequent revisions. Shafts of stainless steel, shaft bearing of zinc free bronze and seat faces with nickel weld over lay, micro finished. All the inside and outside of the body is to be coated with double coating of Epoxy liquid. Drilled as per IS:1538. PN-1.6		
	Dia of pipe in mm		
		100	No.
		150	No.
		200	No.
		250	No.
		300	No.
		350	No.
		400	No.
		450	No.
		500	No.
		600	No.
14	Labour for laying & fixing of cast iron valves including jointing & testing but without cost of jointing materials]		
	Dia of pipe in mm		
		100	No.
		150	No.
		200	No.
		250	No.
		300	No.
		350	No.
		400	No.

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

		450	No.
		500	No.
		600	No.
15	Supply of DI Dismantling joint with MS. Nut Stud & washers coated for rust prevention & internal rubber rings etc. complete assembly set as per type design inclusive of all taxes and duties, insurance, loading/ unloading & stacking FOR at site complete.		
		100	Each
		150	Each
		200	Each
		250	Each
		300	Each
16	Providing & fixing cast iron butterfly valves including jointing & testing with cost of jointing material such as bolts, nuts and rubber insertion all complete as per IS:13095-1991. (Valves above 200 mm dia should be gear operated)		
	Dia of pipe in mm		
		350	Each
		400	Each
		450	Each
		500	Each
		600	Each
17	Supply of DI Dismantling joint with MS. Nut Stud & washers coated for rust prevention & internal rubber rings etc. complete assembly set as per type design inclusive of all taxes and duties, insurance, loading/ unloading & stacking FOR at site complete.		
	Dia of pipe in mm		
		350	Each
		400	Each
		450	Each
		500	Each
		600	Each

18	Construction of RCC Valve Chambers for valves, flow meters etc. including cost of PCC and RCC work, cost of supply and bending and binding of reinforcement steel with required shuttering, cost of precast RCC slabs with lifting arrangement, bailing out/ dewatering (by pumps or otherwise) of water and supply and installation of frame and covers wherever required, including supplying and fixing polypropylene coated foot-rests, conforming to ASTM D 4101 specification, injection moulded around a 16 mm steel reinforcing bar of grade Fe 415, IS:1786 (approx. wt. 900 gm each), and all the miscellaneous items of work as per drawing and specifications, but excluding the supply and installation of pipes and specials, valves etc. The item shall be as per specification, drawing and as directed by the Engineer-in-charge. for respective sizes of the following Items.	
	Chamber for Sluice Valve - S1	Each
	Chamber for Sluice Valve - S2	Each
	Chamber for Butterfly Valve - B1	Each
	Chamber for Butterfly Valve - B2	Each
19	Providing & laying mechanically mixed cement concrete 20mm maximum size graded crushed stone excluding cost of centring & shuttering (For Valve Chambers, & Pipe Pedestals)	Cum
	RCC Grade M-20	
	Pedestal of pipe	
20	Supplying, Fitting and placing un-coated HYSD bar reinforcement in foundation complete as per drawing and technical specification and relevant clauses of section.	Kg
21	Providing and fixing form work i/c centring shuttering, strutting, staging, propping, bracing etc. complete and i/c/removal of formwork.	
	Foundation/footing/column base/plinth beam of any shape and size up to plinth level.	Sqm
22	Chamfering ductile iron pipes of all types and classes to make suitable for tyton joints.	
	100	Per End
	150	Per End
	200	Per End
	250	Per End
	300	Per End

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

		350	Per End
		400	Per End
		450	Per End
		500	Per End
		600	Per End
23	Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20cm. In depth including consolidation of each layer by ramming watering, lead upto 50m and lift up to 1.5m in all kinds of soils		
	Dia of pipe in mm		
		100	Cum
		150	Cum
		200	Cum
		250	Cum
		300	Cum
		350	Cum
		400	Cum
		450	Cum
		500	Cum
		600	Cum
25	Excavation for roadway in soil using including loading in tipper for carrying of cut earth to embankment site and unloading with all lifts and lead upto 1000 meters as per relevant clauses of section 300.		
	excavation for temporarily filling of available excavated earth for road restoration		
		100	
		150	
		200	
		250	
		300	
		350	
		400	
		450	
		500	
		600	

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

26	Providing & Supplying M.S. Pipe as per IS Specifications with inside & outside epoxy coating as per relevant IS code, duly tested for usage in Drinking Water inclusive of all materials, central, state and municipal taxes and duties inspection charges, transit insurance, loading/unloading for site unloading & stacking etc. complete as per direction of Engineer-in-charge.	
	Dia. of pipe 200.00 mm (I. D.) Thickness of pipe :8.00 mm(carrier pipe,NH crossing)	Rm
	Dia. of pipe 300.00 mm (I. D.) Thickness of pipe :8.00 mm(carrier pipe,NH crossing)	Rm
	Casing pipe	
	Dia. of pipe 400.00 mm (I. D.) Thickness of pipe :10.00 mm (NH crossing)	Rm
	Dia. of pipe 600.00 mm (I. D.) Thickness of pipe :10.00 mm (NH crossing)	Rm
27	Labour only lowering & laying of M.S. Pipe & M.S. Specials such as distance pieces, straps etc. including all site arrangements complete	
	Up to 250 mm. dia., 5 mm to 8 mm thick.	Rm
	Above 250 mm.Upto 500 mm. dia. 5 mm to 8 mm thick.	Rm
	Above 500 mm.Upto 750 mm. dia. 5 mm to 8 mm thick.	Rm
28	Welding in all positions M.S.Pipes,	
	Butt Joints : Plate Thickness	
	6 mm	Rm
	8 mm	Rm
29	Providing and fixing M.S. structural work fabricated from standard sections, (MS rounds, angles, channels etc.) including cutting to size, drilling welding including cost of steel fasteners, clamp in RCC structural members as directed, including two coat of enamel painting over one coat of red oxide primer complete	Kg
30	Ground Penetrating Radar Survey	
	Conducting Ground Penetrating Radar Survey in a corridor of 4-6 meter width to detect buried utilities like pipes, cables, etc. in such corridor. Marking of the detected utilities on the map of corridor with information of locations and depths to the top of various utilities detected. Work to be conducted using 500 MHz and 300 MHz antenna for best possible resolution and penetration.	Each

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

31	Installation of Steel product pipe by HDD method including preparing and setting up the plant and equipment, preparing new pipe work material, installing new pipe-work and commissioning by HDD operation including all related civil and mechanical works like excavation, shoring / strutting etc drilling, stinging, reaming and pulling back the new pipe-work on the designed bore path alignment proper disposal of drilling fluid as back fill of site after completion all inclusive as per IndSTT:101, Code of Practice for Horizontal Directional Drilling Technique	
	In Hard Soil, 450mm to 800mm	
		Each
32	Earth work excavation for pipe trench in all kinds of soil and WBM in areas including dressing, watering and ramming and disposal of Excavated earth lead upto 50 meters and lift upto 1.5m, disposal of earth to be leveled, neatly dressed	cum
33	Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20 cm. in depth including consolidation of each layer by ramming watering, lead up to 50m and lift up to 1.5m in all kinds of soils.	cum
	Refilling HSC Pipeline trenches	
34	Providing & supply of clamp saddle for House service connections from PE/DI pipe water distribution mains shall be of fastened strap types with threaded outlet for service connection. Clamp saddle should be suitable for nominal size of distribution mains pipe line. The strap shall be elastomer coated(insulated) type for fine grip on pipe and as well as to protect the coating on pipe and to insulate the identical metals. The saddle shall be single strap type upto pipe sizes of NB 600 and service outlet 15m,20mm&25mm. Fasteners shall be of Threaded nut bolt washer type. The sealing between the saddle and mains shall be obtained by using a profiled elastomer seal matching to the curvature of the pipe. The seal shall be of elastomer type, suitable for all potable water application. The material of construction of the body,	
	100 NB x 15mm, 20mm, 25mm	Nos
	150 NB x 15mm, 20mm, 25mm	Nos
35	Providing & fixing Polyethelene – Aluminium - Polyethelene (PE-AL-PE) Composite Pressure Pipes conforming to IS – 15450 - 2004 U.V. stabilized with carbon black having thermal stability for hot & cold water supply, capable to withstand temperature up to 80oC with pipe in trenches, refilling and testing of joints complete as per direction of the engineer in charge. (External work)	
	1620 (20 mm OD) Pipe	RM

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	2025 (25 mm OD) Pipe	RM
	2532 (32 mm OD) Pipe	RM
36	Providing and fixing brass ferrules Conforming to IS-2692 / 1984 (Reaffirmed 2005), tested to 21.00kg/sq.cm. i/c boring and tapping the main	
	15mm	Nos
	20mm	Nos
	25mm	Nos
37	Providing and supply of Brass stop-cock Suitable for food products & drinking water, female threads in accordance with ISO 7/BS:21/IS:554 and shall be inclusive of all cost such as testing all taxes related to central, state, municipal inspection charges, transportation upto site, transit insurance, loading, unloading, stacking etc. Complete	
	Brass stop-cock 15 mm dia	Nos
	Brass stop-cock 20 mm dia	Nos
	Brass stop-cock 25 mm dia	Nos
38	Supply laying, installation of G.I pipe 15mm dia for House Service Connection pipes at places of drainage crossings including all special fittings of composite material (engineering plastic blend and brass inserts wherever required) e.g. elbows, tees, reducers, couplers & connectors etc., with trenching, refilling and testing of joints complete as per direction of the engineer in charge.	Rm
39	Providing and Fixing MS/PP Meter Box of Required Size to accommodate the meter with opening and Locking arrangement etc complete.	Nos
40	Providing & Supply of Compression fittings, PN1.6 rated in Conformation to ISO:14236-2000 and shall be tested as per ISO:3459, ISO : 3501 & ISO: 3503, suitable for drinking water & approved by WRAS, UKI KIWA etc., in food grade polypropylene and shall be inclusive of all cost such as testing, all taxes related to central, state & municipal, inspection charges, transportation up to site, transit insurance, loading, unloading, stacking etc. complete	
	Compression Fittings	
	Metal inserted Compression Female Threaded Adaptor with SS 304 Material	
	20x15mm	Nos
	25x20mm	Nos
	32x25mm	Nos
	Metal inserted Compression Male Threaded Adaptor with SS 304 Material	
	20x15mm	Nos

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	25x20mm	Nos
	32x25mm	Nos
	Coupling 20x20	Nos
	Coupling 25x25	Nos
	Coupling 32x32	Nos
	Compression 90 Deg. Elbow	Nos
	20mm	Nos
	25mm	Nos
	32mm	Nos
41	Supply and Installation of Multi Jet, dry dial, inferential type, horizontal, Magnetically coupled , class 'B' water meters Conforming to IS- 779 : 1994 and ISO 4064: 1993 standard with EEC/ MID certification mark , with IP 68 protection class copper can register with 5 mm tempered mineral glass cover, successful Life Cycle Test Certificate from FCRI and AMR compatibility with 5 years warranty complete with brass nuts and nipples.	
	15 mm	Nos
	20 mm	Nos
	25 mm	Nos
42	Digitization of satellite image includes collection of DGPS points of important level marks geo referencing of satellite image, creation of base map by interpretation & digitization from the satellite data creating road network, rivers, water bodies, building land use etc in different layer cleaning of digitized map topology building overlaying of water supply features such as pipes, nodes, valves, tanks, reservoirs, pump etc. generating unique ID's for each properties / features which has been mapped. Generation of hard copy plot for consumer survey / field survey work handing over the two sets of soft copies of maps created from satellite image in shape file format as per direction of Engineer-in charge.	SqKm
43	Carrying out consumer survey in order to collect identification details, socio economic characteristics details of consumers connection details of consumption of water usage, preparing database systems including all the attribute tables of consumers data, matching of consumer survey data with billing data, integration of consumer survey with GIS layer, showing coverage of water supply scheme on digitised map using different annotations, attaching the attribute tables to the point feature representing consumer in appropriate GIS software etc complete as per prescribed format as per direction Engineer-in charge and detailed specification etc complete.	

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

44	Provision for customer facilitated center with redressal facilities and collection center	
45	Provision for Billing software with creating mobile application and training to AMC staff and providing 20 smart phones with above application including trial run period of three months etc. complete	

Activities for Electromagnetic Bulk Flow Meters, Flow with Level Control valves and allied works but not limited to the followings

S.No.	Description of item	Unit
1	Electromagnetic Bulk Flow Meters Supply of Electromagnetic full bore meter complete as per specification including transportation to site, storage, safety, installation, testing, commissioning, making connections with existing pipe line, including excavation at site, cuts in the existing pipe system, dewatering and reinstating the same after completion of installation as per specification and drawings including all taxes. Accuracy of meter + 0.3% of measured value, Flange connection as per AWWA & IS, Liner: Hard Rubber, Fully welded sensor housing complying to IP 68 standard, Electrodes SS 316, Sensor housing SS 304, Cable gland 1/2" NPT, Sensor housing fully welded SS 304 housing with protective Polyurethane paint, Flow Transmitter/ Converter : Microprocessor based, modular design display 2 line back lit LCD for indication of actual flow rate, forward, reverse, sumtotalizer, Perfection category : IP 65 Output : One current output (4-20 mA) one scalable pulse output with remote reading facility.	
	For Distribution network including OHT outlets & DMA	
	100 mm	Each
	150 mm	Each
	200 mm	Each
	250 mm	Each
	300 mm	Each
	400 mm	Each
	450 mm	Each
	500 mm	Each
	600 mm	Each
	For Feeder Main Flow meters	
	150 mm	Each

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

		200 mm	Each
		250 mm	Each
		300 mm	Each
		400 mm	Each
		450 mm	Each
		500 mm	Each
		600 mm	Each
		900 mm	Each
		1000 mm	Each
		1200 mm	Each
2	Flow with Level Control valves Supply of FCV with level control complete as per specification including transportation to site, storage, safety, installation, testing, commissioning, making connections with existing pipe line, including excavation at site, cuts in the existing pipe system, dewatering and reinstating the same after completion of installation as per specification including all taxes with Flow Transmitter/ Converter : Microprocessor based, modular design display 2 line back lit LCD for indication of actual flow rate/level, forward, reverse, sumtotalizer, Perfection category : IP 65. Dia of FCV With altitude control valve size should be suitable to connected pipe size		
	For Raw water + Clear water + Gravity main + connecting main		
		Connected to Pipe size 250 mm	Each
		Connected to Pipe size 300 mm	Each
		Connected to Pipe size 400 mm	Each
		Connected to Pipe size 500 mm	Each
		Connected to Pipe size 600 mm	Each
3	Construction of RCC Valve Chambers for valves, flow meters etc. including cost of PCC and RCC work, cost of supply and bending and binding of reinforcement steel with required shuttering, cost of precast RCC slabs with lifting arrangement, bailing out/ dewatering (by pumps or otherwise) of water and supply and installation of frame and covers wherever required, including supplying and fixing polypropylene coated foot-rests, conforming to ASTM D 4101 specification, injection moulded around a 16 mm steel reinforcing bar of grade Fe 415, IS:1786 (approx. wt. 900 gm each), and all the miscellaneous items of work as per drawing and specifications, but excluding the supply and installation of pipes and specials, valves etc. The item shall be as per specification, drawing and as directed by the Engineer-in-charge. for respective sizes of the following Items.		
	Chamber for Flow Meter - F1		Each

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	Chamber for Flow Meter - F2	Each
4	Fixing of Flange Socket on Existing pipeline by cutting existing pipeline including cost of labour, Gas Cutter with gas cylinder, Transportation, etc.	
	300 mm	Each
	400 mm	Each
	500 mm	Each
	600 mm	Each
5	Providing and Laying ductile iron PN-1.6 type flanged sockets Conforming to IS-9523/2000 having dimension as per table 23 of IS-9523/2000 in the nominal diameter/sizes with external bitumen coating and internal cement mortar lining with finishing as per clause 13 of IS-9523/2000. (laying Conforming to IS 12288 : 1987)	
	300 mm	Each
	400 mm	Each
	500 mm	Each
	600 mm	Each

Annexure –“F-4 (Water Treatment Plant-80 MLD)” : Price Schedule

Abstract of Price Schedule

Annexure: F-4/1: Design, Construction, Testing and Commissioning of 80 MLD WTP

S. No.	Component	Break Up (As % of LUMP SUM offer for 80 MLD WTP)
1	Civil Works	45%
2	Electro-Mechanical Works	40%
3	Installation, Commissioning, testing and trial run for 06 months	15%
TOTAL		100%

Annexure: F-4/2: Detailed Breakup for Civil Works

Item No.1: Aeration cascade, Inlet channel & Parshal flume

(10% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design including topographical survey, geotechnical investigation (determination of SBC)	5%
2	Excavation	10%
3	Foundation	20%
4	100% Shaft complete	25%
5	100% Aerator complete	25%
6	Inlet channel & measuring flume	13%
7	Remaining works & after three months trial run	2%
Total		100%

Item No.2: Chemical House, Office --

(18% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	Excavation	10%
3	P.C.C.	10%
4	Foundation	20%
5	1st. Floor complete column & slab	20%
6	2 nd floor complete column & slab	15%
7	Complete Brick masonry, doors, windows & Sanitation	18%
8	Complete plastering & painting work & all remaining items	2%
Total		100%

Item No.3: Flash Mixers (2No.)

(5% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	Excavation	20%
3	P.C.C.	20%
4	Foundation complete	20%

5	Walling complete	33%
6	Hydraulic testing & all remaining works	2%
	Total	100%

Item No.4: Two Lamella Plate or Tube Settler / Clarifiers --

(15% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	Excavation	15%
3	P.C.C.	10%
4	Complete foundation	38%
5	Complete walling	30%
6	Hydraulic testing and all remaining works	2%
	Total	100%

Item No.5: Filter House

(15% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	Excavation complete	15%
3	P.C.C. complete & base slab	10%
4	Foundation complete	23%
5	Walling complete	23%
6	Filter house complete including doors & windows	22%
7	Hydraulic testing and painting & all remaining works	2%
		100%

Item no.6: Construction of Clear Water Reservoir (515kL)

(12% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	Excavation	15%
3	P.C.C. complete	10%
4	Foundation complete	30%
5	Complete height o vertical wall	26%
6	Roof slab	12%
7	Hydraulic testing	2%
		100%

Item no.7: Wash water Tank

(10% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	P.C.C. & Excavation	10%
3	Foundation	20%
4	Complete supporting structure up to bottom slab	20%

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

5	Bottom slab	20%
6	Vertical wall	20%
7	Roof slab	13%
8	Hydraulic testing & all remaining work	2%
		100%

Item No.8: Clear Water Pump House

(10% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	Excavation complete	10%
3	P.C.C.	10%
4	Foundation	18%
5	Complete columns & beams	25%
6	Complete brick masonry, doors, windows & sanitation	30%
7	Complete plastering & painting work & all remaining items	2%
		100%

Item No.9: Chlorine room / Tonner stone

(5% of civil work of total lump sum offer for Civil Works Part)

Sl.	Sub-component	% of Sub-component
1	After submission of structural design.	5%
2	Excavation complete	10%
3	P.C.C.	10%
4	Foundation complete	30%
5	Column & beam complete	21%
6	On its complete construction	22%
7	All remaining works	2%
		100%

Annexure: F-4/3: Detailed Breakup for Electro-Mechanical Works

S. No.	Component	Percentage	Cumulative percentage
1	PARSHAL FLUME & Ultramagnetic Flow Meter(1 No.) --- Flow measuring instrument-----1.5% --- Bypass arrangement ----- 0.5%	2%	2%
2	FLASH MIXER (2 NO.)- ----Agitator with drive -----4% ----De-sludge pipes & valves-----1%	5%	7%
3	Lamella Clarifier (2 NO.)— (a) Flocculator with paddle drive-----10% (b)Lamella Clarifier-----10% (c)Sludge pipes with specials -----10%	30%	37%
4	FILTERS AND FILTER HOUSE (DUAL MEDIA	20%	57%

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

	FILTER) (a) C.I. Pipes & specials for Inlet, Outlet & Drain & Air wash-----5% (b) Under drain pipes & specials-----5% (c) Rate of flow & loss of Head Indicators----5% (d) Complete Filter Media -----5 % (as per CPHEEO Manual)		
5.	CHEMICAL HOUSE : (a) Alum agitators with drive and dosing equipment-- -----3 % (b) Lime agitators with drive and dosing equipment-- -----3 % (c) Vacuum type Chlorinators -----3 % (with one standby) (d) Chlorine Tonners (6 No.)-----3 % (e) Handling equipment-----3 %	15%	72%
6	CLEAR WATER SUMP(515 kL) & PUMP HOUSE with EOT 5 Ton Gantry Crane ----- (5%)	5%	77%
7.	Recirculation System for used back wash water (a) Recirculation pumps-----3% (b) Recirculation piping-----1.0 % (c) Centrifuge-----3 % (d) Sludge Thickener-----3 %	10%	87%
8.	Electrification of Buildings of WTP site including (a) Panel Board and Power wiring-----5% (b) Illumination work(with LEDs for producing 300 LUX illumination)-----2%	7%	94%
7	LABORATORY EQUIPMENT	2.5%	96.5%
9	PLC-SCADA Automation work from Raw Water Pumps & Clear Water Pumps & all treatment Units of Proposed WTP based on Lamella Clarifier & recirculation of wastewater with provision and to cover distribution system including OHSRs	3.5%	100%
	Total		100%

On supply of Mechanical & Electrical equipments (90% of Electrical Mechanical work)

On erection of above item, 10% payment shall be made for the items erected as per specification.

- Note
1. On supply of Mechanical and Electrical Equipment --- 90%
 2. On Erection, testing and commissioning of Equipment ----- 10%
& Trial run for 12 months

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List of Laboratory Equipments/Glassware/Chemicals required for 80 MLD Water Treatment Plant

S.N.	Name of Equipments	Quantity
01.	Digital Electronic Precision Weighing balance	01
02.	Magnetic Stirrer with Hot plate- capacity 5 liters	01
03.	Water Proof Multiparameter Portable Meter P ^H / mV/Ion/ Conductivity / TDS/ Resistivity/ Salinity/ Dissolved Oxygen/ Temp. without ION ELECTRODES	01
04.	Fluoride Ion Electrode	01
05.	Vertical Autoclave	01
06.	Turbidity Meter Water Proof-IR Source	01
07.	Water Distillation Unit-4 liter/ hour(Wall Type)	01
08.	Micro- Processor Based Photo Colorimeter	01
09.	Bacteriological Incubator-	01
10.	Hot air oven (Medium size)	01
11.	Refrigerator (290 Ltr)	01
12.	Digital Colony Counter	01
13.	Centrifuge	01
14.	Jar test apparatus	01
Other Accessories		
15.	Steel Vessel (S.S. for Auto-clave) Capacity-5lts	02
16.	Test Tube Stand (15 Hole) 18X150mm ss	05
17.	Test Tube Stand (15 Hole) 18X150mm pvc	05
18.	Nessler Tube Stand (100 mm dia)	02
19.	Cruable Tongs ss 18"	02
20.	Cruable Tongs ss 24"	02
21.	Beaker Tongs ss 12"	02
22.	Flask Tongs ss 18"	02
23.	Tissue Paper	05 pkt

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LABORATORY GLASSWARE TO BE SUPPLIED BY THE CONTRACTOR

S.N.	Particulars	Capacity	Qty.
01.	Beaker	50ml	12
		100ml	24
		250ml	24
		500ml	12
02.	Burette	10ml	06
		25ml	06
		50ml	06
03.	Pipette	01ml	12
		05ml	12
		10ml	12
04.	Conical Flask	100ml	18
		250ml	24
		500ml	12
		01 lts	6
05.	Measuring Cylinder	25ml	2
		50ml	2
		100ml	2
		250ml	2
		500ml	2
06.	Volumetric Flask	100ml	06
		250ml	06
		500ml	12
		01Lts.	12
07.	Wash Bottle (Polythene)	01 Lts.	2
08.	Sample Bottle	250ml	18
		500ml	18
10	Reagent Bottle	1Lts.	12
		2 Lts.	6
11.	Dishes Crystallizing	100x 50mm	4
12.	Petridish (withcover)	80mm	8
13.	Durham Tube	1''x 3/8''x6/16'',3'' 1/16''	300
14.	Nessler Tube	100ml	24
15.	Test Tube (Rimless)	(size 6''x3/4'')	300
16.	Glass Rod		12
17.	Funnel	50mm	6
		100mm	6
18.	Distilled Water Bottle	2.5 lts.	6
19	Burette Stand		2

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

20.	Pipette Stand Horizontal		4
21.	Whatman Fiter		01
	(1) NO. 40 ,15 cm	100 nos	01pkt
	(2) NO. 1, 15 cm	100 nos	01pkt
	(3) No. 540, 12.5 cm	100 nos	01pkt

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LABORATORY CHEMICALS TO BE SUPPLIED BY THE CONTRACTOR

S.N.	Particulars	Capacity	Quantity
01	O – Toludine	500 gm	06 nos.
02	Phenolphthalein Indicator Solution	125 ml	06 nos.
03	Phenol Red	125 ml	06nos.
04	Potassium Dichromate	500 gms	02 nos.
05	Potassium Chromate	500 gms	02nos.
06	Potassium Hydroxide (P)	500 gms	02 nos.
07	Potassium Chloride	500 gms.	02 nos.
08	Potassium Thicyanate	500 gms.	02 nos.
09	Potassium Iodide	250 gms.	02 nos.
10	1-10 Phenanthroline	25 gms	02 nos.
11	Buffer Tab P ^H 4.0	20 tablets	01 no.
	Buffer Tab P ^H 7.0	20 tablets	01 no.
	Buffer Tab P ^H 9.2	20 tablets	01 no.
12	Phenol Di-sulphonic acid	500 ml	02 nos.
13	Potassium Metaperiodate	100 gms	01 nos.
14	Ammonia Solution 0.91-25%	2.5 liters	02 nos.
15	Ammonia Buffer Solution	500 ml	02.nos
16	Acetic Acid glacial	500 ml	02 nos.
17	Ammonium Acetate	500 gms.	01 no.
18	Ammonium per sulphete	500 gms	02 nos.
19	Aluminum Hydroxide	500 gms.	02 nos.
20	Hydrochloric Acid	2.5 liters	01 no.
21.	Sulphuric Acid	2.5 liters	01no.
22.	O-Phosphoric Acid 85%	500 ml	01 no
23	Nitric Acid	2.5 liters	01 no.
24.	Murexide	5gm	02 nos.
25.	Eriochrome Black T	25 gm	04 nos.
26.	Sodium Hydroxide	500 gms.	02 nos.
27	Sodium Chloride	500 gms	02 nos.
28.	Silver Nitrate	25 gms.	04 nos.
29	SPANDA AR	5 gm	02 nos.
30.	Sodium Carbonate	500gms.	02 nos.
31.	Starch Soluble	500 gms.	02.nos
32	Silver Suphate	25 gms	02 nos.
33	Sodium Fluoride	500 gms.	01 no.
34	Sodium Acetate Anhydrous.	500 gms.	01 no.

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

35	Chloroform	500 gms.	01 no.
36.	Methyl Orange	125 ml	03 nos.
37	Glycerol 98%	500 ml	01 no.
38	Barium Chloride	500 gms.	01 no.
39	Ethanol Absolute	500 ml	01 no.
40	Hydrazine sulphate	100 gms.	05 no.
41	Mac Conkey Broth	500 gms.	02 nos.
42	Glass Wool	250 gms.	02 nos.
41	Mac Conkey Broth	500 gms.	02 nos.
42	Glass Wool	250 gms.	02 nos.
41	Ferrous Ammonium Sulphate	500 gms.	01 no.
42	Sodium Thio Sulphate	500 gms	01 no.
43	Magnesium Sulphate	500 gms.	01 no.
44	Hydrogen peroxide 30%	500 ml	01 no.
45	Ammonium Chloride	500 gms.	01 no.
46	Copper Sulfate	500 gms.	01 no.
47	Sodium Azide	500 gms.	01 no.
48	Calcium Carbonate	500 gms.	01 no.
49	Hexamine GR	500 gms	01 no.
50	Sulphanilamide AR	500 gms.	01 no.
51	Potassium Nitrate	500 gms.	01 no.
52	Hydroxylamine	500 gms.	01 no.
53	EDTA	500 gms	02 nos.
54	Zirconiumoxy chloride	500 gms.	02 nos.
55	Potassium per magnet	100 gms.	02 nos.
56	Sodium Sulphate	100 gms.	02 nos.
57	Sodium Arsinat	100 gms.	02 nos.
58	Sodium oxalate	100 gms.	02 nos.
59	Murcuric Sulphate	500 gms.	01 nos.

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Annexure - "F-5 (Operation and Maintenance for 5 years including replacement and warranty after successful completion of 12 months trial run)" : Price Schedule

Payment Schedule for O & M for 5 years on successful completion certified by Engineer in charge

- a. 1st year----18 % of total O & M amount to be paid
- b. 2nd year-----19 % of total O & M amount to be paid
- c. 3rd year----20 % of total O & M amount to be paid
- d. 4th year-----21 % of total O & M amount to be paid
- e. 5th year-----22 % of total O & M amount to be paid

ANNEXURE- "G-I"

GUARANTEE BOND

(To be used by approved scheduled banks)

1. In consideration of Municipal Corporation RAIPUR (here in after called the Corporation) having agreed to exempt..... (herein after called the said contractor(s) from the demand under the terms and conditions of an agreement dated made betweenand Municipal Corporation for the work of.....(here after chatted the said Agreement)

Indicate name of work) notified vide N.I.T. N..... Datedissued by the Executive Engineer. Municipal Corporation. RAIPUR (herein after called the said Agreement) of earnest money deposited for the due fulfilment, by the said contractor(s) of the terms and conditions contained in the said agreement on production of a Bank Guarantee for Rs . (Rupees

.....only.) We to the as "The Bank" at the request of the said contractor(s) do hereby undertake to pay the Municipal Corporation(an amount not exceeding Rs against any loss or damage caused to or suffered or would be caused to or suffered by the Municipal Corporation by the reason of any breach by the said contractor (s) of the terms or condition contained in the said agreement.

2. We()

Bank Ltd.. do hereby under -take to pay the amounts due and payable under this guarantee without any demur merely on a demand from the Municipal Corporation stating that the amount claimed is due by way of loss or damage caused to or suffered by the Municipal Corporation by reason of any breach by said contractor {s) of any of the terms or conditions contained in the said agreement or by reason of the contractor (s) failure to perform the said agreement. Any such demand made on the Bank shall be conclusive, as regards the amount due and -payable by the bank under this guarantee However, our liability this guarantee shall be restricted to an amount not exceeding Rs.....

3. WeBank limited further agree with the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that if shall continue to be enforceable till all dues of corporation under or by virtue of said agreement have been fully paid and its claims satisfied or till .. department

..... certifies that the terms of the said agreement have been fully and properly carried out by the said contractor (s) and accordingly discharges the guarantee unless a demand or claim under this guarantee is made on us in writing on or before the we shall be discharged from all Liability under this guarantee thereafter,

4. We (*) Further agree that the guarantee herein contained shall remain in full force and affect during the period that would be taken for the performance of the said agreement and that shall continue to be enforceable till all the dues of the Municipal Corporation under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till the Executive Engineer, Municipal Corporation certify that the terms and conditions of the said agreement have been fully and properly carried out by the said contractor (s) and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the>(*w)..... we shall be discharged from all liability under this guarantee.

5. We.....(^)..... further agree with the Municipal Corporation that Municipal Corporation shall be The fullest liberty without effecting in any manner our obligation hereunder to vary any of the terms and conditions or the said agreement to extend time of performance by

*(indicate name of the bank)

**Here write a date beyond 9 months of the prescribed date of opening of tenders,

The said contractor(s) from time to Time or to postpone for any time or for time to time, any of the power exercisable by the Government against the said contractor(s) and to forebear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said contractor(s) or any

Forbearance act or commission on the part of the Municipal Corporation or any indulgence by the Commissioner municipal Corporation to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties, would but for this provision have effect of so relieving us.

6. This guarantee which not be discharged due to the change in the Constitution of the Bank or the an tractors)

7. We.....(*) Bank Limited, lastly undertake not to revoke this guarantee it currency except with The previous consent of the Municipal Corporation, in writing datedday of

or..... (indicate the name of the Bank)
indicate The name of the Bank

ANNEXURE- "G-II"

(Revised form of Bank Guarantee Bond)

GUARANTEE BOND

(in lieu of Security Deposit)

(To be used by approved scheduled Bank)

1. In consideration of RAIPUR Municipal corporation (here in after called the Government) having agreed to exempt..... (herein after ailed the said contractors) from the demand under the terms and conditions of an agreement datedmade between for the work (Name of work) (Herein after called the said Agreement) of security deposit for' the due fulfillment by the said contractors) of the Terms and conditions in The said agreement On production of a Bank Guarantee for RsRupees.....only..... (*)(herein after referred to as "The Bank" (at the request of the said contractors) do here by undertakes to pay to The Municipal Corporation and a amount not exceeding Rsagainst any loss or damage caused to or suffered or would be caused to or suffered b^y the Municipal Corporation, by reason of any breach by the said contractor (s) of the terms or conditions contained in the said agreement in cache said contractor and the Government for the work of (indicate name of work) notified vide N.I.T. No..... Dated issued by the Executive Engineer, Municipal Corporation, RAIPUR (herein after called the said Agreement) of earnest money for the due fulfillment by the said contractor (s) of the germs and condition.

2. We (*)do hereby undertake to pay the amounts due and payable under this guarantee without any demur merely on a demand from The Municipal Corporation stating that the amount claimed is due by way of loss or damage caused to or suffered by The Municipal Corporation by reason of any breach by said contractor(s) of any of the terms or conditions contained in is said agreement or by reason or The contractor(s) failure to perform the said agreement. Any such remand made on the Bank shall be conclusive as regards the amount due and payable by the bank under

is guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs.....

3. We undertake to pay To the Municipal Corporation any money so demanded not withstanding any dispute or disputes raised by the contractor(s) in any suit or proceedings pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal.

4. We (*) further agree That the guarantee herein contained shall remain in full force and effect during the period That would be taken for the performance of ne said agreement and That is shall continue to be enforceable

till all the dues of the Municipal Corporation under or by virtue of the said agreement have been fully paid and its chums satisfied or :is charged or till the Executive Engineer, Municipal Corporation, RAIPUR certified That the terms and conditions of the said agreement have been fully and properly carried out by the said contractor(s) and accordingly discharged this guarantee. Unless a demand or claim under this guarantee Is made or lJtR in writing on or before The (here indicated a date which*%M falls 9 months beyond the due date of completion of the work)we shall be discharged from all liability under this guarantee.

5. Me (*) further agree with the Municipal Corporation shall have that fullest liberty without our consent and with effecting in any y manner our obligations here under to vary any of the terms and conditions of the said agreement to extend, try e of performance by the said contractors) from time to time or to postpone for any of the powers exercise able by the Municipal Corporation against the said contractors) and to forebear or enforce any of the, terms and conditions relating to the said agreement and we shall not be relieved from our liability by reasons of any such variations, or extension being granted to the said contractor(s) or forbearance, actor commission on the part or the Municipal Corporation or any indulgence by The Municipal Corporation to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision have effect of so relieving us.

6. This guarantee will not be discharged due to, the change in the Constitution of the Bank or the contractor(s).

7. We (*) lastly undertake not to revoke this guarantee it currency except with the previous consent of the Municipal Corporation, in writing

Dated the Day of
.....
For (*)

.....
(*) In indicate the name of the Bank
.....
.....

ANNEXURE H

SPECIAL CONDITIONS OF N.I.T

(Reference Clause 8 of NIT)

- (1) “Additional performance security (APS) shall be deposited by the successful bidder at the time of signing of agreement when the bid amount is seriously unbalanced i.e. less than the estimated cost by more than 10% in such an event the successful bidder will deposit the Additional performance security (APS) to the extent of difference of 90 % of the PAC and bid amount in the shape of FDR, in favor of the Commissioner before signing the agreement. The same shall be refunded along with the normal S.D. after completion of the work. If the contractor fails to complete the work or left the work incomplete, & the additional performance security (APS), Shall be forfeited by the department, & the agreement shall be terminated and action shall be taken in accordance with clause 3 of the agreement. In case the tendered/contractor refuses to deposit Additional performance security (APS) then his bid will be rejected by the sanctioning authority and earnest money shall be forfeited”
- (2) If the tendered, whose tender has been accepted, and after signing the agreement, (i) does not start regular actual physical items of work within 25% (twenty five percent) of the time allowed for completion, or abnormally slowdown the work or (iii) abandons the work, or (iv) merely goes on applying for extension or time, the Commissioner shall serve a “show cause” notice with details to the contractor in this regard and if the contractor does not reply, or if his reply is considered not satisfactory (at the sole discretion of the Commissioner), his earnest money and the performance security money or the Bank Guarantee in this regard shall be forfeited in favour of the RAIPUR MUNICIPAL CORPORATION. if the contractor has committed a similar default on earlier occasion (s) in previous three consecutive years the contractor shall be debarred from participating in any future tender of RAIPUR MUNICIPAL CORPORATION for a period of 2 (two) years from the date of such order, by the authority which had registered him/her.
Such orders & action shall be final binding and conclusive
- (3) Detailed program Construction:
 - (i) Within 15 days of issue of order to start work, the contractor shall submit in the prescribed Form a detailed construction programme month wise mentioning start and completion of each item/event involved in the due performance of the contract for contract more than 10 Crores Contractor shall also submit detailed programme month wise for
 - (a) Materials procurement
 - (b) Their transport arrangement to work site with details of No. of truck/tippers
 - (C) Detailing of construction plants & equipments
 - (d) Cash flow/revised Cash flow
 - (ii) The contractor shall submit in the first week of each month a statement of “target vis-à-vis actual performance” of each item/event with slippage, if any mentioning reasons of slippage and proposal for revised construction programme to complete the same in targeted date or validly extended date.

Failure to submit this monthly statement for 4 (Four) months can be treated as “Fundamental Breach of Contract” and can result in invoking clause 3 of the conditions of contract.

If Contractor Fails To Submit Bank Guarantee of 5% Amount of The Gross Bill, Then 5% Amount of Bill shall be Deducted form his Running and Final Bill Payment. However, The Constructor Can Get Refund of Such Performance Cash Security Amount Deducted If He Submits Appropriate Bank Guarantee Valid For The Period As Stated Above or 36 (Thirty Six) Month of one Year (As The Case May Be) After Actual Completion.

If required, the Executive Engineer shall ask the contractor to extend the validity period of the bank guarantee (s) for such period which be consider it proper and the contractor shall extend the validity period of such bank guarantee accordingly. If the contractor fails to extend the period accordingly, the Commissioner shall encase the B.G. before the expiry of the validity period.

- (i) The contractor shall have to carry out all necessary “ Rectification” of defects noticed, caused due to any reasons at his own cost within such reasonable period mentioned in such communication notice from the Executive engineer to him.
- (ii) Failure of the contractor to rectify the defects properly in the given period, it shall be open for the Executive Engineer/Assistant Engineer to get the defect (s) rectified either departmentally or through other agency (without calling any tender/quotation) and recover the actual cost plus 15% (Fifteen Percent) of such cost from the contactor from any sum, in any form, and available with the department or can be recovered as “Arrears of Land Revenue”
 - (iv), (v) Deleted in case form date of completion of work (one year)
- (iii) After two years of completion of construction, 50% (Fifty Percent) of available performance Bank Guarantee shall be returned to the contractor subject to the satisfaction of the Commissioner RAIPUR MUNICIPAL CORPORATION.
- (vi) Remaining performance Bank Guarantee as would be remaining (after recovery all cost plus 15% (Fifteen percent) shall be returned after 3 years of completion.

The performance guarantee will be in addition to the normal security to be deducted as per clause 1 of agreement for the execution of contract.
- (4) The tendered/contractor shall give in advance authority letter (s) in favour of the Commissioner, authorizing him to get all bank’s fixed deposit receipts, Bank Guarantees (either normal security deposit and or for performance security) to get these bank receipts and guarantee deeds verified and got confirmed from the concerned bank. It will be only after getting such confirmation that the Commissioner shall pay any amount accordingly or refund the equal amount for which BG submitted has been duly verified and confirmed.
- (5) The contractor shall no remove minor mineral form borrow areas, quarries without prior payment of Royalty charges.

Municipal Corporation RAIPUR

Name of Contractor

Date or work order

Due date of completion

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

Detail work programme – Original/1st Revision/2nd Revision/ Revision)

Work Items

Sr. No.	Items	Unit	Months							
			1	2	3	4	5	6	7	8
1										
2										
3										
4										
5										
6										

Approved

Executive Engineer

Signature

MONTHLY TARGET Vs. ACTUAL ACHEVEMENT

Cumulative Achievement of item of work for the month ending of

Agt. No.

Name of Work

Length

Date of W.O.

.....

.....

Date of Completion.....

Sr. No.	Items	Cumulative Work Programme			Cumulative Achievment actual	Slipage if any (Period)	Reason for slippage (Use add sheet if needed)
		As per Original	1St Revison	Last No. Revision			
1	2	3 (a)	3 (b)	3 C	4	5	6

TENDER DOCUMENT FOR RAIPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
SCHEME UNDER AMR COMPATIBLE UT MISSION GOVERNMENT OF CHHATTISGARH

Comments of Executive Engineer if any

Cash Flow for performing the contract (applicable for works cost)

Name of Division Name of Contractor

Period of Contract

Value

(A)	Investment	1st Month	2nd Month	3rd Month	4th Month	5th Month	6th Month
(I)	Initial (E.M.) P.G. Insurance (Establish Site Office)						
(II)	Advance for Procurement of Material (if any)						
(III)	Advance for Procurement of labour (if any)						
(IV)	Purchase of New Equipment (if any)						
(V)	Other overheads staff including head office						
(VI)	Other if any (Furnish details)						
Total Investment(x)							
(B)	Receipt						
(I)	Gross Bill Amount						
	Deductions.						
a	S.D.						
b	Advance						
c	TDS						
d	Other recoveries if any						
(y) Total Receipt							
Net cash flow (x-y)							

Note: - (1) This Should co-relate to work programme/progress of work during the month.

(2) Running bill will be expected to be paid within 15 days of the receipt and checking of measurement, quality and quality of items

- (3) Investment less net receipt for 1st 15 days and then during.
- (4) (Final bills is expected to be paid within 2 months of satisfactory completion work.
- (5) Total investment less Total Receipt (-) be shown in bracket.

**Commissioner
Municipal Corporation
RAIPUR, Chhattisgarh**

ANNEXURE-I

Guidelines for bidders on using Integrated eProcurement System Govt. of Chhattisgarh. <https://eproc.cgstate.gov.in>

Note: These conditions will over-rule the conditions stated in the tender document(s), wherever relevant and applicable.

1. Vendor / Bidder Registration on the e-Procurement System:

All the Users / Bidders (Manufacturers / Contractors / Suppliers / Vendors / Distributors etc.) registered with and intending to participate in the Tenders of various Govt. Departments / Agencies / Corporations / Boards / Undertakings under Govt. of Chhattisgarh processed using the Integrated e-Procurement System are required to get registered on the centralized portal <https://eproc.cgstate.gov.in> and get approval on specific class (e.g. A, B, C, D, UGE, UDE) from Public Works Department (in case to participate in tenders restricted to vendors / bidders in a particular class).

The non – registered users / bidders who are also eligible to participate in the tenders floated using the e-Procurement system are also required to be registered online on the e-Procurement system.

Vendors are advised to complete their online enrolment / registration process on the portal well in advance to avoid last minute hassle, it is suggested to complete enrolment at least four days before the last date of bid submission date, failing which may result in non-submission of bids on time for which vendor/end user shall be solely responsible.

For more details, please get in touch with e-Procurement system integrator, M/s. Mjunction Services Limited, Raipur – 492 001 on Toll free 1800 258 2502 or email helpdesk.eproc@cgswan.gov.in.

2. Digital Certificates:

The bids submitted online must be signed digitally with a valid Class II / Class – III Digital Signature Certificate to establish the identity of the bidders submitting the bids online. The bidders may obtain pair of Encryption & Signing Class – II / Class – III Digital Certificate issued by an approved Certifying Authority (CA) authorized by the Controller of Certifying Authorities (CCA), Government of India.

Note: It may take upto 7 to 10 working days for issuance of Class-II / Class-III Digital Certificate, Therefore the bidders are advised to obtain it at the earliest. It is compulsory to possess a valid Class-II / Class-III Digital Certificate while registering online on the above mentioned e-Procurement portal. A Digital Certificate once mapped to an account / registration cannot be remapped with any other account / registration however it may be inactivated / deactivated.

Important Note: bid under preparation / creation for a particular tender may only be submitted using the same digital certificate that is used for encryption to encrypt the

bid data during the bid preparation / creation / responding stage. However bidder may prepare / create and submit a fresh bid using his/her another / reissued / renewed Digital Certificate only within the stipulated date and time as specified in the tender.

In case, during the process of a particular bid preparation / responding for a tender, the bidder loses his/her Digital Certificate because of any reason they may not be able to submit the same bid under preparation online, Hence the bidders are advised to keep their Digital Certificates secure to be used whenever required and comply with IT Act 2000 & its amendments and CVC guidelines.

The digital certificate issued to the authorized user of an individual / partnership firm / private limited company / public limited company / joint venture and used for online bidding will be considered as equivalent to a no-objection certificate / power of attorney to the user.

Unless the certificate is revoked, it will be assumed to represent adequate authority of the specific individual to bid on behalf of the organization / firm for online tenders as per Information Technology Act 2000. This authorized user will be required to obtain a valid Class-II / Class-III Digital Certificate. The Digital Signature executed through the use of Digital Certificate of this authorized user will be binding on the organization / firm. It shall be the responsibility of management / partners of the concerned organization / firm to inform the Certifying Authority, if the authorized user changes, and apply for a fresh digital certificate for the new authorized user.

3. Online Payment: As the bid is to be submitted only online, bidders are required to make online payment(s) of the Registration fee / Transaction or Service fees / EMD using the online payments gateway services integrated into the e-Procurement system using various payment modes like Credit Card / Debit Card / Internet Takiyang / Cash Card / NEFT / RTGS etc.

For the list of available online modes of electronic payments that are presently accepted on the online payments gateway services, please refer the link '**Payments accepted online**' on the eProcurement portal <https://eproc.cgstate.gov.in>.

4. Setup of User's Computer System: In order to operate on the e-Procurement system for a bidder / user, the computer system / desktop / laptop of the bidder is required to have Java ver. 765 , Internet explorer 9 / 11, latest Mozilla firefox with IE Tab V2 (Enhanced IE Tab) or any other latest browser. A detailed step by step document on the same is available on the home page. Also internet connectivity should be minimum one MBPS.

5. Publishing of N.I.T.: For the tenders processed using the e-Procurement system, only a brief advertisement notice related to the tender shall be published in the newspapers and the detailed notice shall be published only on the e-Procurement system. Bidders can view the detailed notice, tender document and the activity time schedule for all the tenders processed using the e-Procurement system on the portal <https://eproc.cgstate.gov.in>.

6. Tender's Critical Dates & Time/Tender Time Schedule: The bidders are strictly advised to follow the tender time for their side for tasks / activities and responsibilities to participate in the tender, as all the activities / tasks of each tender are locked before the start time & date and after the end time & date for the relevant activity of the tender as set by the concerned department official.

7. Download Tender Document(s): The tender document and supporting document(s) if any can be downloaded only online. The tender document(s) will be available for download to concerned bidders after online publishing of the tender and up to the stipulated date & time as set in the tender.

8. Submit Online Bids: bidders have to submit their bid online after successful filling of forms within the specified date and time as set in the tender.

The encrypted bid data of only those bidders who have submitted their bids within the stipulated date & time will be accepted by the e-Procurement system. It is expected that the bidder complete his bid and submit within timeline, a bidder who has not submitted his bid within the stipulated date & time will not be available during opening.

Bid documents uploading during bid preparation should be less than five MB (for individual document) and over all bid documents should be less than fifty MB.

9. Submission of Earnest Money Deposit: The bidders shall submit their Earnest Money Deposit Either as in usual physically sealed Earnest Money Deposit envelope and the same should reach the concerned

office OR Online using payment gateway as stated in the Notice Inviting Tender/ Tender document. Bidders also have to upload scanned copy of Earnest Money Deposit instrument OR Online Payment /NEFT/RTGS receipt along with the reference details online.

10. Opening of Tenders: The concerned department official receiving the tenders or his duly authorized officer shall first open the online Earnest Money Deposit envelope of all the bidders and verify the same uploaded by the bidders. He / She shall check for the validity of Earnest Money Deposit as required. He / She shall also verify the scanned documents uploaded by the bidders, if any, as required. In case, the requirements are incomplete, the next i.e. technical and commercial envelopes of the concerned bidders received online shall not be opened.

The concerned official shall then open the other subsequent envelopes submitted online by the bidders in the presence of the bidders or their authorized representatives who choose to be present in the bid opening process or may view opened details online.

11. Briefcase: Bidders are privileged to have an online briefcase to keep their documents online and the same can be attached to multiple tenders while responding, this will facilitate bidders to upload their documents once in the briefcase and attach the same document to multiple bids submitting.

For any further queries / assistance, bidders may contact:

1. The Service Integrator of e-Procurement system, M/s. Mjunction Service Ltd. on Help Desk Toll free No. 1800 258 2502 or email helpdesk.eproc@cgswan.gov.in.
2. Mr. Shailesh Kumar Soni, Sr. Manager, Chhattisgarh Infotech & Biotech Promotion Society (CHiPS) on Tel. No. 0771 - 4014158 or email: pro-chips@nic.in.

Annexure – ‘J’
Pre contract Integrity Pact

1. GENERAL

1.1 This pre-bid contract Agreement (herein after called the Integrity Pact) is made on.....day of the month.....20.....between, the RAIPUR MUNICIPAL CORPORATION acting through Shri.....(Designation of the officer , Department) RAIPUR MUNICIPAL CORPORATION (hereinafter called the “BUYER” which expression shall mean and include, unless the context otherwise requires, his successors in the office and assigns) and the First Party , proposes to procure (name of the Stores / Equipment /Work/Service) and M/srepresented by ShriChief Executive Officer (hereinafter called the “BIDDER/Seller” which expression shall mean and include , unless the context otherwise requires, his successors an permitted assigns) and the Second Party, Is willing to offer/has offered.

1.2 WHEREAS the BIDDER is a Private Company/Public Company/Government Undertaking/ Partnership/ Registered Export Agency, constituted in accordance with the relevant law in the matter and the BUYER is a Ministry/Department of the Government, performing its function on behalf of the RAIPUR MUNICIPAL CORPORATION.

2. OBJECTIVES

NOW , THEREFORE the BUYER and the BIDDER agree to enter into this pre-contract agreement , hereinafter referred to as Integrity Pact, to avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to during and subsequent to the Contract to be entered into with a view to :-

2.1 Enabling the BUYER to obtain the desired Stores/Equipment /Work/Service at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

2.2 Enabling BIDDERS to abstain from bribing or indulging in any corrupt practices in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing any corrupt practices and the BUYER will commit to prevent corruption, in any form, by its official by following transparent procedures.

3. COMMITMENTS OF THE BUYER

The BUYER commits itself to the following :-

3.1 The BUYER undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favors or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

3.2 The BUYER will, during the pre-contract stage, treat BIDDERS alike, and will provide to all BIDDERS the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to the other BIDDERS.

3.3 All the officials of the BUYER will report the appropriate RAIPUR MUNICIPAL CORPORATION

office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the BUYER with the full and verifiable facts and the same *prima facie found* to be correct by the BUYER, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the BUYER and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the BUYER the proceedings under the contract would not be stalled.

4. COMMITMENTS OF BIDDERS

The BIDDER commits itself to take all measures necessary to prevent corrupt practices, un fair means an illegal activities during any stage of its bid or during any pre-contract or post- contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following :-

4.1 The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER, connected directly or indirectly with the bidding process, or the any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

4.2 The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour , any material or immaterial benefit or other advantage, commission, fees, brokerage, or inducement to any official of the BUYER or otherwise in procuring the Contract of forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the RAIPUR MUNICIPAL CORPORATION for showing or forbearing to show favour or disfavor to any person in relation to the contract or any other contract with the Government.

4.3 The BIDDER further confirms and declares to the BUYER that the BIDDER in the original Manufacture/Integrator/Authorized RAIPUR MUNICIPAL CORPORATION sponsored export entity of the stores and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the BUYER or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

4.4 The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payment he has made, is committed to or intends to make to officials of the BUYER or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

4.5 The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

4.6 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

4.7 The BIDDER shall not use improperly, for purpose of competition or personal gain, or pass on to others, any information provided by the BUYER as part of the business relationship, regarding plans,

technical proposal and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

4.8 The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

4.9 The BIDDER shall not instigate or cause to instigate any third person to commit any of the acts mentioned above.

5. PREVIOUS TRANSGRESSION

5.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any RAIPUR MUNICIPAL CORPORATION Department in India that could justify BIDDER's exclusion from the tender process.

5.2 If the BIDDER makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

6. EARNEST MONEY (SECURITY DEPOSIT)

6.1 Every BIDDER while submitting commercial bid, shall deposit an amount as specified in RFP as Earnest Money/Security Deposit, with the BUYER through any of the following instruments :

(i) Bank Draft or a Pay Order in favour of

(ii) A confirmed guarantee by an Indian Nationalised Bank, promising payment of the guaranteed sum to the(BUYER)on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever, The demand for payment by the BUYER shall be treated as conclusive proof of payment.

(iii) Any other mode or through any other instrument (to be specified in the RFP).

6.2 The earnest Money/Security Deposit shall be valid up to the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and BUYER, including warranty period, whichever is later.

6.3 In the case of successful BIDDER a clause would also be incorporated in the Article pertaining to Performance Bond in the Purchase Contract that the provisions of Sanctions for violation shall be applicable for forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

6.4 No Interest shall be payable by the BUYER to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

7. SANCTIONS FOR VIOLATIONS

7.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the BUYER to take all or any one of the following actions, wherever required:-

- (i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceeding with the other BIDDER (s) would continue.
- (ii) To forfeit fully or partially the Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is signed), as decided by the BUYER and the BUYER shall not be required to assign any reason therefore.
- (iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.
- (iv) To recover all sums already paid by the BUYER, and in case of the Indian BIDDER with interest thereon at 2% higher than the prevailing Prime lending Rate while in case of a BIDDER from a country other than India with Interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the BUYER in connection with any other contract such outstanding payment could also be utilized to recover the aforesaid sum and interest.
- (v) To encase the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the BUYER, along with interest.
- (vi) To cancel all or any other contracts with the BIDDER and the BIDDER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such cancellation / rescission and the BUYER shall be entitled to deduct the amount so payable from the money (s) due to the BIDDER .
- (vii) To debar the BIDDER from participating in future bidding processes of the RAIPUR MUNICIPAL CORPORATION for a minimum period of five years, which may be further extended at the discretion of the BUYER.
- (viii) To recover all sums paid in violation of this Pact by BIDDER (s) to any middlemen or agent or broken with a view to securing the contract.
- (ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the BIDDER, the same shall not be opened.
- (x) If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or Indirectly, is closely related to any of the officers of the BUYER, or alternatively if any close relative of an officer of the BUYER has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filling of tender Any failure to disclose the interest involved shall entitle the BUYER to rescind the contract without payment of any compensation to the BIDDER.

The term 'close relative for this purpose would mean spouse whether residing with the RAIPUR MUNICIPAL CORPORATION servant or not, but not include a spouse separated from the RAIPUR MUNICIPAL CORPORATION servant by a decree or order of a competent court, son or daughter or step son or step daughter and wholly dependent upon RAIPUR MUNICIPAL CORPORATION servant but does not include a child or step child who is no longer in any way dependent upon the RAIPUR MUNICIPAL CORPORATION servant, or of whose custody the RAIPUR MUNICIPAL CORPORATION servant has been deprived of by or under any law, any other person related, whether by blood or marriage, to the RAIPUR MUNICIPAL CORPORATION servant or to the RAIPUR MUNICIPAL CORPORATION servant's wife or husband and wholly dependent upon RAIPUR MUNICIPAL CORPORATION servant.

(xi) The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly with any employee of the BUYER, and if he does so, the BUYER shall be entitled forth with to rescind the contract and all other contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such rescission and the BUYER shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

7.2 The decision of the BUYER to the effect that a breach of the provisions of this pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Monitor (s) appointed for the purpose of this Pact.

8. FALL CLAUSE

8.1 The BIDDER undertakes that if has not supplied /is not supplying similar product/systems or subsystems at a price lower than that offered in the present bid in respect of any other Department of the RAIPUR MUNICIPAL CORPORATION or PSU and if it is found at any stage that similar product/systems or sub systems was supplied by the BIDDER to any other Department of the RAIPUR MUNICIPAL CORPORATION or a PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the BUYER, if the contract has already been concluded.

9. INDEPENDENT MONITORS

9.1 The BUYER will appoint Independent Monitors (hereinafter referred to as Monitors) for this Pact.

9.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

9.3 The Monitors shall not be subject to instructions by the representatives of the Parties and perform their functions neutrally and independently.

9.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement including minutes of meetings. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

9.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the BUYER.

9.6 The Monitor will submit a written report to the designated Authority of BUYER/Secretary in the Department/within 8 to 10 weeks from the date of reference or intimation to him by the BUYER/BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

10. FACILITATION OF INVESTIGATION

In case of any allegation of violation of any provisions of this Pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information of the relevant documents and shall extend all possible help for the purpose of such examination.

11. LAW AND PLACE OF JURISDICTION

This Pact is subject to Indian Law, the place of performance and jurisdiction shall be the seat of the BUYER.

12. OTHER LEGAL ACTIONS

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the any other law in force relating to any civil or criminal proceedings.

13. VALIDITY

13.1 The validity of this Integrity Pact shall be from the date of its signing and extend up to 5 years or the complete execution of the contract to the satisfaction of both the BUYER and the BIDDER/Seller whichever is later. In case BIDDER is unsuccessful , this Integrity Pact shall expire after six months from the date of the signing of the contract.

13.2 If one or several provisions of this Pact turn out to be invalid ; the remainder of this Pact shall remain valid. In such case, the parties will strive to come to an agreement to their original intentions.

The parties hereby sign this Integrity Pact aton.....

BUYER

Name of the Officer
Designation
Department /PSU

Witness

1).....
.....
2).....
.....

BIDDER

COMMISSIONER

Witness

1)
.....
2)
.....

Performance Security for Works Contract Period

Option 1: (Demand Guarantee)

[Insert Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Insert name and Address of the Employer]*

Date: *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[insert name of Contractor, (hereinafter called "the Applicant")]* has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the execution of *[insert name of the contract and brief description of the Works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (*[insert amount in words]*),¹ such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for its demand or the sum specified therein.

This guarantee shall be valid until the date of issue of the **Works Contract Completion Certificate**.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

[Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.]

¹ *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency(cies) of the Contract or a freely convertible currency acceptable to the Beneficiary.*

Performance Security for O&M Contract Period

Option 1: (Demand Guarantee)

[Insert Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Insert name and Address of the Employer]*

Date: *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[insert name of Contractor, (hereinafter called "the Applicant")]* has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the execution of *[insert name of the contract and brief description of the Works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (*[insert amount in words]*),¹ such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for its demand or the sum specified therein.

This guarantee shall be valid until the date of issue of the **Final Contract Completion Certificate**.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded. _____

[signature(s)]

[Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product]

APPENDIX-1

Qualification Information

<i>1.1</i>	<i>Constitution or legal status of Bidder/attach copy]</i>				
	<i>Place of registration of Firm/ Company (in case of other than individuals)</i>				
	<i>Principal place of business:</i>				
	<i>Name of Power of attorney holder of signatory of Bid (bidder)/attach copy]</i>				
<i>1.2</i>	<i>Total annual volume of civil engineering construction work executed and payments received each year in the immediate five years preceding the year in which tenders are invited. (Attach certificate from Chartered Accountant)- indexed @ 10% (ten percent) compounded per year</i>	<i>Financial Year</i>	<i>(Rs. in crores)</i>		
			<i>"Civil engineering construction work" Turn over in the year</i>	<i>Add for indexing</i>	<i>Total</i>

Note :

- 1.1** Preparatory firm, partnership firm with the certificate of registration by register/artocle and Memorandum of Association with Certificate of Incorporation.
- 1.2** Mention and highlights the year, which the tendered considers for evaluation for the Committee

APPENDIX - 2

Information regarding minimum one similar work

- (i) **One Work completed as similar work during last ten years**
(ii) **Or being executing one such similar work**

Sno	Project	Name of Employer	Value of Contract	Contract No.	Date of Issue of Work Order	Stipulated Date of Completion	Actual Date Of Completion	Value of Work Done	Remarks Explaining reasons for Delay, if any and the amount of Deductions due to delay Also mention if any Claim or dispute is Pending in any forum.
1	2	3	4	5	6	7	8	9	10

Note :-

- (i) Attach certificates from the Engineer in charge not below the rank of Examiner or equivalent.
(ii) Tendered may attach certified copies of work order and completion certificate issued by Engineer in charge not below the rank of Executive Engineer

APPENDIX - 3

Work Performed on all classes of Civil Engineering Construction Works over the last ten years

Sno	Project Name	Name of Emoloyer	Descript Ion of Work	Value of Contract	Conteact No.	Date Of Issue Work Order	Stipulated Date of Completion	Actual Date Of Completion	Year wise value of work done as per certificate of employer Rs. In Lacs						Remarks explaining Reasons for Delay if Any and the amount Of deductions due to Delay also mention if Any claim or dispute Is pending in any Forum.
									10	11	12	13	14	15	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Note :-

- (iii) Attach certificates from the Engineer in charge not below the rank of Examiner or equivalent.
- (iv) Tendered may attach certified copies of work order and completion certificate issued by Engineer in charge not below the rank of Executive Engineer

APPENDIX - 4

Existing commitments and on going all classes of civil engineering construction works.

Sn o	Projec t Name	Desc ription of Work	Cont ract No & Year	Name & Address Of the Employer	Value of Contract (Rs. Lakhs.)	Date of Issue of Work Order	Stipulated Date of Completion	Stipulated period of Completion in Months	Anticipate A date of Completion	Value of Work done Up to date Of issue Of N.I.T (Rs. Lakhs)**	Probable value of Works Remaining To be Completion (Rs. Lakhs) **	Anticipate Months Required Completion Of balance works	Value of Claims Or Dispute If Any pending
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Note –

- ** Enclose certificates from Engineer (s) in charge (Not below the rank of Executive Engineer or equivalent) for value of work remaining to be completed, value of work done, anticipated date of completion.
- Tendered may attach certified copies of work order issued by Engineer in charge not below the rank of Executive Engineer

APPENDIX - 5

Availability of Major items of Contractor's Equipment proposed for carrying out the Works. List all information requested below.

Item of equipment	Total number available	Description n, make, and age (Years), and capacity	Condition (new, good, poor) and number available	Nos. (i) Owned, (ii) leased, or (iii) to be purchased	If these are in use in some work, mention the details.	No. of equipments proposed to be utilized <i>in this work</i> (Out of total Nos.)
1	2	3	4	5	6	7

APPENDIX – 6

Qualifications of consultants /each technical personnel proposed for the Contract.

Position	Name	Qualify action	Date from which they are working in the bidders organization	Years of experience				Remark
				Road Works	Building Works	Bridge works	Others	
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5(a)</i>	<i>5(b)</i>	<i>5(c)</i>	<i>5(d)</i>	<i>6</i>

Note :

- I. If any personal is proposed to be engaged, furnish details here under:- (if necessary use separate sheet for each -for C. V.) (Enclose certificates)
- II. If any technical persons are to be changed during the construction periods, than it can be changed with prior intimation to the Engineer in charge.

APPENDIX – 7

Financial reports for the immediate previous five years: balance sheets, profit and loss statements, audited auditors’ reports, etc., list below and attach copies.

Year	Income Tax Clearance Certificate (optional)	Balance Sheet	Profit & loss statement	Reserve brought forward in any	Net credit Balance if any [for debit show (-)]	Auditors’ Report	Other information if the bidder wishes to submit
1	2	3	4	5	6	7	8

APPENDIX – 8

Information on current claims, arbitration, litigation in which the Bidder is involved.

SI. no.	Name of Other party(s)	Agt. No. date year and Deptt.	Brief of cause of claims, arbitration /dispute (give reference of contract details)	Where Litigation pending (in the department/Court/a arbitration) (mention Deptt./Court /Arbitration)	Amount Involved/ claimed

Can use separate sheets for each agreements if necessary.

APPENDIX – 10

List of key plant & Equipment to be deployed on Contract Work

Sr. No.	Type of Equipment	Maximum age as on 1.04.12 (years)	Contract Package Size			
			From Rs. 3 Crores to Rs.10 Crores	From Rs. 10 Crores to Rs.30 Crores	From Rs. 30 Crores to Rs.50 Crores	From Rs..5 Crores abov'
1						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
	Total					

Note: - The list & other Details of the equipment and plants as mentioned above are tentative. S.E. of the Nagar Nigam/Joint Director Office/ Directorate can modified the above list of the plant and equipment as per their requirements.

APPENDIX – 11

List of Technical person to be deployed on Contract work

Sl.	Personnel	Qualification	Contract Package Size			
			From Rs. 3 Crores to Rs.10 Crores	From Rs. 1 Crores to Rs.30 Crores	From Rs. 31 Crores to Rs.50 Crores	From Rs.51 Crores & above
1	2	3	4	5	6	7
1	Project Manager	B.E. Civil+15years Exp in Water Supply Scheme. (5 years as manager)		1	1	1
2	Site Engineer	B.E. Civil+ 10 years Exp. (5 years in Water Supply.)	1	1	2	4
3	Plant Engineer	B.E. Mech.+10 Years Exp. or Dip. Mech+15 years Exp.	1	1	1	2
4	Quantity Surveyor	B.E. Civil+7 Years Exp. or Dip. Civil+ 10 Years Exp.	1	1	1	2
5	Soil & Material Engineer	B.E. Civil +10 years Exp.	1	1	1	2
6	Survey Engineer	B.E. Civil +5 years Exp. or Dip. Civil+8 years Exp.	1	1	1	2
		Total				

Note' - The list of (he Technical persons Qualification & Experience as mentioned above are tentative. S.E. of the Nagar Nigam/Joint Director Office/ Directorate can modified the above list as per their requirements.

APPENDIX – 12

CONTACT PERSONS

SI No.	Name of Executive Engineer of the Division	Divisional	STD Code	Phone No. Office/ residence	Name District
1	2	3	4	5	6

APPENDIX - 13

Affidavit

I..... S/o.....

Aged..... years..... resident..... of.....

.....(address.....
.....)

(For and on behalf of.....), do

here by and herewith solemnly affirm / state on oath that: -

1. All documents and Information's furnished are correct in all respects to the best of my knowledge and belief
2. I have not suppressed or omitted any information as is required.
3. **I am/ We are neither black listed nor debarred by Govt. of India / Other State Govt. Departments/ Chhattisgarh State Govt. Departments/Urban Local Body.**
4. That I have Not being CDR by any bank.
4. I hereby authorize the Nagar Nigam/Nagar Palika/Nagar panchayat Officials to get all the documents verified from appropriate source(s).

Deponent

(.....
.....)

Authorized signatory / for and on behalf of

.....

(Affix Seal)

Verification

I..... S/o..... do here by affirm

that the contents stated in Para 1 to 4 above are true to the best of my knowledge and believe and are based on my / our record.

Verified that this date of 200... at (Place).....

Deponent

Seal of attestation by a Public

Notary with date

of.....

Authorized signature / for and on behalf