



Bilaspur Municipal Corporation

Augmentation & Reorganisation of Water Supply Scheme, Bilaspur

UNDER AMRUT MISSION

TENDER DOCUMENTS

For Turn Key Package

Form "F"

(Lump-sum Contract)

**Name of Work: Augmentation of Water Supply scheme –Bilaspur Under Mission AMRUT on
Turn Key Basis (Form – F)**

(PAC Rs.18196.81 Lacs)
COST OF TENDER DOCUMENT & BID PROCESSING FEE —Rs.60,000.00

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

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

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Municipal Corporation Bilaspur, Chhattisgarh

DETAILED NOTICE INVITING TENDER

NIT. No.

Bilaspur/Dated :

Online tender for the works mentioned below are invited by the Commissioner, Municipal Corporation, Bilaspur for the following work in Form “F” for lump Sum contract from the contractors registered with Unified Registration System (Single Window) on GoCG PWD Department & e-Procurement System Portal (<https://cgeprocurement.gov.in>) through sub portal <https://uadd.cgeprocurement.gov.in> as per the 'key Dates' mentioned below . All other conditions for submission of tenders and criteria for prequalification etc. have been mentioned in the tender documents and prequalification documents.

Group No.	Name of work	Probable amount of contract (Rs. in Lacs)	Earnest money	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>“Engineering, procurement, construction, testing, commissioning and trial run & 05 years of Operation & Maintenance including replacement & warranty of all components of Augmentation of Water Supply Scheme of Bilaspur town of 72 MLD Intermediate capacity WTPs with Operation & Maintenance on TURN KEY JOB basis including replacement & warranty.</p> <p>(i) RCC SUMP AT CHAINAGE 1800 M OF RBC FOR TRANSFER OF WATER FROM CANAL TO GRAVITY PIPE LINE OF 15.0 X8.55 M SIZE</p>	Rs. 18196.81 Lacs	Rs.90.98 Lakhs	30 months	Rs. 60000.00 (Rupees Sixty Thousand only) payable at the time of Bid Preparation and Hash Submission through online payment Gateway.	120 days	In Class ‘A’

<p>(ii) RAW WATER GRAVITY MAIN FROM CANAL INTAKE TO SUMP @ WTP Dia: 1500 mm MS pipe 10 mm Thick 26630 m in length. Including all MS specials, valve, thrust block, hydraulic testing and commissioning without coating and inside lining etc. ISI 3589 2001</p> <p>(iii) CONSTRUCTION OF SUMPWELL WITH PUMP HOUSE AT WTP SITE 1700 KL Capacity Sump at WTP site. Pump house size of 25 sqm.</p> <p>(iv) RAW WATER PUMPING MACHINERY ON Sump @ WTP SITE Provide (2W+2S) Vertical turbine pumps to discharge 1696840 LPH against total head of 11 M Including electrical panel specials, valves EOT and other accessories</p> <p>(v) RAW WATER PUMPING MAIN from Sump to WTP Including specials, valve, hydraulic testing and commissioning etc. As directed by Engineer in charge 900 mm dia DI-K9 L= 100 M</p> <p>(vi) CONSTRUCTION OF ELECTRIC SUB STATION AT WTP SITE 1500 KVA 33/415</p> <p>(vii) WATER TREATMENT PLANT 72 MLD CAPACITY (72 MLD) in 22 hours based on Lamella plate settler & recirculation of used back wash</p>						
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<p>water.with 20% over loading of each treatment unit Including recirculation arrangment for used back wash water and sludge .including PLC-SCADA monitoring and control system of proposed 72 Mld WTP.</p> <p>(viii) CLEAR WATER PUMPING MACHINERY AT WTP Centrifugal pumps to discharge 1690295 lph. against total head of 40 m (2W+2S) Including electrical panal specials , valves EOT and other accessories</p> <p>(ix) CLEAR WATER PUMPING MAIN FROM SUMP TO MBR FOR LEFT & RIGHT ZONE Including specials, valve, thrust block, hydraulic testing FCV and Road reintating and commissioning etc.as directed by engineer in charge. 800 mm dia DI-K9 L= 100 700 mm dia DI-K9 L= 100</p> <p>(x) CONSTRUCTIO N OF MBR FOR LEFT ZONE 2090 KL 25 M STAGING & FOR RIGHT ZONE 4680 KL 25 M STAGING AT WTP SITE. Including water tightness test 12 months trial run an 12 month DLP</p>						
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<p>(xi) CLEAR WATER GRAVITY MAIN FROM MBRs AT WTP SITE TO BILASPUR CITY LEFT AND RIGHT SIDE ZONES OF ARPA RIVER 300 to 1100 mm dia DI K-7 pipe L =32870 m with 1000 mm dia MS pipe 12 mm thick crossing over River Arpa over newly constructed bridge Including specials, valve, thrust block, hydraulic testing and commissioning etc.</p> <p>(xii) OVER HEAD SERVICE RESERVOIR IN BILASPUR ON LEFT & RIGHT SIDE OF ARPA RIVER ZONE 3, 2850 KL, ZONE 4, 820 KL & in ZONE 7 880 & 600 KL . Staging height 21 M for all. Including water tightness test 12 months trial run an 12 month DLP</p> <p>(xiii) PIPE PUSHING FOR ONE RAILWAY, 4 ROAD CROSSINGS For Rly Crossing :- i.500 mm dia MS pipe 10mm th L=90 M ii.300 mm dia MS pipe 10mm th L=90 M For N.H.Crossing i.1700 mm dia MS pipe 10mm th L=60 M ii.800 mm dia MS pipe 10mm th L=90 M iii.600 mm dia MS pipe 10mm th L=90 M iv.650 mm dia MS pipe 10mm th L=60 M v.450 mm dia MS pipe 10mm th L=60 M vi.1500 mm dia MS pipe</p>						
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<p>10mm th L=60 M</p> <p>(xiv) ALLIED CIVIL WORKS Compound Wall for 1.Canal Intake -60M WTP - 1136 M OHSR --200 M 2.Chain link for Electric Sub station - 1050 sqm 3. Main Gate -9 No Total 4.Vicket Gate – 9 No Total 5. Telephone connection with internet and furniture 6.Staff Quarter I-Twin -4 Nos H – twin – 4 Nos G – Twin – 2 Nos 7.C.C. internal Roads in WTP premices 3200 sqm.</p> <p>(xv) BULK FLOW METER AT EACH ZONE INLET JUNCTION 300 mm 400 mm 500 mm 600 mm 700 mm 1000 mm Total 36 Nos.</p> <p>(xv)PLC & SCADA MONITORING AND CONTROL SYSTEM OF ENTIRE SYSTEM under THE PROJECT PLC & SCADA for entire exiting & proposed water supply system, Intake, raw water pumping station, WTP of existing 10 and 24 Mld and proposed 17 Mld, clear water pumping station, and Over head Service reservoirs.. REFORM WORKS GIS mapping including supply of GIS software & consumer survey..</p>						
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	(xv) STRUCTURAL STEEL BRIDGE ACROSS ARPA RIVER 300 M LONG FOR GRAVITY MAIN.					
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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 BILASPUR Municipal Corporation on Dated 2017,3.00 PM The contractors shall give their suggestions and conditions 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 & B" physically as per dates Indicated in Key Dates. The Physical Envelope 'A' should contain the following: -
 - i. The Earnest Money, of **Rs.90.98 Lakhs in the form of FDR/TDR of a Nationalised /Scheduled bank of India** in favour of the "**Commissioner, Municipal Corporation, Bilaspur**" payable at 'Bilaspur' which will be returned to the unsuccessful Bidders after the award of contract. 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 similar work within the last five years under a single contract or in multiple contracts.
(ii)	Providing and laying, jointing , testing, commissioning of water supply pipelines M.S./D.I. as below under single or multiple contract – i.750mm and above M.S. pipe Length – 13.30 Km and ii. 1100/2 = 550mm dia , of a minimum half of the total length of largest diameter i.e 1367m. Overall quantity laid of diameter 150mm and above should not be less than half of the desired combined estimated length i.e. – $32.87/2 = 16.44$ Km
(iii)	At least one drinking Water Treatment Plant 50% of the required capacity i.e. 36 Mld in a single contract.
(iv)	Over Head Service Reservoir of at least 50% (Consolidated capacity not less than 6000 KL) with atleast one OHSR of minimum 2340 KL @ 20 m staging under single or multiple contract.
(v)	a)Pump– motor works of at least 50% of the desired capacity including all civil, mechanical and electrical works .i.e. i.Raw Water V.T. Pumps of discharging capacity 850 Cum ii.Clear Water Horizontal Centrifugal Pumps of discharging capacity 845 Cum. b)Electric Sub Station of minimum 750 KVA with 100 % stand bye.

Note: (“ Similar work” means- water supply schemes comprising of Intake/Raw Water pumping station, Rising main, Drinking Water Treatment Plant,Clear Water Pumping Station ,Overhead Service Reservoir , Clear water mains and distribution system).

TECHNICAL CRITERIA FOR SUPPLYING & FIXING OF CONSUMER METERS

1. Manufacturer’s who fulfil the minimum specifications as mentioned in Annexure E written authorization 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, BMC 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 / manufacturerafter instaalaation and commissioning of watermeters.
7. The contractor who was blacklisted anywhere in India 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 Manufacturer or a Authorized Dealer or 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. Manufacturer /Authorized Dealer to submit experience certificate from the officer not below the rank of Superintendent Engineer in PHED/Municipal Corporation
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, level)/Automation systems for 3 years is must.

**Commissioner
Municipal Corporation
Bilaspur, Chhattisgarh**

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. In Lacs	Rs. 10,546.71 Lacs
1	Achieved in "any one financial year" a financial turnover (in all classes of Construction Works related to Water Supply Schemes) 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. In Lacs	
2	Satisfactorily completed at least 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. In Lacs	
3	Satisfactorily completed at least two similar 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. In Lacs	
4	Satisfactorily executing at least one similar work having received payment of value not less than 40% (forty percent) OR Two similar 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. In Lacs	
5	One similar work completed & satisfactorily executing one similar work Total aggregate value in both the integrated 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. In Lacs	

Note:

(2) " Similar work" means- water supply schemes comprising of Intake/Raw Water pumping station, Rising main, Drinking Water Treatment Plant , Clear water reservoir and pumping station, Booster pumping station, Clear water mains and distribution system along with PLC/SCADA Automation system).

The Key Dates of Tender are

Seq No	BILASPUR 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 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, 17:31 PM onwards.

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duly attested.

1- iath;u %&

Valid registration in Class 'A' with Unified Registration System (Single Window) on GoCG PWD.

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dk;Z fu"iknu {kerk = (2.5 xA x N)-B

Where (A) – fiNys 5 o"kksZ esa fd;s x;s dk;Z dh vf/kdre jkf'k ¼10 izfr'kr vf/kHkkj izfro"kZ lfrg^{1/2}

Where (N) – izLrkfor fufonk vof/k ¼o"kksZ esa^{1/2}

Where (B) – izxfrjr dk;Z dh jkf'k

Bsdskj@QeZ@daiuh dh dk;Z fu"iknu {kerk fufonk esa nf'kZr jkf'k ds cjkckj vFkok vf/kd gksuh pkfg,A

- 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 Bilaspur, 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 with CG PWD Department (Single Window) System 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://municipalcorporationBilaspur.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 unloading 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. The 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. ---- 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/TDR drawn in favour of “**Municipal Commissioner Bilaspur**” payable at “**Bilaspur**” 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 Bilaspur**” payable at “**Bilaspur**” 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 Department, Chhattisgarh (<https://cgeprocurement.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 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) Affidavit regarding not being declared CDR by any bank
- l) The bidder should have a positive net worth
- m) BID CAPACITY
- n) Undertaking for validity of bid for 120 days.
- o) Appendix '1' Qualification Information
- p) Appendix '2' Experience of similar nature of work
- q) Appendix '3' List of other construction work
- r) Appendix '4' Existing Commitments
- s) Appendix '5' Machinery available with the tenderer
- t) Appendix '6' Technical Personnel available with the tenderer
- u) Appendix '7' Financial report
- v) Appendix '8' Current claims and arbitration
- w) Appendix '9' List of plants and machinery required
- x) Appendix '10' List of plants and machinery to be deployed
- y) Appendix '11' List of personnel to be deployed
- z) Appendix '12' Contact persons (Clients for whom the work has been carried out by the bidder)
- y) Appendix '13' Affidavit

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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.

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

11.0 Bid Opening and Evaluation

Bid Opening

(1) The Municipal Corporation Bilaspur 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 Bilaspur, 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 Bilaspur may consider appropriate, will be announced by the Municipal Corporation Bilaspur at the opening.

(4) The Municipal Corporation Bilaspur will prepare minutes of the Bid opening, including the information disclosed to those present in accordance with relevant Clause of ITB.

(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 ITB, 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 Bilaspur shall inform, by email, telegram or facsimile, 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 Bilaspur, 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 ITB 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 Bilaspur may consider appropriate will be announced by the Municipal Corporation Bilaspur at the time of bid opening.

(8) **Process to be Confidential** (a) 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 Bilaspur 's processing of bids or award decisions may result in the rejection of his Bid

(9) Clarification of Bids and Contacting the Municipal Corporation Bilaspur

(10) No Bidder shall contact the Municipal Corporation Bilaspur 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 Bilaspur '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 Bilaspur will determine whether each Bid

- (a) Meets the eligibility criteria as defined in relevant Clauses.
- (b) Has been properly signed;
- (c) Is accompanied by the required securities; and
- (d) 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

- (a) 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 Bilaspur '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.

12.1 Corrections of Errors

(1) Bids determined to be substantially responsive, will be checked by the Municipal Corporation Bilaspur for any arithmetic errors. Errors will be corrected by the Municipal Corporation Bilaspur 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 Bilaspur 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 ITB.

12.2 Evaluation and Comparison of Bids

(1) The Municipal Corporation Bilaspur will evaluate and compare only the bids determined to be

substantially responsive in accordance with relevant Clause of ITB.

(2) In evaluating the bids, the MUNICIPAL CORPORATION, BILASPUR 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 ITB.

(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 Bilaspur 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 Bilaspur may require that the amount of the performance security set forth in relevant Clause of ITB be increased as described in relevant clause.

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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, Bilaspur. 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.

ii lkoZtfud miØe {ks=ksa esa fd, x, dk;Z gsrq mPp Lrj }kjk tkjh izek.k i= dks lacaf/kr Bsdsnkj fufonk dh izfØ;k esa dk;Z vuqHko izek.k i= ds :i esa izLrqr dj ldsaxs] ftls fufonk izfØ;k esa ekU; fd;k tkosxkA

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.90.98 lakhs only** in the form of Fixed Deposit Receipt/Term Deposit Receipt in favour of the "**Commissioner, Municipal Corporation, Bilaspur** payable at "**Bilaspur, 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, Bilaspur Municipal Corporation, Bilaspur**” payable at Bilaspur 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

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, Bilaspur. 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 form 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.

WITNESS :-

~~The tender for the works shall be witnessed by a contractor failure to observe this condition shall render the tender of the contractor liable to Rejection.~~

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 Bilaspur 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 .(Excluding the code of conduct period) 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 be subject to liquidated damages according to clause 13 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 including POL (SUV, INNOVA or equivalent) for field Engineers of Municipal Corporation Bilaspur for the Project period which will be deployed on work for supervision. The average run per-vehicles will be 3000 Km./ month.

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 Bilaspur 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 Bilaspur, 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, Grasim, 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 be 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 FROM CONTRACTOR:-

Any amount due to Government from the Contractor on any account of concerning work may be recovered from 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 from 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 Bilaspur. 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 Bilaspur 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 Bilaspur.

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 through PDMC 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 wised 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 Bilaspur, 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 Bilaspur 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 Bilaspur 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 5 years or more 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 Bilaspur, 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 Bilaspur /Police the facts of such accident. The contractor shall indemnify Municipal Corporation Bilaspur against all loses 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 Bilaspur 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 Bilaspur 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 BMC and tender being cancelled.

EXCISE EXEMPTION: Municipal Corporation Bilaspur, 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' 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) 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.

(5) 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 Bilaspur Municipal Corporation.

(a) The successful bidder shall first submit General Arrangement drawing accommodating all the proposed units & submit the same for approval through 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.

- (6) **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 Bilaspur Municipal Corporation, the contractor shall arrange the same and bear the entire cost.

- (7) **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.
- (7A) **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.
- (8) **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.
- (9) **MOBILISATION ADVANCE:** Mobilization advance up to 5% (Five percent) of the contract value shall be given if requested by the contractor within 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
- (10) **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 – whichever event is earlier.
- (11) 3% of bill amount shall be deducted from each bill for hydraulic testing of pipe line work work (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.
- (12) **USE OF DI FITTINGS:** Provision of laying & jointing of DI fittings P.N. 1.6 conforming to IS: 9523:2000 duly inspected and approved by RITES/SGS/DGS & D as per tender. DI specials shall be manufactured as per IS: 9523 and shall be ISI marked. In case of flanged joints, the flanges shall be at right angles to the axis of the pipe machined on the face. The bolt-hole circle shall be concentric with the bore and bolt holes shall be located off the centre lines as per IS: 9523. Fittings shall be tested as per IS: 9523.
- (13) **HINDRANCE FREE ALIGNMENT OF PIPELINE ETC:** BILASPUR 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 Bilaspur Municipal Corporation for above works.
- (14) **DEPTH OF EXCAVATION FOR LAYING OF PIPELINE:** The crown of the pipeline will be kept minimum 1.0 m below the firm GL.
- (15) **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.

- (16) **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.
- (17) **VALVES WITH ACTUATORS:** The valves should be compatible with actuators as mentioned in Annexure-E.
- (18) **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.
- (19) **PERMISSION FOR INSTALLATION OF CONSUMER WATER METERS:** Municipal Corporation Ambikapue will provide the permission for fixing of consumer water meters.
- (20) **PREPARATION OF GIS BASED MAP:** Contractor has to prepare a entire layout plan of indicating the complete water supply scheme including all existing and proposed components of the scheme including locations of all Bulk Flow meters, FCV, pressure gauges & valves etc on GIS platform with supply of GIS software .This shall be put on the web site of the Municipal Corporation and monthly updated by the contractor indicating the progress of the work achieved during execution period and in O & M period.
- (21) **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.
- (22) **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 as required shall be provided by the contractor, ~~which shall be limited upto the property line of the consumer.~~
- (23) **APPROVAL OF DESIGNS:** 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 .
- (24) **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 ten OHSRs with the distribution mains is included in the scope of work of this Contract.
- (25) **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. “

(26) RECYCLING OF WASTE WATER SYSTEM in THE PROPOSED WTP : Total maximum sludge volume = 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 2 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 of 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.”

(27) 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 contractor’s 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 within 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 from the proposed WTP 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 Bilaspur Municipal Corporation.

(28) LIST OF SPARES TO BE MAINTAINED DURING O &M period of 72 MLD WTP:

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 72 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 72 MLD 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 3 ppm

(29) 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 all Water Treatment Plants.

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.”

(30) 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.

(31) 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’s, existing & 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.

(32) HANDING OVER OF PROPOSED 72 MLD WTP: After the award of the Contract, the contractor shall operate and maintain PROPOSED 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-1’	Specification for GSR @ Ch 1800 m of RBC.
ANNEXURE ‘E-II’	Specification for Providing Lowering Laying Jointing 1500 mm dia MS 10mm thick Gravity Pipe line in 1:4000 m Gradient
ANNEXURE ‘E-III’	Speciafication of OHSR ,Sump & Pump House
ANNEXURE ‘E-IV’	Speciafication of Raw Water Pumping Machinery
ANNEXURE ‘E-V’	Speciafication of DI Raw water Pumping Main
ANNEXURE ‘E-VI’	Speciafication of WTP
ANNEXURE ‘E-VII’	Speciafication of Clear Water Pumping Machinery

ANNEXURE 'E-VIII'	Speciafication of Clear Water Pumping Main
ANNEXURE 'E-IX'	Speciafication of Major Service (Balancing) Reservoir
ANNEXURE 'E-X'	Speciafication of DI K-7 Gravity Main
ANNEXURE 'E-XI'	Speciafication of Over Head Tank (OHSR)
ANNEXURE 'E-III'	Speciafication of GSR & Pump House
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,
Bilaspur**

NAGAR PALIK NIGAM BILASPUR
BILASPUR AUGMENTATION & RE-ORGANISATION 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
A	Lump Sum offer for construction of Proposed Water Supply Scheme at Bilaspurpur.	Rs.
B	Lump Sum offer for 5 Years O & M of 72 MLD WTP, new raw water pumps, clear water pumps, PLC-SCADA monitoring and control system [covering all existing and proposed RWPs, CWPs, OHSRs, Electromagnetic flow meters, pressure gauges, FCVs] including replacement and warranty.	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 Bilaspur 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 Jagdalpur 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 BILASPUR 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 may be allotted or used for the purpose of carrying out the contract.
- (c)** The “Commissioner” means Commissioner of Bilaspur 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 Bilaspur” shall mean the BILASPUR MUNICIPAL CORPORATION. Competent Authority means Commissioner of BILASPUR MUNICIPAL CORPORATION.
- (f)** The term “Chief Engineer” means the Competent Authority from BILASPUR MUNICIPAL CORPORATION.
- (g)** The term "Superintending Engineer" means the Superintending Engineer of the concerned BILASPUR MUNICIPAL CORPORATION / UADD
- (h)** The term "Executive Engineer"/"Engineer-in-Charge"/"Divisional Officer" means the Executive Engineer of BILASPUR MUNICIPAL CORPORATION.
- (i)** The term "Assistant Engineer" means the Assistant Engineer BILASPUR MUNICIPAL CORPORATION.
- (j)** The word "Sub Engineer" shall mean "Section Officer" of the BILASPUR 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 BILASPUR 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 BILASPUR 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, Bilaspur. 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 considered to be the property of Bilaspur 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 BILASPUR 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 form 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 24 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 Bilaspur 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 Bilaspur 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 Bilaspur 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. 30000/- (Rs. Thirty Thousandonly)** 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 mpowered 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 contract 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 contract, 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 withhold 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 BILASPUR 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 BILASPUR 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 contractor(s) 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 other preliminary or incidental measures on account of or with a view to the Execution of the works or the performance of the contract.

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 BILASPUR 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 BILASPUR MUNICIPAL CORPORATION to recover further sums due or which may become due to the contractor by BILASPUR 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
Bilaspur**

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 on 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 used 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 hand 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 aid. 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 from 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

TENDERING FOR WORKS COSTING Rs. 2.00 LAKHS OR MORE

1. Name & Style (of the company, firm, H.U.F., or Individual) in which the applicant assessed to Income Tax and Address for purpose of assessment.
2. The Income Tax Circle/Ward/District in which the applicant is assessed to Income Tax.
3. Following particulars concerning the last Income Tax Assessment made:-
 - (i) Reference No. (Or G. I. R. No.)of the assessment.
 - (ii)
 - (iii) Assessment year and Accounting year.
 - (iv) Amount of Total Income Assessed.
 - (v) Amount of Tax Assessed I. T., S. T., E. P. T.,B. P. T.
 - (vi) Amount of Tax paid I. T., S. T., E. P. T.,B. P. T.
 - (vii) Balance being tax not yet paid and reasons for such arrears.
 - (viii)Whether any attachment or certificate proceedings ending in respect of the arrears.
 - (ix) Whether the company of firm of H. U. F. on which the assessment was made has been of is being liquidated, wound up dissolved, petitioned or being declared insolvent as the case may be.
4. The position about later assignment namely, whether returns submitted under section 22(1) or (2) of the IT Act and whether tax. Paid under section 18(a) of the Act and the amount of tax so paid or in arrears.
5. In case there has been no Income Tax Assessment at all in the past, whether returns submitted under section 21(1) or (2) and 18-A (3) and if so, the amount of Income Tax Return of Tax paid and the Income Tax Circle/Ward/District concerned.
6. The name and address of branch (es) verified the particulars set out above and found correct subject to the following remarks.

Dated/2017 **Signature of**
I.T.C.
Circle/Ward/District.

7. Bidders are required to submit their PAN details, Income Tax Return and financial statement of their firm of last 05 years'duly vetted by an approved/authorised Chartered Accountant.

Dated:

Commissioner
Municipal Corporation
Bilaspur

SPECIAL CONDITIONS OF CONTRACT

1. The Addresses are : (i) “Employer” : The Commissioner Municipal Corporation, Bilaspur
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 Bilaspur, Chattisgarh.
- (5) The performance Securities amount is 5% of the contract value

Binding Signature of
Commissioner, Municipal Corporation, Bilaspur

.....

Binding Signature of
CONTRACTOR

.....

(On behalf of)

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.

ANNEXURE 'E'

SALIENT FEATURES OF THE PROPOSED PROJECT

1.	Name of Project	Augmentation to Bilaspur Water Supply Scheme Under AMRUT MISSION	
2.	District	Bilaspur	
3.	Location (Nagar Nigam)	Latitude 25° 05'11.95N Longitude 82° 08'33.30E	
4.	Population Projection Complete Bilaspur Town	Year	Population
		2011	342016
		2020	390828
		2035	479691
	Part I Project Area for Ward No. 1 to 59 (To Be Proposed Under AMRUT)	Year	Population
		2011	303397
		2020	348350
		2035	427554
	Part II Non Project Area for Ward No. 60 to 66 (07 Wards) (Ward No. 60 to 66 are under Railways hence not considered as they are having their own water supply arrangements)	Year	Population
		2011	38619
		2020	42478
		2035	52137
5.	Water Demand for Augmentation for Ward No. 1 to 59	Year	Demand in MLD
		2020	61.06
		2035	74.66
		Year	Demand in MCuM
		2020	22.29
		2035	27.25
		2050	32.76
5.	Name of the Wards to be Benefited	Vikas Nagar, Vishnu Nagar, Nehru Nagar, Kasturba Nagar, Ayodhya Nagar, Bhakta Kanwarram Nagar, Tilak Nagar, Guru Ghasidas Nagar, Om Nagar, Rajendra Nagar, Gayatri Nagar, Mother Teresa Nagar, Ambedkar Nagar, Kanti Kumar Bhartia Nagar, Rani Laxmibai Nagar, Pandit Deendayal Upadhya Nagar, Vinoba Nagar, Vidya Nagar, Sanjay Gandhi Nagar, Priyadarshini Nagar, Nirala Nagar, Azad Nagar, Shahid Ashfaqullah Nagar, Ramnagar, Subhash Nagar, Pandit Munnulala Shukla Nagar, Lala Lajpatrai Nagar, Shivaji Nagar, Sant Ravidas Nagar, Nagrao Shesh Nagar, Krishnanagr, Vasantbhai Patel Nagar, Shahid Ramprasad Bismil Nagar, Gandhinagar, Indiranagar, Taty Tope Nagar, Ramdas Nagar, Bhagt Singh Nagar, Maharana Pratap Nagar, Vivekanand Nagar, Shankar Nagar, Shahid Hemu Kalani Nagar, Veer sawarkar Nagar, Arvind Nagar, Sant Namdeo Nagar, Shastri nagar, Kapil Nagar, Pandit Devkinandan Dixit Nagar, Ramkrishna	

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

		Paramhans Nagar.
6.	Name of the Wards not considered for the Project (Railway Wards)	Bilasa Nagar, Wireless Colony, Bharatmata Nagar, Jagannath Nagar, Babu Nagar, New Loco Colony, Tripur Sundari Nagar.
7.	Existing Source of Water	The existing source of water is ground water. No of deep borewells are supplying water to various zones through zonal OHSR's.
8.	Proposed Source of Water Total 32.76 McuM	Kharung Tank (Khutaghat Dam) Right Bank Canal 1800m Downstream of the Dam
	Salient Features of Kharung Tank (Khutaghat Dam)	<ol style="list-style-type: none"> 1. Live Storage Capacity: 192.32 MCuM 2. FTL: 294.04M 3. Top of Bund Level: 298.61M 4. Lowest Sill Level: 283.46M 5. Head Discharge of RBC: 6.88 Cumecs 5. Required Discharge: 1.04 Cumecs
	RCC Intake Structure	<ol style="list-style-type: none"> 1. RCC canal Intake Structure with Head Regulator, Cross Regulator on the Right Bank Canal. 2. Concrete Lining to 1800m RBC (To be constructed by WRD)
	Raw Water Gravity Main, Dia Length -	1500 mm dia MS pipes 10mm Thk Pipes 26630 M.
	Raw Water Sumpwell cum Pumphouse at WTP Campus	RCC Sumpwell 1700 KL Capacity with Overhead Pumphouse near Cascade Aerator.
7.	Raw Water Pumping Machinery Design Year 2035 Vertical turbine pumping Sets Discharge HP Head Stand bye	<p>04 nos. (2 running at a time & 2 Stand bye)</p> <p>1696840 LPH Each</p> <p>As per Design</p> <p>11 m</p> <p>100%</p>
	Raw Water Pumping Main from CW Sump well to Lip of Aeration fountain of WTP	900 mm Dia DI K-9 Pipes 100M length
9.	Water Treatment Plant Design Year 2035	Conventional Type 72 MLD Near Khamtarai with Recirculation, Automization and Lamela Clarifiers

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

10.	Clear Water Pumping Machinery, Horizontal split casing Year 2035 Centrifugal Pumping sets Discharge HP Head Stand bye	For MBR Pumping For Zone I (Left of ARPA) & Zone II (Right of ARPA) 4 No. 1690300 LPH Each As per Design 40 m. 100%																																	
11.	Clear water pumping mains	For MBR I - 800 mm Dia DI K-9 pipes , Total Length 100 m. For MBR II - 700 mm Dia DI K-9 pipes , Total Length 100 m.																																	
	Proposed MBR (Master Balancing Reservoir)	MBR Zone I: RCC OHSR Capacity 2090 KL, Staging height 25m MBR Zone II: RCC OHSR Capacity 4680 KL, Staging height 25m Designed for 2 Hours capacity inside WTP premises																																	
	Clear water gravity mains from MBR I & II to Various Overhead tanks	Proposed 11000mm to 300mm Dia DI K-9 Pipes for Length m																																	
	Zone wise Abstract of Clear Water Gravity Mains For Both The zones	<table border="1"> <thead> <tr> <th>Dia of Pipe</th> <th>Zone I (Left)</th> <th>Zone II (Right)</th> </tr> </thead> <tbody> <tr> <td>1100mm DI K-7</td> <td></td> <td>2733 M</td> </tr> <tr> <td>1000mm DI K-7</td> <td></td> <td>3067 M</td> </tr> <tr> <td>800mm DIK-7</td> <td></td> <td>285 M</td> </tr> <tr> <td>700mm DIK-7</td> <td>89 M</td> <td>2090 M</td> </tr> <tr> <td>600mm DIK-7</td> <td>2766 M</td> <td>7072.M</td> </tr> <tr> <td>500mm DIK-7</td> <td></td> <td>713 M</td> </tr> <tr> <td>450mm DIK-7</td> <td>1810 M</td> <td>502 M</td> </tr> <tr> <td>400mm DIK-7</td> <td>438 M</td> <td>3448 M</td> </tr> <tr> <td>350mm DIK-7</td> <td>572 M</td> <td>1875 M</td> </tr> <tr> <td>300mm DIK-7</td> <td>1770 M</td> <td>3210 M</td> </tr> </tbody> </table>	Dia of Pipe	Zone I (Left)	Zone II (Right)	1100mm DI K-7		2733 M	1000mm DI K-7		3067 M	800mm DIK-7		285 M	700mm DIK-7	89 M	2090 M	600mm DIK-7	2766 M	7072.M	500mm DIK-7		713 M	450mm DIK-7	1810 M	502 M	400mm DIK-7	438 M	3448 M	350mm DIK-7	572 M	1875 M	300mm DIK-7	1770 M	3210 M
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TENDER DOCUMENT FOR BILASPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME
UNDER AMRUT MISSION GOVERNMENT OF CHHATTISGARH

		ZONE 5	1 to 8P & 9	2280 KL
				440KL
				1200 KL
		ZONE 6	8P, 11 & 15 to 22	450 KL
				900 KL
				2100 KL
		ZONE 7	33, 36, 37, 38	400 KL
		ZONE 8	29P, 34, 35	750 KL
		ZONE 9	39 to 44	1350 KL
				950 KL
				300 KL
		ZONE 10	28, 29P, 30, 31, 32	1600 KL
		ZONE 11	10, 12, 13, 14	2000 KL
		ZONE 12	23 to 27	1150 KL
			Total Capacity	20825 KL
	Proposed Overhead Tanks Location	Zone 3	49, 51, 52, 53, 57, 50P	2850KL
		Zone 4	45, 46, 47, 48	820 KL
		Zone 7	33, 36, 37, 38	880 KL
		Zone 7	33, 36, 37, 38	600 KL

Out Line of the Proposed Scheme :

The intake point from the Right bank Canal from Kharung Tank (Khutaghta Dam) at 1800 m away from outlet gate of the dam has been proposed on the left Bank of Canal. The Intake point shall be constructed by WRD as a full deposit work on behalf of BMC. Water thus received through canal point will be transported by 1500 mm dia MS pipe with flow as Open Channel flow as per Manning's formula with a uniformly sloped at 1:4000 m for travelling upto Birkona point parallel to the RB Canal upto 25.70 Km and following further the branch canal upto 0.93 km thus making the Gravity Raw Water pipe of 26.63 Km. The water will thus be collected in a 1700 KL GSR at Birkona WTP site near village Birkona as the natural flow can be delivered at a level below the GL of Birkona WTP site. Designed capacity of VT pumps running 2 at a time will then deliver water to the aerataion fountain of 72 MLD Capacity Conventional WTP with Lamella Clarifiers. The water after purification will be collected in a clear water sump of WTP. Clear water thus collected will be pumped by designed capacity of centrifugal pumps running 2 at a time and 2 standby will deliver water to TWO MBRs proposed for TWO regions of Bilaspur City, i) For zone on the left Bank of Arpa River which is nearer to Birkona site and ii) For zone to the right side of Arpa river. The capacity respectively of MBR as above is 2090 KL & 4680 KL of 25 m staging height each respectively. The water from these MBRs will travel by Gravity flow independently to each zones, to OHSRs already existing and some proposed as per the immediate demand of population growth envisaged in the project. The proposed OHSRs are 2850 & 820 KL in Left Zone and 880-600 KL two OHSRs in Right zones. The proposed OHSRs are having staging height of 21 m each. The Gravity Main pipe line will cross the river Arpa at about 2.5 km from Birkona, for which 280 m long Bridge proposed for 2.0 m wide passageway for carrying 1000 mm MS pipe and workable space in case of O&M.

ANNEXURE - "E-1"

Scope of work & Specifications for Raw water RCC Sump

1.0 GENERAL

The scope of work is as follows:

- 1) Raw water channel/RCC duct/MS pipe from near the Head Regulator of right bank canal (near Kharung Tank)
- 2) Raw Water Rectangular Sump for storage capacity of 5minutes of Ultimate Demand @ Source point.

The salient features of the Scheme are as under: Sump at Canel Intake

- a) Peak Demand for Ultimate Design Year (2050)= 89.76 MLD,
- b) Length of Intake pipe from Canal to Sump: As will be carried out by WRD
- c) Canal bed level at off take (RL)= 283.10 m
- d) Invert level of Sump = 281.10 m
- e) Water level of Canal =285.10 m may vary with the depth of supply level in non Irrigation Period
- f) HFL at Intake Station = 285.30 m
- g) Minimum depth of water = variable with the level of supply in Canal
- h) Silt deposition at Sump=0.30 m
- i) Effective depth of water in Sump= 3.0 to 4.20 m
- j) Inlet port is located above bed level of canal= 1 m
- k) Therefore effective depth of water available at inlet port=3.0 m
- l) Size of the Sump=15 m x 8.55 m
- m) Length of MS 10 mm thick plate raw Water Gravity Main = 26630 m (Approximately)
- n) Note:- Requisite total station survey will be carried out by contractor to verify above details & collect all water resources related data from concerned EE WRD Division.

Specification of GSR & Pump House at WTP Premices

The salient features of the Scheme are as under:

1	Daily Demand Intermediate Stage 2035	:-	74.661	ML
2	Hours of Pumping	:-	22	Hours
3	Rate of pumping.		3393681.01	Lit./Hr.
4	Detention period		30	Minutes
5	Capacity of GSR	:-	1696840.51	Litres
		Say	1700000.00	MLD
6	G.L. at GSR site		275.94	M

7	L.S.L of GSR	272.94	M
8	F.S.L of GSR	275.94	M
9	Bottom of Suction Pit	271.94	M
10	Inlet through 1500 mm Gravity Main	274.829	M

Note: Specifications for execution of sub items in making RCC Sump covered under MBR/OHSR Sub work Specifications separately attached in details in this NIT

SCOPE OF WORK:

After written order to commence the work, contractor; will have to submit the structural details, design and drawings of the entire structure including allied works within **30** days from the written order regarding acceptance of his offer. The tenderer is required to complete the following works including the planning, design, construction, testing, commissioning and O&M -

Intake chamber from the existing Right Bank canal(at about 1800m downstream of Khutaghat Dam) and Raw water intake structure in Bilaspur District Bilaspur at the selected site to draw raw water from the canal as given below-

The size of the intake structure on the Right Bank canal should have the proper housing as outlet for Raw Water Gravity Main for MS pipe of 1500 mm DIA conforming to IS: fitted with a fine screen in the bell mouth ; inlet port of adequate size and screens for drawing 89.76 MLD raw water; operating valve and a control room on top. The connection shall be made in the canal intake structure with screens and sluice gates(TO BE EXECUTED BY WRD Bilaspur) in such a manner to allow the water in the RCC chamber of size not less than 15M x 8.55M. there should be sufficient arrangement for the air to escape without any trouble.

2.0 DETAILED INVESTIGATION

It will be necessary for the tenderer to depute technical personnel to visit the site of construction to get them acquainted with the prevailing site conditions and for any additional information contact the office of Engineer-in-charge to collect all relevant information for planning and designing the entire construction work of said structure. The preliminary information is available with the Municipal Corporation. Topographical, hydrological and geological information is required to be collected by the contractor themselves from the Water resources Department and by carrying out the Topographical survey as given below:

- Topographical data has to be collected by the tender by carrying out topographical survey.
- A location Plan of proposed site showing layout of Canal Intake well .
- Hydrological data has to be collected from WRD Chhattisgarh
- The exact chainage of the Right Bank Canal near the Khutaghat Dam where the permission would be given by WRD Chhattisgarh , would be intimated by Municipal Corporation in due course of time. This is the point where the proposed MS duct of 1500 mm dia would be connected to the proposed canal Intake structure..
- The maximum flood discharge of Kharung river observed near the Right Bank canal with flood level details are required to be collected by the contractor from WRD Chhattisgarh. The gauging

details at the head regulator located near the Right Bank canal are required to be collected by the contractor from WRD Chhattisgarh. Therefore a safe RL of HFL should be worked out for planning water supply structures at the intake site on right bank.

The tenderer shall confirm the above topographical and hydrological investigations done and satisfy themselves before submission of their tender as these details are just for guidance. No claims on variation of above data shall be considered for payment.

3.0 PREPARATION OF TECHNICAL REPORT

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.

3.1 DETAIL DESIGNS AND DRAWINGS

On acceptance to tender the contractor shall submit a general layout drawing of the proposed components, showing the works to be carried out by WRD in dotted lines, structural details, designs and drawings of the entire structure including allied works within 30 days from the date of acceptance of his offer.

The responsibility for design, construction, structural stability and water tightness shall rest solely with the contractor. The contractor shall have to submit **four sets of completion drawings** immediately after completion of work.

Detailed design shall include all the required calculations for all the components including the following:-

- Detailed drawings and its design for trash rack structure ,inlet port, screens, fine screen on the bell mouth of MS 1500 mm DIA pipe for drawing water from the canal intake, valve control, Control room in the Canal Intake structure,

Minimum thickness of the concrete shall not be less than 200mm for the RCC walls and 150mm for slabs

14 Design Loadings

14.3 For stairs inside the well : 500 kg/sqm

14.4 For stair case from Sump Roof to : 500 kg/sqm
bottom of Sump

15 Buoyancy : Buoyancy allowed in the design of the Intake well and bridge foundation shall be 100% for foundation resting on rock

16 Seismic Zone : Zone-II Importance factor 1.5

19 SPECIAL FEATURES :

The structure will be designed for Seismic zone II.

GENERAL CONDITIONS :-

1. 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.
2. 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 BMC, before submitting the design.

3. The prices should be firm inclusive of all taxes, handling, storage, transportation, wages, watch and ward etc. at the site of work.
 4. 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.
 6. Weather proof Exterior painting on exterior & Acrylic Emulsion in two coats on inside walls including good architectural appearance of structure should be provided.
 7. 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. Anti termite treatment to entire structure below ground level shall be provided.
The contractor shall 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, Hydrological survey, Geological investigation including trial bores for soil investigation / test for preparation of canal cross section, fixing of HFL, structural design & BOQ for Raw water sump-cum canal intake structure , RCC approach road, etc. complete as directed by the Engineer-in-charge for the above sub component. Collection of data regarding design of complete item of raw water sump cum canal intake structure from relevant department etc. all level will be with reference to mean sea level including following work:-
 - a) Preparation of Contour plan general arrangement drawing, layout of site, cross-section of site on proper scale as directed by the department.
 - b) Architectural/ Structural drawing having following items :-
Layout plan, elevation, cross-section i/c details of raw water sump cum intake structure, and different small element relevant to complete item of intake structure.
 - c) 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.

3.2 FOUNDATION OF Raw Water Intake structure

The foundation of the Sump well-cum intake structure shall be resting on firm strata after having determined the SBC at that location. The depth of foundation should also be sufficient from consideration of bearing capacity, settlement, and suitability of strata at foundation level and stability of structure as a whole against overturning and sliding.

The foundation of Intake chamber will be laid over lean concrete of minimum M20 concrete, 200 mm thick. The minimum grade of concrete used in structure will be Cement concrete M-30 and stresses in concrete will be taken from IS:3370.

Use of explosive will be avoided for foundation excavation which will be done by dropping heavy chisels.

ANNEXURE - "E-2"

**Specification for Providing Lowering Laying Jointing 1500 mm dia MS
10mm thick Gravity Pipe line in 1:4000 m Gradient**

**SPECIFICATIONS FOR PROVIDING LOWERING LAYING AND JOINTING OF MS
PIPELINE**

ITEM For EXCAVATION IN ALL TYPES OF SOFT AND HARD STRATA FOR PIPELINE TRENCHES (Applicable where these Items occur in the scope of works in different sub works under this NIT)

1.1 GENERAL

The specifications contained in the standard specification as per Note 1.0 in CG SOR 2013

1.2 DISPOSAL OF EXCESS EXCAVATED MATERIALS

All materials obtained from any excavation as required to be carried out under this contract will be the property of and the contractor shall not have any claim on it. The excavated stuff if approved by the Engineer-in-charge can be used by the contractor free of cost for the construction of this work. The surplus excavated material remaining after the use of other items shall be transported outside within a lead of 5 km and disposed off as directed by the Engineer-in-charge without any extra cost. The royalty charges if applicable will be paid by the contractor to revenue department.

1.3 DEWATERING

No distinction shall be made as to whether the material being excavated is dry, moist or wet. The item also includes bailing out of water by manually or pumps to keep the trenches reasonably dry for all further works of lowering, laying, jointing and testing of the pipeline till the completion of the work, unless separate item is provided in the schedule of quantities. For dewatering of foundations in excavation and during the construction of foundation masonry if required for water to be dewatered more than bucketful quantity shall be done by the contractor.

1.4 SHORING AND STRUTTING

The item includes all shoring and strutting that may be required. On no account the width of trenches more than these mentioned here in after shall be measured. If excavation width more than the specified is required for the purpose of keeping machinery, stepping due to loose material or for any other reasons the same shall be at the Contractors cost.

1.5 LIGHTING, BARRICADING AND GUARDING

The items of excavation are including necessary lighting at night at suitable intervals, but not more than 15 meter along the excavated trenches and at all crossing and barricading the same by fencing so as to avoid the accident. Watchmen shall be employed at place where the trenches cross over any traffic road to caution the vehicles and pedestrians etc. The arrangements shall be maintained till completion of work and at the cost of the Contractor.

1.6 ALIGNMENT AND LEVELS

Before the trench excavation is commenced, sight rails shall be erected at every 30 meters and at all points of change of direction, gradient and at ends. The excavation work shall be preceded by a detailed survey along the alignment of the main to obtain ground levels at every 30 meters or less distance. Temporary benchmark shall be constructed by the contractor at necessary distance along the alignment and shall be maintained till the completion of work. All labour and materials required for the survey work of fixing benchmark etc. shall be provided by the contractor at his own cost. For any mistakes in survey the Contractor is fully responsible. He should not lay the pipes in the trench unless the alignment is thoroughly checked by the Engineer-in-charge or his authorized representative who is empowered to sign the work order book in token of checking the exact grade and level of the trenches excavation.

Excavation at random places shall not be measured. Any non-technical practices during the excavation of the contracted work shall be viewed very seriously by the.

1.7 DEPTH AND GRADES OF TRENCHES

The trenches shall be excavated to the required grades and depths and on the lines as shown on approved drawings as directed by the Engineer-in-charge. The depth of excavation and the levels of the pipe inverts shall be checked by means of boning rods of suitable lengths. Additional depths if required to be excavated for pipes, for sockets, collars, specials, joints and for any other working facility shall not be measured and paid. Under no circumstances the Gradient of Pipe shall vary in any range except 1:4000 throughout its length of 26630 m. The pipe is to be laid for uniform gradient as water to be carried from Start to end by Gravity and the available drop in levels for the entire length permit to lay the pipe line in 1:4000 only and is binding on the contractor. Deviation will be made good by the contractor by all means.

The Contractor shall notify the Engineer when the trenches are ready for bedding so that the Engineer can inspect and record the depth. Only on explicit approval by Engineer, the bedding shall be provided by the Contractor.

1.8 WIDTH OF TRENCHES

The maximum width of the trenches admissible for payment shall be as under.

1500 mm Dia. I.D.M.S 2.10 m at the laying of pipe position.

or actually excavated width whichever is less shall be recorded. Extra widths for pits at sockets, collars, specials, joints, and construction and also for working liabilities shall neither be measured nor paid for. Similarly, extra excavation required for providing and casting fixity block, thrust blocks, encasing etc. shall be measured and paid for under this item only and no extra item will be considered for this work. The pits for welding joints will also be covered under the item of work of excavation. Unless otherwise specific lifts and leads are mentioned in the tendered item, the tendered rate shall be for all lifts and leads involved in the work.

Excavation carried out in excess of the width specified shall be at the contractor's own risk and shall not be measured. So also the excavation carried out in excess of the required depths shall be made good to the required level by either concrete or masonry of proportion as directed by the engineer without extra cost.

1.9 PRESSING AND CONSOLIDATING OF THE TRENCHES

The bed of the trenches shall be well rammed before laying of the concrete for bedding. Hollows, if any, shall be filled with concrete M-10 grade duly rammed and watered to required level and grade at cost of the Contractor.

1.10 CLASSIFICATION OF STRATA

The excavation strata as encountered during excavation shall be classified as under:

1.10.1 SOFT MATERIAL

This includes soils of all types, sand, gravel, soft murum, hard murum and boulders up to size 0.1 Cum., W.B.M. road surfaces.

1.10.2 HARD MATERIAL

This includes boulders of size greater than 0.1 cum, all types of rock, (soft and hard), asphalt Tar road, surface & base, concrete roads.

1.10.3 ITEM OF EXCAVATION IN SLUSHY SOIL

The item includes excavation for foundation /pipe trenches in slush Muddy/ Marshy / Slushy /Soil including use of pochain, labour for dewatering during execution including removing the excavated material upto a distance of 50 metres and lifts as below, stacking and spreading as directed, preparing the bed by cleaning the mud, labour required for execution for shuttering item but excluding backfilling etc. complete. Providing and fixing shuttering shall not be paid separately.

The Engineer-in-charge shall be the final authority for deciding the classification of strata and no arbitration on this ground will allowed.

1.11 METHOD OF EXCAVATION

The excavation can be done manually or by mechanical means for soft materials and also in hard rock by pickaxe, blasting, manual chiseling or chiseling. Which method of excavation for each strata is to be adopted is to be decided by the contractor, however, no separate / enhanced payment shall be admissible for type of excavation means resorted to.

The contractor has to get the excavation done in both the strata by any or with combination of above-mentioned methods. The labours, materials, i.e. machinery, tools, blasting material, JCB, pochain compressor etc. are to be arranged by the contractor as his own cost and responsibility. The necessary permission for laying the pipe line along the road is obtained by the Deptt. & the contractor shall take the work after receiving permission from respective departments in hand.

1.11.1 EXCAVATION BY CHISELLING (All Hard Strata)

Excavation in hard strata shall be done by chiseling, wedging or line drilling as specified or ordered by the Engineer. The excavation refers to excavation generally for foundation, wet or dry, in hard rock by chiseling, wedging or line drilling and shall comply with the specifications.

1.12 MODE OF MEASUREMENT AND PAYMENT

The width of excavation trenches admissible for payment for various diameters of pipes is as below:

For D.I./M.S./RCC pipes

1500 mm O.D. + 0.6 M. in soft and hard material

MANUFACTURING, FABRICATING TRANSPORTATION AND WELDING OF M.S.PIPES & SPECIALS AT SITE

2.1 GENERAL

The work includes fabrication of 700 mm (I.D.), 10.00 mm thick M.S. pipes from material supplied by or providing of spirally welded pipes from Steel Authority of India. The M.S. plate for fabrication of pipe shall conform to grade 410 Mpa (i.e. Tensile strength 4100 Kg/sqm.).

2.2 SCOPE

The scope of work shall cover the following works under the contract.

1. Scope of Work

- a. Laying of Water Pipeline from intake pump house to site covering a distance of approximately 26.63 Kms.
- b. Fixing of air release valves, scour valves, butterfly valves etc. on the pipe main.
- c. The pipe will have internal as well as outside coating as per ISO standard. (The thickness of internal Lining is 9mm and outside wrapping)
- d. Fixing of Surge production devices, if required.
- e. The successful contractor will finalize the final alignment of the pipeline route based on the preliminary survey carried out by the representative.
- f. Any road crossings will be carried out by the contractor as directed by concerned Deptt. And as directed by Engr. -in- charge.
- g. The contractor will carry out all the Excavations work on all strata and also fixing of specials and different valves, up to getting clearances client/consultant. (A typical trench drawing indicating the total depth of the trench required, bedding space, dimension of the coverage above the pipeline is attached.)
- h. The contractor will fix expansion joints where the pipeline is laid above the ground. (The contractor will manufacture and bring it to the site only upon getting written permission from Client / Consultant.)

- i. The contractor will make suitable approach road wherever necessary at their own cost for carrying out the job successfully and also for clients and consultant to approach the site for inspection.
- j. The contractor will tackle all the local problems and liaison with Govt. officials at his own cost.
- k. All the special bends like 30^o, 45^o, 60^o, 90^o etc. are to be fabricated at the site by the contractor with the pipe supplied by the client.
- l. All the specials required to fix different valves will be prepared by the contractor at his workshop for which **separate payment will be made to the contractor as per the rates** mentioned in the schedule contractor shall be paid as per Kg basis of the finished product.
- m. **The contractor also will make RCC Chambers for all the air release valve at scheduled rate.** Provision of RCC Air Valve Shaft and MS box has to be done by the contractor

Brief Outline of the work to be Carried Out

Transporting, lowering, laying, jointing and testing of M.S. pipes of 1500 mm (I.D.) 10.00 mm thick pipe. The pipes shall be in coated from outside with coaltar and solvent based rubber modified bituminous primer of density 0.92 gms/cu cm and viscosity of 1000-2000 cps @ 150 gms/sqm followed by seven layers (4mm thick) of polythene polymerized bitumen and polyester of local 7 layers) pipe coat wrapping should conform to requirement of IS-10221 and AWWA C-203 for pre-fabricated tapes including covering cost on pipe coating as per specifications for underground pipes & for above ground pipes, shall be out coated with elastomeric thermoplastic antifungal graft co- polymer coating of 50 micron . The out coating shall be preferably done in the factory. From inside the pipes shall be coated with Cement Mortar lining 9 mm thick. **The contractor has to demonstrate that the inside surface of pipe is so smooth that it will give 'C' value of minimum 130.**

The tenderer shall fabricate the specials at site from the pipes supplied by and transport them to the laying site including loading, unloading and stacking at site at their own cost.

2.3 SUPPLY OF MATERIALS

The will supply M.S. spirally welded pipes, cement, steel and valves etc. required for the fabrication of pipes. All requirements of such materials will have to be arranged by the contractor from store. The plates required for fabrication of M.S. pipes under this tender shall be of Fe 410 grade (IS: 3589 – 1991). The minimum tensile strength shall be 410 mpa & the percentage elongation shall be 18%. Yield stress shall be 2600 kg/sq.cm. minimum Allowable stress to be used.

- | | | |
|-----|---|----------------|
| i. | Specified minimum yield stress | 2600 kg/sq.cm. |
| ii | For combined bending & direct
Compression for design test pressure
Without considering surge i.e. for
10 kg/cm ² pressure | 1300 kg/sq.cm. |
| iii | For combined bending & direct
tension for design test pressure
Without considering surge i.e. for
10 kg/sq.cm. pressure | 1560 kg/sq.cm. |
| iv | For design pressure considering
sum of working & surge pressure | 1950 kg/sq.cm. |

The conveyance of fabricated materials from store to workshop / site of work shall be deemed to have been covered in the relevant items of fabrication of pipes, specials etc. The contractor should note that the steel plates and other structural steel required for fabrication of specials is to be procured by him from store at his cost. The Contractor has to procure such plates in several stages as the circumstances demand or as directed by .

There shall not supply any steel or structural steel to the contractor for his use for preparing jigs, testing arrangements, platforms etc. in the factory or in the field. The contractor shall have to make his own

arrangements for procuring them at his own cost immediately on receipt of work order and the **shall not entertain any request for extension of completion period or compensation on increase in cost etc.** It will be entirely the responsibility of the contractor to maintain the inventory of the plates and any loss or theft shall be borne by the contractor. If the length of pipe line is less than that of the fabricated pipes then the cost of steel plates shall be recovered from the running bills.

2.5 CUTTING OF PLATES TO SIZE

The pipe drums shall be fabricated with only one longitudinal joint.

The plates shall be cut on all the sides to the exact dimensions and shape required by a suitable plate-cutting machine for fabrication of pipe drums. Tolerance in cutting shall not be more than ± 3 mm in width and length. Before cutting, all the edges of the plates shall be cleaned by brushing or grinding. The standard length of fabricated pipes shall be in meters.

The plates shall be given a bevel at the edges depending upon the welding machine to be used by the Contractor. Ends of the pipes fabricated shall necessarily have 'V' edges as in the field hand welding is to be done. The bevel shall generally be from outside. In the factory where automatic machine having sufficient penetration is used, the edges in the pipe may be square cut. The type of joints to be adopted in the factory shall depend on the type of welding machine to be used and the method of welding to be adopted. Experimental welding shall be demonstrated by the contractor to the Engineer-in-charge in the factory and testing of samples there from shall be done by the Engineer in charge at contractor's cost before finally deciding the voltage and current characteristics for proper welding to be adopted.

After the plates are cut the edges shall be made smooth to remove all inequalities by means of polishing grinder. Care shall be taken to see that cut edges of the plate are perfectly straight. Jigs to be used for this purpose shall depend upon the cutting machine used. The correctness of the cutting shall be checked before the plates are rolled into pipe drums. Corrections if any shall be made by re-cutting if necessary. If any plate or flat is found to be warped the defect shall be removed by putting the plate into roller press at the contractor's cost.

If the contractor finds that some of the plates are laminated or are badly corroded these shall be stacked separately and shall not be used for fabrication of pipes etc. The contractor shall not be entitled for any extra claim on account of handling and cutting plates, which are subsequently rejected by the Engineer.

2.6 ROLLING OF PLATES

The plates cut to exact size shall be put into rolling machine to form the pipe drum of the required dia. The contractor shall adjust the rolling machine so as to give a uniform curvature to the pipe drum throughout its circumference. The curvature shall be checked by the contractor's foreman during the process of rolling and rolling shall be repeated till such stage the exact curvature is obtained. Contractor shall roll the pipe drum even after longitudinal welding is done if proper curvature is not obtained. Heating of plates shall not be allowed to have the desired curvature.

2.7 TACKING OF DRUMS

Rolled drums shall then be taken to the assembly platform for tacking for longitudinal welding. Where machine welding is to be done there shall be no need to have a gap between the faces depending upon penetration obtained. If hand welding is permitted by the Engineer gap shall be between 2 to 4 mm. Clamp spiders tightening rings or any other approved gadgets shall be used during assembling and tacking.

The tacked drums shall then be taken to the assembly platform for tacking them to make pipes of minimum 6 M lengths. The Engineer may also change the lengths of pipes depending on the site conditions and may ask the contractor to fabricate the pipes in any shorter length than specified or longer lengths than standard lengths.

Maximum length shall not exceed 12 M and the contractor shall comply with such orders without claiming any additional cost for the same.

The assembly shall be truly cylindrical and without kinks, the faces being exactly at right angles to the axis of pipe. The contractor shall provide at his cost suitable gasket to check the correctness which shall be as per Para 8 of IS:3589.

2.8 WELDING OF PIPES

Assembly as described above shall then be transferred to a qualified automatic welding machine of approved make for full welding. All the circumferential joints as well as longitudinal joints shall be done on automatic welding machine only. The Engineer may, at his discretion allow hand welding only for the sealing run or for some minor welding.

Electrodes of approved make & size conforming to IS: 814 (specification for covered electrodes for metal arc welding of mild steel) only shall be used for welding depending upon the thickness of the plates and the type of joint. The current and the arc voltage required for the machine shall be decided after the experimental welding is done. All expenses for these experiments shall be borne by the contractor. The current and the arc voltage once decided shall not be altered, without the permission of the Engineer-in-charge for that particular thickness of plate. The welding shall conform to IS: 822 and 823. In case of thin plates gas welding may be resorted to. Gas Welding also shall be subject to the same specifications and test as those for the electric welding.

The welders employed by the contractor shall be sufficiently experienced and qualified as per relevant IS in welding works to execute the works of standards as specified in IS: 817 and type of welding work carried out particularly for this type of work. A joint entrusted to a particularly individual or a pair shall as far as possible be completed only by them in all respects including sealing run.

2.9 TYPES OF WELDED JOINTS

The circumferential joints of the pipes shall be butt welded with required number of runs externally and internally. Pipes below 700 mm dia shall be welded only externally. All fillet welds shall have a throat thickness not less than 0.7 times the thickness of the pipe to be welded.

2.10 WELDING PROCEDURE

All parts of pipes, specials, etc. which have all loose scale, slag, rust, paint and any other foreign material shall be removed with wire brush and left clean and dry. All scale and slag shall be removed from each run of weld when that run is completed. Welding shall conform to relevant provisions of IS: 3589 and IS : 816-1969.

2.11 TESTING OF WELDED JOINTS:

Welded joints shall be tested in accordance with procedure laid down in Indian Standard Specifications (IS: 3600, Part I – 1985 of procedure for Testing Fusion welded joints and weld metals in steel)

At least one test specimen shall be taken out for testing for every hundred factory welded pipes. Test pieces shall be taken out from places pointed out by the Engineer. These shall be machined and tested as early as possible. The shape of the test pieces removed for testing shall be such that it shall give the specimen of the required dimensions with the weld in the middle of the specimen and at the same time leave the holes in the pipe with rounded corner. This hole shall be patched with a plate of suitable size cut from a separated pipe of same diameter. It must ensure good butt weld.

2.12 TENSILE TEST

The test specimen taken perpendicularly across the weld shall be shaped in accordance with Indian Standard Specifications IS: 223. The tension test specimen shall be machined. The protruding welded portion from inside as well as outside shall be removed by machining before the specimen is tested. If the specimen shows defective machining or develops flaws not associated with welding, it shall be discarded and another specimen substituted. The welded joint shall show strength not less than the minimum tensile strength for the plate in accordance with ISS: 226.

2.13 BEND TEST

Bend Test specimen shall also be prepared in the same fashion as the tensile test specimen. The specimen shall stand being bent cold 18 ½ degrees around a pin that has a diameter equal to 4.5 times the plate thickness, without developing cracks. For this test face representing inside of the pipe shall be placed next to the pin.

2.14 PROCEDURE ON FAILURE TEST SPECIMEN

If the test fails in either tensile or bend test or in both, two additional test specimen shall be taken out from the section and shall be tested for tensile and bend test. If any one of them fails, extensive gouging and re-welding shall be done for the welded joints in that section to the full satisfaction of the Engineer. However, if both the samples give satisfactory results, the joint form which the original sample was taken and had failed shall be repaired to the satisfaction of the Engineer by gouging and welding etc. at contractor's cost.

Welder who had done the welding of the joint that has failed shall be solely held responsible. Since all other factors like electrodes, current, arc voltage are already controlled, negligence on the part of the welder only is responsible for such failure. For first such failure the welder shall be warned and if the welded joint done by him fails for the second time, he shall be removed from the job.

2.15 WORKSMANSHIP

All pipes fabricated out from steel plates of Fe 410 grade shall be free from excessive pitting, crack, surface flaws, laminations or any other defect. All such defective plates shall be stored separately and should not be used. All the pieces shall be properly stored in different stacks size-wise. The pipes shall be truly cylindrical and straight in axis, acceptable tolerance being as per IS: 3589. The ends of the pipes shall be accurately cut with level for field welding depending on sizes as specified earlier. The tolerance in outside diameter for leveled and for butt welding shall be as per Table 2 Para 12 IS: 3589.

In case of pipes to which flange adopters are to be fixed, the external diameter of the pipe shall not be more than 1 mm than the theoretical one.

The contractor shall have to roll the pipes several times to achieve this accuracy. The longitudinal welding at the ends of the pipes shall be ground smooth and flush with the plates for at least a length of 200 mm from the ends. No additional payment shall be made for re-rolling or grounding the welds as described above.

Any minor repair in welding that is required to be done shall be done only after obtaining the permission from the Engineer-in-charge. Whenever he finds that the work has not been done by the contractor as specified above and to this satisfaction and the pipes fabricated have injurious defects these shall be liable for rejection. No payment shall be made to the contractor for such fabrication and welding.

2.16 TEST OF WELDS

The test on welds shall conform to Para 14 of IS: 3589

2.17 TRANSPORTION OF PIPES

The item includes engaging mobile crane for lifting and loading the pipes into truck from manufacturer's yard, transporting the pipes from stack yard to the site of work by truck or whatever means including all materials, labor and equipments required for this operation. The rate mentioned in Schedule 'B' under item of pipe manufacture & supply also accounts for making all required arrangements for conveying pipes up to work site. The contractor shall take adequate care during handling & transportation so that the in coating & out coating of the pipe is not damaged. If any damage is observed the same shall be repaired properly to the satisfaction of Engineer and if the Engineer is not satisfied then the Contractor will have to replace the pipe at his cost. The Engineer shall not accept major repairs to coating of the pipe.

The contractor should note that the cost of transportation of pipes from factory to work site including loading, unloading and carting is included in the rate of pipe supply.

2.18 MODE OF MEASUREMENT AND PAYMENT FOR PROVIDING FABRICATION OF M.S. PIPES WITH INTERNAL CEMENT MORTAR LINING (BY CENTRIFUGAL PROCES) IN FACTORY

The providing and fabrication of pipes shall be measured in Running meter of pipes fabricated and shall include the cost of supplying all the labor material, machinery for loading, unloading if any, handling plate, cutting and shaping the same to the required size and shape forming 'V' edge, rolling the plates to form pipe drums, assembling the drums to form pipes, taking and full welding of all circumferential and one longitudinal joints on the automatic welding machine, and stacking them size wise in the yard. The rate includes loading, unloading and transportation of pipe from workshop to work site.

No additional payment for hydraulic testing of specimen-fabricated pipe shall be made to the contractor. The charges to be paid to third party inspecting agency for testing of pipes are to be borne by contractor. The break up for payment for this item shall be as under:

1.	Supply of M.S.pipe at site of work	-	75% of 90% Rate of pipe
2.	After laying of pipe & welding of joints	-	10% of 90% Rate of pipe
3.	After hydraulic testing & on giving 'c' value test for min. Value of 130	-	Balance

3. ITEM NO: 6 ELASTOMERIC THERMO PLASTIC FIRE RETARDANT COATING

The coatings used shall be based on liquid, chemically cured epoxies. The curing agent might be amine, amine-adduct or polyamide. The epoxy coating shall be fire retardant coating, having skin tensile strength 18 to 21 kg/sqcm, antifungal, antibacterial, anticorrosive, graft co-polymer coating. The minimum dry film thickness DFT shall be of 50 micron on external pipelines in laid/ unlaidd condition after proper cleaning.

4. ITEM NO: 7 HYDRAULIC TESTING OF FABRICATED PIPES AT FACTORY

The pipe length fabricated shall be as specified earlier above. The contractor shall provide hydraulic testing of all the pipes at the factory. The arrangements made by the contractor for hydraulic testing of pipes shall be subject to the approval by the Engineer. The contractor shall paint inside the serial number of pipe the diameter and the plate thickness and letter 'H' as well as the date of the test etc. as directed by the Engineers. The pipes shall be inspected thoroughly before testing for any apparent defect in welding and the contractor shall repair such defects by gouging and re-welding. Such pipes will be used only on approval of the Engineer-in-Charge. Necessary provisions for storage tank for water for testing water pumping arrangements if necessary and making available the required water shall be made by the contractor.

Hydraulic testing of pipe manufactured will be inspected by Engineer or his authorized representative to the satisfaction of the Engineer-in-charge or his authorized representative and expenses for such additional testing if any will be borne by the contractor.

Accurate pressure gauge of approved make shall be mounted on one end of the pipe to indicate the pressure inside the pipe being tested. Each pipe shall be tested to pressure of 16.00 Kg/cm² operating pressure & 26.00 Kg/cm² of test pressure. The pressure shall be applied gradually by approved means and shall be maintained at least for 10 minutes during which time, the pipes be hammered throughout its length with sharp blows with 1 kg hand hammer. The pipe shall stand the test without showing any sign of weakness, leakage, oozing or sweating. If any leakage is observed it shall be repaired by gouging and re-welding on approval of the Engineer in Charge. No separate / additional payment shall be made for dewatering, gouging, repairing and retesting and the handling required to be done for such pipes.

4.1 ITEM OF HYDRAULIC TESTING OF PIPELINE

After the work of laying pipeline is completed and before it is commissioned, the pipeline shall be hydraulically tested in the field both for its strength and leakage in the following manner.

NOTE

Whether stated specifically elsewhere or not the testing in section of 1 km shall have to be completed within 3 months of laying and jointing. **Delay in testing will be subject to a fine at 10% of the cost of the testing item for delay of every fortnight or part thereof.**

Each valve section of the pipeline shall be subjected to hydraulic test in section. For this test the pipe shall be slowly filled with clean water by opening cross connection with the existing mains or otherwise by pumping water into the line (water and pumping arrangement is to be arranged by contractor) as directed and all air shall be expelled from the pipeline through air valves and wash out fixed on the pipeline. Once the pipe is full, the cross connection or pumping shall be closed. The pressure in the pipeline should then be raised in stages and built up and maintained by means of suitable approved pumps to the specified test pressure based on the elevation of the lowest point on the line or section under test.

The test pressure shall be not less than 16.00 kg/sq.cm. Before starting the pressure test the expansion joint (if any) shall be tightened. The test pressure shall be maintained for at least 2 hours. The drop in pressure shall not exceed

0.7kg/cm² within a period of 2 hours after the full test pressure is built-up. Under this pressure no leak or sweating shall be visible at the welded joints. During the test the pipe shall be struck sharp blows with 1.5 kg hammer. Water shall not spout ooze or sweat through any part. In case of any leak observed anywhere in the field joints whether welded or bolted the same shall be repaired entirely at the contractors cost which shall include repairs to welding and regunitting etc. The repaired joint shall be subjected to retest. No section shall be accepted unless it is perfectly watertight.

The entire cost of testing, retesting, including cost of water taken together shall be paid under relevant item of Bill of Quantities. The contractor shall make all the arrangements for all labour, pumps, pressure gauge, equipment, etc. The gauges should be got calibrated from standard laboratory / Proof Consultants having such facility if insisted by the Engineer-in-charge. The contractor shall arrange for labour required for operating air valves, score valves etc. Any labour of employed for the above activities of the test other than supervision shall be charged to the contractor by .

The hydraulic testing of the water main will be carried out for entire length as directed by Engineer-in-charge. If any leakages are observed even during defects liability period due to defective workmanship the same shall be rectified immediately. The charges of repairs if done by will be recovered from the amount of retention money. Repairs on live water mains are to be carried out immediately to avoid wastage of water and other problems such as disruption of water supply and traffic etc. In view of this it will be very difficult to give prior intimation to concerned contractor, as such the cost of repairs being the expenditure will be recovered form the contractor's retention money withheld in deposit without giving any prior intimation. The contractor will not challenge or claim any extra for such action on the part of the .

Generally the contractor shall be required to test the pipeline in sections of 2 km by using necessary equipment. However, if the Engineer-in-charge directs to test the pipeline lengths in further suitable sections in the interest of the work the tenders will have to carry out the test in such sections as directed by Engineer-in-charge.

4.2 MODE OF PAYMENT AND UNIT OF MEASUREMENT

The length of pipe line to be tested for Hydraulic testing shall be in suitable section length in which case rate shown at Item No. 16 of Sub-work No. 2 will be applicable. Payment for actual length of pipeline satisfactorily tested by the contractor shall only be released by the owner. The length in 2 decimals of a km. will be measured and recorded.

P.C.C. & R.C.C. STRUCTURES

The item includes designing RCC structures like thrust blocks, columns, foundations etc. as mentioned in Bill of Quantities. The item also includes designing components of bridge wherever applicable such as Footings, Columns, Braces, Slabs of Required sizes, preparing detail working drawings, **getting approval from water supply consultant and structural approval from proof consultants** etc. complete.

The Design of RCC structures shall be carried out by a Design Engineer / Structural Engineer having minimum qualification of post graduation in structural engineering. He shall sign the design and drawing and put his name and stamp.

5.1 DESIGN

The design shall be carried out in confirmation with following IS codes (latest editions):

- | | | |
|------|--------------------|---|
| I. | I.S. 456 – 2000 - | Code of Practice for Plain and Reinforced Concrete |
| II. | I.S. 3370 – 1965 | - Code of Practice for Concrete Structure For the Storage of Liquid |
| | Part – I – 1965 | -General Requirements |
| | Part – II – 1965 - | Reinforced Concrete Structures |
| | Part – III – 1967 | - Prestressed Concrete Structures |
| | Part – IV – 1967 | - Design Tables |
| III. | I.S. 875 – 1987 - | Code of Practice for Design Loads For Building and Structures |
| | Part – I – 1987 | -Dead Loads |
| | Part – II – 1987 - | Imposed Loads |
| | Part – III – 1987 | - Wind Loads |
| | Part – IV – 1987 | - Snow Loads |

Part – V – 1987 -	Special Loads and Load Combinations
IV. I.S. 1893 – 2002	- Criteria for Earth Quake Resistance Design of Structures
V. I.S. 13920 – 1993	-Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces
VI. I.S. 1786 – 1985	- High Strength Deformed Steel Bars and Wires For Concrete Reinforcement

5.2 FOUNDATION FOR STRUCTURES

- 5.2.1 The foundation shall be designed for actual S.B.C. of strata confirmed by plate load bearing test. Minimum depth of foundation shall satisfy the following criteria,
- Depth in soft rock shall not be less than 1.0 m or depth in hard rock shall not be less than 0.5 m.
 - The total depth in all stratas put together shall not be less than 2.0 m for individual footing.
 - In B.C. of soil raft shall be provided at minimum depth of 3.0 m. No pile foundation shall be allowed.
- 5.2.2 The design shall be for seismic zone – III and the staging shall be designed for ductile detailing as per I.S. 13920 – 1993 for seismic zone - III
- 5.2.3 Increase in permissible stresses in braces for earth quake / wind force design will not be allowed.
- 5.2.4 Irrespective of the type of foundation proposed in the design one set of bracing be provided at the ground level.
- 5.2.5 Uplift pressure on the foundation of structure should be considered as per available water table at the site in rainy season.
- 5.2.6 Age factor for increase in strength shall not be considered for design.
- 5.2.7 If the foundation consists of individual column footing minimum clear distance between edges of footing shall be not less than width of footing.
- 5.2.8 The foundation shall be checked for negative pressure on soil due to combined direct and bending stresses. Negative pressure shall not be allowed on the foundation soil.
- 5.2.9 TMT Fe – 415 (Make - SAIL, TATA TISCON, RINL (VIZAG) shall only be used.

5.3 MINIMUM STEEL

Design requirements as set out in relevant codes in respect of steel shall be fully satisfied. However following minimum steel should be provided.

A. Vertical Steel in Column

- The cross sectional area of longitudinal reinforcement, shall not be less than 0.8 percent nor more than 6 percent of the gross cross sectional area of the column.

Note :- The use of 6 percent reinforcement may involve practical difficulties in placing and compacting the concrete, hence lower percentage is recommended. Where bars from the columns below have to be lapped with the columns under consideration, the percentage of steel shall usually not exceed 4 percent.

- In any column that has a larger cross sectional area that required to support the load, the minimum percentage of steel shall be based upon the area of concrete required to resist the direct stress and not upon the actual area.

- B. Horizontal Links in Columns
Not less than 8 mm dia. At 200 mm center to center or 10 mm dia. not more than 300 mm center to center.
- C. Exposed RCC Surface
On both faces when thickness is 150 mm or more
- 2 Kg/Sqm in one direction
 - 2 Kg/Sqm in perpendicular direction

The above requirement is satisfied if 8 mm bars @ 200 mm center to center or 10 mm bars @ 300 mm center to center are provided.

Even if design steel is less than above, the above minimum shall be provided.

- D. Water Retaining Members
The minimum reinforcement in walls, floors, roofs on each of two directions at right angles shall have an area of 0.3 % of the concrete section in that direction for sections upto 100 mm thick. For section of thickness greater than 100 mm and less than 450 mm the minimum reinforcement in each of the two directions shall be linearly reduced from 0.3 % for 100 mm thick sections to 0.2 % for 450 mm thick section. For section of thickness greater than 450 mm reinforcement in each direction shall be kept at 0.2 %. In concrete sections of thickness 225 mm or more, two layers of reinforcing steel shall be placed one over each face of the section to make up the minimum reinforcement specified in this clause.

5.4 COVERS TO REINFORCEMENT

Minimum cover to reinforcement shall be as per I.S. 456-2000 and I.S. 3370 (Latest version).

- a. Footing / Raft
 - 50 mm at Bottom and Sides
 - 40 mm at Top
- b. Columns
 - 40 mm
- c. Braces, Beams, Slabs
Vertical Wall, Gallery Landings - 25 mm

- 5.4.1 Design shall be based on accepted bases and well known methods of design as well as the provision of I.S.S. (Latest editions). However methods based on experimental investigation as mentioned in para 18.2 'C' in I.S. 456-1978 shall not be allowed. Similarly the methods / practice of design having no documented evidence shall not be entertained. Only well defined and well known methods of design shall be followed.

5.5 MODE OF MEASUREMENT AND PAYMENT

The item shall be measured as Job quantity and the payment shall be made on lump sum basis.

ITEM OF TOR STEEL REINFORCEMENT FOR RCC WORKS

- 6.11 The item provides for supply of **Tor Steel bars**, cutting, bending, binding with wire and placing in position.
- 6.12 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	415	200

- 6.13 The binding wire shall conform to Specification A-15 of Standard Specification of Public Works Department, Latest Edition.

- 6.14 Bending reinforcement confirm accurately to the dimensions and shapes in the details drawings (approved) or as directed by the Engineer-in-charge.
- 6.15 Bars shall be bend cold only. In no way bending by heat will be allowed.
- 6.16 Bard with kinks, bends or cracks shall not be used.
- 6.17 Details of length, size, laps and bending diagram shall be got approved from the Engineer.
- 6.18 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.
- 6.19 Welding, if permitted shall conform to standard practices & specifications.
- 6.20 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.
- 6.21 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.
- 6.21 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.

6.23 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.

PROVIDING, SUPPLYING AND FIXING OF SLUICE VALVES, BUTTERFLY VALVES AND SCOUR VALVES ,PRESSURE RELIEF VALVES & AIR VALVES

7.3 SLUICE VALVES

SCOPE

7.3 CONSTRUCTIONAL FEATURES

Sluice valve shall generally conform to BS: 5150/ IS 14846. They shall be of non - rising spindle type except for the valves for bypass. The gate face rings shall be securely pegged over the full circumference. Valve of 600 mm and above shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm. Valve of 700 mm and above shall be provided with thrust bearing arrangement for ease of operation. Valve of diameter 400 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15 % in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 200 N. valves spindles and hand wheels shall be positioned to give good access for operational personnel. Hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels. Valves shall have two position marked at the shut end of the scale, first one corresponding to the position of the gate tangential to the bore of the seating and the second position below the first, corresponding to the position of the gate as it sits on the seating after moving a further distance equal to the depth of the seating.

7.3 MATERIALS

Material for different component parts of sluice valves shall conform to requirements IS 14846- 2000 as given below:

MATERIALS FOR COMPONENT PARTS OF SLUICE VALVE

Sr. No.	Component	Preferred Material	Ref. To IS No.	Grade Designation	Ref. To IS No.	Grade of Designation
i.	Body, bonnet, dome, stool cover, wedge, stuffing box, gland, thrust plate and cap	Grey cast iron	210	FG 200	1865 1030	260-300 /12 or 500/2
2.	Hand wheel	Grey cast iron	210	FG 200	2062 1865 1030	F410 WA 230-450 W 400/12
3.	Stem	Stainless steel	6603	12 Cr 13 04 Cr 18 Ni 1004 Cr 14 Ni 12 MO2	320 or 6912	HT 2 FHTB-2
4.	Wedge nut, shoe channel	Leaded tin bronze	318	LTB-2	320 28 6912	HTB 2 FHTB-2

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

5.	Body seat ring, wedge facing ring and bushes	Leaded tin bronze	318	LTB-2	3444	Gr.1 Gr.4 Gr.10 04 Cr 18 Ni 10
6.	Bolts	Carbon steel	1363 (Part 1)	Class 4.6	6603	
7.	Nuts	Carbon steel	1363 (Part 3)	Class 4.0	6603	
8.	Gasket	Rubber	638	Type-B		
9.	Gland packing	Jute and hemp	5414		638	Type-B
10	Gear	Spheroidal graphite iron	1865	Gr 500/7	1570	40 Ni 2 Cr 1 MO 28 Gr.B
11	Gear housing	Grey cast iron	210	FG 200	1030 1865	230-450 W 400/12
12.	Pinion & pinion shaft	Wrought carbon steel	1570 (Part 3)	C55 Mn 75	1570 (Part 4) 6603	40 Ni 12 Cr1 MO28 04 Cr 18 Ni 10

7.4 DIMENSIONS AND TOLERANCES

Dimensions of various parts and tolerances shall be in strictly in accordance with Table 2 of IS 14846-2000.

7.5 TESTING

Each valve of PN-1.0 Class shall be tested for (a) Body – 240 mtr. Head (b) Seat : 160 mtr. head.

The test shall be carried out in accordance with Annex B.CI. 101.1 of IS 14846-2000. Test duration for body shall be 5 minutes and that for seat shall be 2 minutes. The valves during test shall now show any sign of leakage.

The following information shall be cast on each valve body in raised letters.

- a) Manufacturer's name or trade mark
- b) Nominal pressure of valve (PN 1.0)
- c) Size of valve (mm)
- d) IS marking embossed
- e) Heat no of cast
- f) Year of manufacture

In addition each valve shall bear conspicuously upon it price to dispatch.

- g) Serial number in punch, on top of flanges and
- h) When the valve has been tested for only open and test it should be marked 'O' distantly & permanently on flanges adjacent to serial numbers.

7.6 THIRD PARTY INSPECTION

The valves shall be delivered to the site with manufacturer's test certificate and third party inspection certificate form approved SGS/RITES third party inspection agency.

7.8 PACKING AND STORAGE

- a) Packing: All valves shall be supplied with the wedge closed. Bright parts shall be protected against rust. Valves of small diameter may be packed in wooden cases and be suitably protected against damage. Parts liable to injury in transit shall be wrapped with wood - wool or similar material as a protection. Hand wheels of valves forwarded loose shall be removed before dispatch.
- b) Storage: Valves shall be stored in roofed stores away from dirt.

7.10 MODE OF MEASUREMENT AND PAYMENT

The valves shall be measured and paid on number basis. And 90% shall be paid only after lowering, laying, & jointing after fixing and balance 10% amount will be paid only after satisfactory hydraulic testing.

7.12 BUTTERFLY VALVES

7.13 SCOPE

This section covers requirements for butterfly valves for general purposes and cover all types of butterfly valves IVC, Kirloskar, Fouress and Audco make only manually, pneumatically, hydraulically or electrically operated with PN - 1 class rating, having double flanged ends for connections.

7.13 CONSTRUCTIONAL FEATURES

The valves shall be with integral body seat, suitable for ON-OFF and regulated operation. It shall be suitable for withstanding pressure from either side.

The valves shall be with double flanged ends.

The valves shall be electrically operated. Valves on raw water pumps delivery and transmission mains shall be with extension spindle. Extension spindle shall be with universal coupling and intermediate supports, if required. Operation of valves shall be with electric actuators mounted on floor stand at floor / top slab level.

Butterfly valves shall be of metal seated type generally as per BS EN 593. Valve shall be suitable for mounting in any position. The valve seat shall be of integrally cast or replaceable design. When the valve is fully closed, the seal shall seat firmly. The seat surfaces shall be machined smooth to provide a long life for the seal. All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve. Valve shall be suitable for throttling purpose. All valve spindles and hand wheels shall be positioned to give good access for operational personnel. Valve of diameter 450 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear shall be such that they can be opened and closed by one man against an unbalanced head of 1.15 times the specified rating. Valve and gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 200 N. All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction for opening and closing being indicated on hand wheels.

7.14 MATERIALS OF CONSTRUCTION

**CAST IRON DOUBLE FLANGED BUTTERFLY VALVES WITH WORM GEAR OPERATED AS PER IS 13095/91,
BS-5155 AND AWWA, C504**

Sr. No.	Description	Material	Specification
1.	Body	C.I.	IS : 210 FG : 200
2.	Valve Disc	C.I.	IS : 210 FG : 200
3.	Body Ring	S.S.	AISI : 304
4.	Retainer Ring	S.S.	AISI : 304
5.	Valve Seat	Rubber	Nitrile
6.	Shaft	S.S.	AISI : 410
7.	Pin	S.S.	AISI : 304
8.	Bush	G.M.	IS : 318 LTB : 2

Sr. No.	Description	Material	Specification
9.	`O' Ring	Rubber	Nitrile
10.	`T' Ring	G.M.	IS : 318 LTB : 2
11.	Collar Bush G.M.	G.M.	IS : 318 LTB : 2
12	Cover Plate	M.S.	IS : 226
13.	Adopter Plate	M.S.	IS : 226
14.	Lock Washer	S.S.	AISI : 304
15.	Gear Box	C.I.	IS : 210 FG : 200
16.	Hand Wheel	C.I.	DO

7.15 REFERENCE

Butterfly valves shall be provided as per IS 13095-1991.

7.16 SERVICE APPLICATION

Tight shut off type having no visible leakage past the disc in closed position.

7.17 DIMENSIONS AND TOLERANCE

Dimensions shall be strictly as per table 1 of IS 13095 - 1991 and tolerance on face to face dimension shall be per clause No.10.4 of IS 13095 - 1991.

7.18 OPERATION

Valves shall be manually operated and capable of being operated at a differential pressure across the disc as marked on valve and shall be Actuator friendly.

7.19 TESTING

Each valve shall be tested for (a) performance test, (b) Body test, (c) Seat test.

Duration of test shall be as per Table 3 of IS 13095-1991. There should be no indication of leakage past the valves disc during test and valves shall be drop tight. Seat test shall be carried out in both directions of valve.

7.20 MARKING

Marking shall be cast integral on the body or on a plate securely attached to the body. The marking shall be in accordance with IS 9866 - 1981.

- a) Manufacturer's name or trade mark
- b) Nominal pressure of valve (PN 1.0)
- c) Size of valve (mm)
- d) IS marking embossed
- e) Heat number of cast
- f) Year of manufacture

7.21 THIRD PARTY INSPECTION

The valves shall be delivered to the site with manufacturer's test certificate and third party inspection certificate form approved third party (SGS/RITES) inspection agency.

7.22 PACKING AND STORAGE

- a) Packing: All valves shall be supplied with the wedge closed. Bright parts shall be protected against rust. Valves of small diameter may be packed in wooden cases and be suitably protected against damage. Parts liable to injury in transit shall be wrapped with wood - wool or similar material as a protection. Hand wheels of valves forwarded loose shall be removed before dispatch.
- b) Storage: Valves shall be stored in roofed stores away from dirt.

7.24 MODE OF MEASUREMENT AND PAYMENT

As mentioned above

7.25 NON-RETURN VALVES

Constructional Features

Non-return valves shall be swing check type , to be installed on the delivery side of the pumps, as shown on the piping & instrumentation diagram, and shall be suitable for installation in a horizontal pipeline. Rapid closing of the valve shall be non-slam type.

Materials of Construction

Body	CI to IS Gr FG260
Door	CI to IS Gr FG260
Body Ring	SS. AISI 304
Door Rings	SS. AISI 304
Hinge Pin	AISI 410 / 431

7.26 KINETIC AIR VALVES

7.27 GENERAL

Kinetic air valves are required with pressure rating as per static head confirming to IS: 14845.

7.28 SCOPE AND GENERAL DESIGN FEATURES

The air valves shall be capable of exhausting air from pipeline automatically when being filled. Air shall be released at sufficiently higher rate so that there shall be no restriction for the inflow rate. Similarly, the valves shall be capable of ventilating pipeline automatically when being emptied. The air inflow rate should be sufficiently high to avoid development of vacuum in the pipeline.

The design shall be such that, higher the rate of flow the greater the resultant down thrust, keeping the ball 'glued' to its seat until the last drop of air is expelled from the pipe system.

Each air valve shall be tamper proof, provided with an isolating sluice valve with flanged end connection. The possible air velocity (inflow and outflow) must be at least 10 m/s.

7.29 CONSTRUCTION FEATURES

The flow of air should be as unobstructed as possible. The low-pressure orifice shall be in the same axis as the main discharge / incoming air flow and must have a diameter sufficiently large. The valve body shall be designed in such a way that the turbulent air at the time of filling of pipeline shall not circulate and cause the ball to be caught in the discharging air stream and blowing the valve shut permanently. The cone angle of the low pressure (large orifice)

chamber shall be such that even at a critical velocity of air escaping at 344 m / sec the total impact force on the vulcanite covered ball is less than the suction force on the annular area between the ball and cone. The annulus around the low-pressure vulcanite covered ball is to be generously proportioned for discharge of air under various differential pressures. Normal range of cone angle is 45° to 60°.

The orifice shall be carefully profiled to allow the requisite flow of air under varying differential pressures. It shall be in moulded synthetic rubber such that even after extended contact the, vulcanite covered ball does not stick to it, when the line pressure becomes zero.

The high-pressure chamber having small orifice shall be so designed that the orifice is effectively sealed in working condition. The orifice shall be profiled in such a manner that the rubber-covered ball is not damaged even after extended contact. There should be machined guide in the chamber, which ensures that the ball travels vertically and makes contact with the nipple and seals off the orifice without fail. The orifice size shall not be less than 2.5 mm and tapering to 10 mm suitable to release accumulated air within the pipeline. High-pressure orifice may be fitted from bottom side of the cover.

7.30 MATERIAL

The material for different components parts of the air valve shall conform to the requirements given below:

No	Component	Material	Reference to IS No.	Grade of designation
1	Body, cover, valve disc, stuffing box, valve guide, cowl, gland, cap, joint support ring	Gray cast iron	210	FG 200
2	Stem	High tensile brass	320	HTB 1 or HTB 2
3	Low pressure seat ring and face ring	Natural rubber	11855	
4.	High pressure orifice	Leaded tin bronze	318	LTB-2
5.	Stem nut	Leaded tin bronze	318	LTB-2
6.	Body seat ring	Leaded tin bronze	318	LTB-2
7.	Bolts	Carbon steel	1363	Class 4,6
8.	Nuts	Carbon steel	1363	Class 4
9.	Gasket	Rubber	638	Type B
10	Gland packing	Jute/hemp	5414	Type III
11	Float (low pressure orifice)	Timber core with rubber coating	-	-
12	Float (High pressure orifice)	Timber core with rubber coating	-	-
13	Float guide	Leaded tin bronze	318	LTB-2

7.31 FLOATS

Minimum float diameters for kinetic air valves shall be as indicated in table 3 of IS 14845. The inner core of the floats shall be made from seasoned wood or any other synthetic material having sufficient bearing strength and equivalent specific gravity.

7.32 TESTING

Testing of all the air valves shall be carried out in the suppliers work shop as per IS: 14845.

Following tests shall be carried for each valve.

- Function and performance test as per clause 12.4.1
- High pressure orifice test as per clause 12.4.2
- Low pressure orifice test as per clause 12.4.3
- Body test as per clause 12.4.4

The performance of the valve for the above-mentioned tests shall be as specified under clause 12.1, 12.2 and 12.3 of IS 14845.

7.33 MANUFACTURER'S TEST CERTIFICATE

The manufacture shall provide a test certificate confirming that all the air valves have been tested in accordance with the relevant standards and performance of the test results observed.

7.34 THIRD PARTY INSPECTION

The inspection and testing of the sample air valves shall be carried out by the inspecting agency (SGS/RITES) appointed by the employer, in the manufacture's workshop before application of any paint. All the tests as required as per IS 14845 shall be conducted in presence of the inspecting agency on the sample valves from the lot (Number of valves to be tested from a lot shall be as per the relevant IS for sampling and testing). The valves shall be dispatched only after issue of the test certificate by the inspecting agency for satisfactory performance of the tested valves. The inspection charges for such tests shall be first paid by the contractor to the inspecting agency, which shall be reimbursed on production of the documentary evidence for the payment made.

7.35 COATING

All coatings shall be carried out after satisfactory testing of the air valves prior to dispatch. Each valve shall be cleaned, prepared and suitably protected with two coats of black Japan confirming to type B of IS: 341 or paint confirming to type 2 of IS: 9862 or IS: 2932 shall be applied by spray.

7.36 MARKING

Each valve shall be permanently marked with a plate securely fixed to the body with the information as specified under clause 15.1 of IS 14845.

The design, construction material, manufacture, inspection, performance and testing shall comply with all applicable Indian Standards and Codes. Nothing in the specification will be construed to relieve the supplier of this responsibility.

7.37 ACCEPTABLE MAKES FOR THE VALVES

Acceptable makes for the kinetic double orifice air valves shall be Fouress, IVC (IVI) or Kirloskar. All the valves shall have the same make.

7.38 INSTALLATION

The installation of the air valves shall be done at the locations shown on L-sections of the pumping main with isolating sluice valve. The job covers supply of the valves at the work site including all taxes and duties, cost of packing, loading, transportation, unloading, stacking and installation at the specified location with cost of all jointing materials such as nuts and bolts, EPDM rubber gaskets etc. The job covers field hydraulic testing of the valves after installation for the specified test pressure for the respective pipeline section.

7.39 MODE OF MEASUREMENT

As mentioned above.

EXPANSION JOINT

8.1 Expansion Joints for MS pipe stretches

Expansion joints shall be provided at the point of fixity & wherever over ground length of more than 300 m is laid, & near the pumps as per IS 5822. There shall be at least one expansion joint in between two anchorages of pipe line laid above ground. The joints shall be suitable for the ID of pipeline and tested at 1.5 times the design pressure rating of valves in the corresponding pipe lines. The expansion allowance must be not less than 150 mm.

SAND BEDDING WITH CONTRACTORS SAND

Filling in plinth and floors with contractor's soil, sand or murum in 15 cm. To 20 cm. (about 6" to 8") layers including watering and compaction complete.

9.1 GENERAL

After the structural foundation and plinth construction is over, and the sides of foundation trenches are filled up to ground level, the space between ground level and such level below top of plinth depending upon the depth of flooring, its bedding and foundation shall be filled in with contractor's soil, sand or murum, as specified and approved by the engineer, watered and compacted.

9.2 CONSTRUCTION

The filling shall be carried out as specified in 53 above except that the material to be filled in shall be brought from outside instead of from the foundation excavation.

The material to be brought from outside shall be either sand, murum, good yellow soil, or a mixture of these and shall be got approved by the Engineer. In no case, black cotton or similar greatly expansive and shrinkable soil shall be used.

The approved material to be filled in shall be clean and free from all rubbish and perishable material and all clods shall be broken to a size of 50 mm or less. The stacking of material should be done in such a way as not to interfere with any general traffic, or any constructional process or activities. The contractor shall be responsible for any mishap or inconvenience of any kind due to his default in this respect.

9.3 ITEM TO INCLUDE

1. Clearing the ground on which filling is to be done and dewatering if necessary.
2. Providing the approved material for filling in
3. Cleaning up the material to be used for filling if necessary
4. Filing contractor's soil in plinth in layers, watering and compaction
5. All labour, equipment and other arrangements necessary for satisfactory completion of the item.

ITEM OF REFILLING TRENCHES

10.1 After jointing and welding of pipeline, site wrapping coating and concreting work refilling of trenches 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. First 2 layers of 15 to 20 cms shall be free from stones or chips or any harmful material to protect the pipe from damage.

The filling shall be done 30 to 40 cms above natural ground or road 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 500 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 . 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 from edge of pipeline trenches 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.

HIGHWAY CROSSING

Wherever it is necessary to cross the Highways, the proposed pipelines should be crossed by the trenchless method. The pipes to be crossed are for raw water, treated water and sewage pumping mains. The pipe shall be laid inside the MS pipe casing with proper slope and alignment. The necessary arrangement viz, Jacking pits & receiving pits, Equipments, including men and material required for jacking the MS sleeve pipe by trench less method and laying the pipe inside MS sleeve pipe shall be arranged by contractor.

11.1 JACKING OF STEEL SLEEVE PIPE

The hydraulic pipe jacking can start after completing the Jacking pit. The hydraulic pipe jacking by tunneling method. A guide frame is fixed on the firm support of the Jacking pit. The main jacking station with hydraulic cylinders shall be fixed on the guide frame and to the abutment structure thrust block made of concrete or steel plate at the end of the pit. Mild Steel make jacking pipes (IS 3589-2001 with material grade is Fe 450) of required dia and length as per requirements are lowered on the guide frame and jacked section wise through the ground from the Jacking pit to the Receiving pit by means of hydraulic jacks. Each length of protective steel pipe is welded to the jacked pipe. Thus, the soil is removed by hand mining under the protection of a cutting shoe and moved through the jacked section to the surface. Depending on the existing soil the jacking pipes have to be lubricated with bentonite liquid. Boulders or other obstacles can be removed with the help of winches without any handicaps. Before arriving to the receiving pit construct the receiving pit. After completion of jacking procedure cut off the cutting shoe and remove out from Receiving pit. Completion of all inspection and handing over of each Section/Package of Pipe Jacking Works with protective steel pipes to the Engineers for inspection and after approval from Engineers Contractor to install his standard sewer pipes.

11.2 GROUND SUPPORT AND DEWATERING

The excavated area will be protected by the machine's shield and subsequently the pipes in order to minimize possible settlement of ground above the pipeline. In addition to that the bore is supported by bentonite suspension, which also reduces the friction between the pipes and the soil. Any dewatering if required shall be arranged by the contractor. There is no separate payment for dewatering.

11.3 CONSTRUCTION OF JACKING PIT

Jacking pit shall be constructed, of size of min. 4.5 m x 3.5 m. This size will vary depend upon the length of MS pipe. The depth of pit shall be such that it will suit the Jacking pipe depth. Proper timbering to be provided with the support of walls & struts during excavation. Required thickness of RR stone masonry wall in cement mortar 1:4 shall be provided for all four sides of the pits. 200 mm thick M 15 PCC floor shall be provided in the pit. A 400 mm thick reinforced concrete thrust or steel plate of suitable thickness wall to be provided to resist the Jacking force. The contractor may propose the alternate construction material such as concrete wall, brick masonry etc. during construction stage. Besides, the pit dimension may be changed to suit the site condition & requirement. Therefore, it is advisable that contractor should consider all these probable changes & method of workings and quote the rate accordingly.

11.4 RECEIVING PIT

The receiving pit shall be constructed with the same material and method adopted for Jacking pit. The size of receiving pit shall be 2.5 m length x 2.5 m width. The depth of it shall be as required to suit the jacking pipe depth. The receiving pit to be constructed as per drawing and as directed by Engineer.

11.5 SEQUENCE OF WORK

- Inspection of pits (including abutment structure, as per attachment) and approval (requirements as per structural analysis).
- Installation of hoist at starting pit.
- Measurement of height and slope for jacking.
- Installation of main jacking station and guide frame.
- Fixing of frame to the firm support.
- Make opening in the wall for beginning of jacking.
- Installation and adjustment of cutting shoe.

- Installation of bentonite liquid station.
- Transportation of Mild Steel pipe from stock yard to jacking station.
- Installation and adjustment of first steel pipe (3.00 metres long) or and as directed by Engineer.
- Fixing of steel pipe and cutting shoe by welding.
- Start of jacking by hydraulic pressure from the main jacking station.
- Lubricate the annular space by the bentonite liquid.
- Excavation of soil by hand mining under the protection of the cutting shoe.
- Transportation of soil through the jacked section with the *help* of tipper to the jacking pit and remove by hoist.
- After jacking of 3.00m installation and adjustment of the next steel pipe.
- Joint both the pipes by welding.
- Continuation of jacking, hand mining and installation of steel pipes for done alignment and slope of designed sewer and as instructed by Engineer.
- Before arriving to the Receiving pit construct the Receiving pit.
- After completion of jacking procedure cut off the cutting shoe and remove out from receiving pit.
- Dismantling of jacking station and guide frame and remove out from Jacking pit.

Final Inspection of each Section /Package of Pipe Jacking Works to the Engineer, Contractor to install his standard sewer pipes.

11.6 QUALITY CONTROL

Control of dimension of Jacking and Receiving pit (as per structural analysis).

Visual checks of each Steel Pipe against damages, disturbances and irregularities as well as measurement of the dimension of wall thickness and inner width. Supervisor will keep record for the pipes delivered to site directly from the factory.

Control of jacking direction and slope as per construction drawings before and during and after jacking.

Control of welding seam (tightness and thickness)

11.7 SAFETY MEASURES

In order to ensure safety during jacking procedure for all labour and the public, the following measures will be implemented :

- a. Signal hats and/or signs have to be erected in order to warn and divert the traffic around the concerned area, where pits are opened.
- b. Pedestrians will not be allowed to enter the area closer than 3 metres to an open pit or the control unit, unless there is sufficient barricading.
- c. A gas monitor has to be used for every entrance and work into the pits or line. Before access, the monitor shall be moved down to the bottom of the pit minimum 5 minutes by rope. When poisonous condition is detected, the area will not be entered.
- d. Accessing people shall use protective clothes, gloves, rubber boots, helmet, head lamp and additional all safety measures including an oxygen bottle with rescue mask has to be available on site all the time.
- e. A ventilation blower shall be used in the jacking section.
- f. Pre-arrangements with the next hospital have to be ensured in case somebody is injured.
- g. A first aid kit must be available on site at every time.
- h. No stay below hanging goods such as pipes.
- i. Use fire extinguisher for fire protection.

11.8 MEASUREMENTS

The measurement for State Highway crossing by push through method shall be in running meters.

MS Pipes and specials underground, outer coating:

12.1 Coating

All underground buried mild steel piping shall be protected by the application of hot coaltar enamel and fibre glass wrapping.

The coating shall consist of one coaltar primer coat, one coaltar enamel coat, wrapping of fibre glass and one more coat of enamel and then a final wrap of enamel impregnated fibre glass.

Pipe surface shall be cleaned thoroughly by shot or sand blasting process. The cleaning shall ensure that the pipe surface shall be free from millscale, rust, oil, welding scale and other foreign materials.

The priming paint shall be of material recommended by the manufacturer. Freshly primed pipe shall be

handled carefully to prevent damage. Any damaged areas shall be re-primed before applying enamel.

The material to be used as enamel shall be Shalimar coaltar enamel and fibre glass manufactured by Fibre Glass Pilkington of India Ltd., or approved equal.

Enamel shall be moisture and dirt free at all times prior to and at the time of heating and application. The primed surface shall be dry and clean at all times and the enamel shall be applied not later than 3 days after application of primer. Along with first flood coat of enamel, single spiral wrap of fibre glass inner wrap shall be applied overlapping at least 25 mm. It shall be seen that fibre glass impregnates in the first flood coat. Second coat of enamel and second wrap of bitumen impregnated fibre glass or kraft paper shall be applied in the same way. The total thickness of the coating shall not be less than 4 mm.

Each end pipes left bare for welding purpose shall be hand coated and wrapped after field welding is completed and the pipe has been hydro-tested.

12.2 Testing of coating and lining

The thickness of the pipe coating and lining shall be measured either by elcometer or by coating thickness gauge.

Bond test shall be carried out by cutting 25 mm square on three sides of the coating. Coating shall be pulled out by lifting one corner of the square. For a good coating the section shall not peel off easily. In addition the external coating shall be tested for any air pockets, porosity etc. by holiday detectors. Arrangements for such testing including the holiday detectors shall be made by the Contractor.

12.3 QUALITY ASSURANCE

The manufacturer shall control the quality of the product during their manufacturing process by a system of process control in order to comply with the technical requirements mentioned hereof as well as in IS 3589-2001.

Internal Linings – Cement Mortar Lining

13.1 Cement

The cement used for the lining shall conform to the existing standards on cement. High alumina cement as per IS 6452 shall be used for mortar lining of pipes which are to be used for water supply schemes.

13.2 Sand

The sand shall have a controlled granulometric distribution from fine to coarser elements; it shall be clean and shall be composed of inert, hard, strong and stable granular particles.

13.3 Water

The water used for the preparation of the mortar shall not contain substances deleterious to the mortar nor to the water it is eventually intended to transport in the pipe.

13.4 Mortar

The mortar of the lining shall be composed of cement, sand and water.

Additives, which shall be specified, may be used, provided that they do not prejudice the quality of the coating and that of the transported water.

The mortar shall be thoroughly mixed and shall have a consistency which results in a dense and homogeneous lining.

13.5 Application of the Lining

The cement mortar lining at works shall be applied by a centrifugal spinning process.

Apart from the inner surface of the joint, the parts of the pipe coming into the contact with the transported water shall be entirely covered with mortar.

The lining shall be cured at a temperature greater than 4 degree celsius.

13.6 Repair of Lining

The damaged or defective areas shall be repaired by using a trowel with fresh mortar so that a continuous lining having a constant thickness is obtained.

Additives may be included in cement mortar to obtain good adhesion against the side of the existing undamaged mortar.

13.7 Thickness of Lining

The normal thickness of the lining shall be as under,

Inside Diameter of steel pipe	Thickness, mm
1500 mm	12.0

At the pipe ends, the lining may be reduced to values below the minimum thickness. The length of chamfer shall not exceed 50 mm.

BLAST CLEANING OF PIPELINES

Prior to blast cleaning surfaces shall be inspected & cleaned if required. The surface should be free of grease, oil, or other foreign matter. Only approved solvents that do not leave a residue shall be used. Preheating to remove grease oil mild scale water & ice may be used provided all pipe is preheated in a uniform manner to avoid distorting the pipe. The external/ internal pipe surfaces shall be abrasive blast cleaned to achieve a near white metal surface. Abrasive blasting & coating shall only be performed when the metal temperature is more than 3° C above dew point.

ITEM OF RCC INFORMATORY STONES

The item includes providing and fixing RCC 1:2:4 Informatory Stones as per type design and drawing or as directed by the Engineer including painting, numbering, fixing in standard size C.C. 1:4:8 block etc. complete as directed by Engineer-in-charge.

15.1 MODE OF MEASUREMENT AND PAYMENT

The item shall be measured as number of informatory stones actually laid along the alignment of raw water rising main. The contract rate shall be on number basis.

ITEM OF REINSTATING THE ROAD SURFACE

16.1 GENERAL

The work shall be executed as described in item of works and to the satisfaction of concerned Deptt. & Engr. –in- charge.

16.2 MATERIAL

16.2.1 Bitumen

The bitumen shall be paying of suitable grade within the range S-35 to S-65 or A-35 to A-5 (35/40 to 60/70) as per Indian Standards Specifications for 'Paving Bitumen' IS:73-1961. The actual grade of bitumen to be used shall be decided by the Engineer-in-charge appropriate to the region, traffic, rainfall and other environmental conditions.

16.2.2 Aggregates

The aggregates shall comprise of 40mm size hand broken stones satisfying standard specification clause Rd 22.3.2 Page No.201 of edition 1979, 20 mm size and 12 mm size crushed aggregates satisfying standard specification clause Rd. 31.3.2 Page No.216 of edition 1979 for respective size of crushed metal. The aggregates shall be clean, strong, durable, fairly cubical in shape and shall be free from disintegrated pieces, organic or other deleterious matters. The aggregates shall satisfy the physical requirements set forth in Table 500-4 of Ministry of Surface Transport's Specifications for road and bridges edition June 1992.

16.2.3 Rubble for rubble soling

The rubble shall comprise of 15 to 23 cm size hand broken stones. The stones shall be clean, strong durable, fairly cubical in shape.

16.3 PROPORTIONING OF MATERIALS

The quantities of aggregates and bitumen required for the work of 75 mm compacted bituminous bound macadam is detailed below.

a)	40 mm size hand broken metal	9.00 Cub mt per 100 Sqmt
b)	20 mm size crushed metal	1.50 Cub mt per 100 Sqmt
c)	12 mm size crushed metal	1.80 Cub mt per 100 Sqmt
d)	Bitumen including tack coat at 50 Kg/100 Sqmt	250 Kg per Sqmt

16.4 PREPARATION OF BASE

The road surface shall be swept clean of all dirt, dust and other loose and foreign matter. The work shall be performed widths and lengths as directed by Engineer-in-charge and may require spreading rubble soling on the refilled surface ramming etc. The edge lines may be marked with stakes (formed of murum or metal 25 cm to 30 cm width).

16.5 SPREADING AND COMPACTION

16.5.1 Spreading of 40 mm size metal

40 mm size hand broken metal shall be spread evenly at the rate of 9 cum / 100 Sqm. of area so as

to form uniform layer over the width of road specified on plants. Any foreign matter, organic matter, dust, grass, etc. shall be removed immediately. The sections shall be checked with camber board, straight edge batten, etc. Any irregularities shall be made good by adding aggregates in case of depressions and removing aggregates from high spots.

16.5.2 Compaction of 40 mm size metal

The surface of 40 mm size metal layer after brought to necessary grades and sections shall be rolled with the use of 8 to 10 tons power roller. Rolling shall commence from the edges and progress towards the center longitudinally except on super elevated portion it shall progress from the lower to upper edge parallel to the centerline of pavement. When the roller has passed over the whole area as prepared once, any high spots or depressions, which become apparent, shall be corrected by removing or adding aggregates. The rolling compaction such that there is no crushing of aggregates and all other roller marks have been eliminated. The each pass of roller shall uniformly overlap not less than 1/3 of the track made in the preceding pass.

Spreading of 20 mm size metal

20 mm size crushed metal shall be evenly spread at the rate of 1.5 cum / 100 Sqmt of area over the 40 mm size hard hand broken metal compacted.

16.5.3 Compaction after spreading of 20 mm size metal

The surface of 20 mm metal layer after brought to necessary grades and sections is rolled with the use of 8 to 10 ton power roller. Rolling shall commence from the edges and progress towards the center longitudinally except on super elevated portion it shall progress from the lower to upper edge parallel to the centerline of pavement. When the roller has passed over the whole area as prepared once, any high spots or depressions, which become apparent, shall be corrected by removing or adding aggregates. The rolling shall then be continued till the entire surface has been rolled to desired compaction such that there is no crushing of aggregates and all other roller marks have been eliminated. The each pass of roller shall uniformly overlap not less than 1/3 of the track made in the preceding pass.

16.5.4 Bitumen application

Bitumen to be used shall be got approved from Engineer-in-charge of IS grade S35 needs heating to a temperature range between 177 degrees to 191 degrees. Bitumen other than grade IS 535 shall be heated to a temperature appropriate to that grade. Bitumen shall be applied through a pressure sprayer uniformly at the rate of 200 Kg./100 Sqm. To ensure correct application of bitumen being sprayed, known dimensioned area be checked for use bitumen and accordingly dosage may be increased or decreased as the case may be.

16.5.5 Key aggregate

On completion of bitumen application, 12 mm size key aggregates shall be spread immediately at a uniform rate of 1.8 Cum per 100 Sqmt. of area when entire surface is in hot condition. Brooms shall be used ensure even distribution of key aggregates.

16.5.6 Final compaction

Immediately after spraying of bitumen and spreading of key aggregates, the surface shall be rolled with a power roller to obtain full compaction and to force the bindage of key aggregates in to the interstices of the course aggregate. The rolling shall continue till the asphalt surface hardness and key aggregates stop moving under power roller.

16.6 SURFACE FINISH AND QUALITY CONTROL

The surface finish shall conform to requirement of clause 902 of specification for Roads and Bridges by Ministry of Surface Transport, Quality Control test and their frequencies shall be as per para 5 of table 900-3 on page No.228 of specification for Roads and Bridges by Ministry of Surface Transport.

16.7 ARRANGEMENT OF TRAFFIC

During the period of execution, arrangement of traffic shall be carried out according to the clause 112 (excluding last para of 112.6) of specifications for Roads and Bridges by Ministry of Surface Transport.

16.8 ITEM TO INCLUDE

- a) Labour and materials required for preparing surface
- b) Supplying spreading, compaction rubble soling of 30 cm depth.
- c) Supplying, spreading, compaction of 40 mm hand broken size metal and 20 mm crushed metal.
- d) Supplying, heating and spraying of bitumen
- e) Supplying, spreading and compaction of 12 mm crushed metal.

16.9 Wet Mix Macadam

- f) (Providing, laying, spreading _____ and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub-base/ base course on well prepared surface and compacting with vibratory roller to achieve the desired density as per clause
- g)
- h)
- i) _____
- j) ~~Providing and fixing water hammer control devices of Air vessel / Bladder type / 3 stage dynamic pressure suppressing valves~~
- k) _____
- l)
- m) Providing and laying Pitching on slopes
- n) laid over prepared filter media including _____ boulder apron laid dry in front _____ of toe of embankment complete as per drawing and Technical specifications as per section 2504.

Valve Chamber:-

Providing and constructing RCC valve chamber with 15cm thick 1:3:6 proportion PCC bedding excluding excavation, cement concrete grade M-15 (Nominal mix) with stone aggregate 20 mm Nominal size for benching, precast RCC frame as directed by Engineer-in-Charge. (Note :- Wall thickness : 0.2 M for depth of 1.2M and 0.35 M for balance depth exceeding 1.2M. 12 mm plaster 1:3 inside chamber).
Size 2.5m x 2.5m, depth 3.5 M with cover

ANNEXURE - "E-3"

Construction of RCC sumpwell and OHSR's of Capacity and Staging height as mentioned below.

Sr. No.	Particulars	Capacity	Location	Tentative SBC of Soil
1	Construction of RCC Sumpwell cum Pumphouse	1700KL	Near WTP	10T/Sqm
2	Construction of RCC MBR for Left Zone	2090 KL, 25M Staging, 7.0M container Height	Near WTP	10T/Sqm
3	Construction of RCC MBR for Right Zone	4680 KL, 25M Staging, 7.0M container height	Near WTP	10T/Sqm
4	Construction of RCC OHSR at Zone 3	2850KL, 21M Staging, 7.0M Container height	Chantidih, Near existing OHSR of 450KL	10T/Sqm
5	Construction of RCC OHSR at Zone 4	820KL, 21M Staging, 7.0M Container height	Patwari Training Center, Near existing OHSR of 1375KL	10T/Sqm
5	Construction of RCC OHSR at Zone 7	880KL, 21M Staging, 7.0M Container height	At Torwa, Near existing OHSR of 1375KL	10T/Sqm
5	Construction of RCC OHSR at Zone 7	600KL, 21M Staging, 5.0M Container height	Near PGBT, Near existing OHSR of 750KL	10T/Sqm
6	Construction of Monitoring Room for SCADA Monitoring	250 Sqm	At WTP Campus	10T/Sqm

Note:- Specifications for execution of sub items in making RCC Sump covered under MBR/OHSR Sub work Specifications separately attached in details in this NIT.

The table below shows details of Inlet, Outlet, overflow, and wash out pipe diameters of OHSR's

S.NO	Name of OHSR	Inlet Pipe diameter in mm	Outlet Pipe diameter in mm	Overflow pipe diameter in mm	Washout pipe diameter in mm
1	Chantidoh	350	750	350	200
2	PTC Pro	350	350	350	150
3	Tikrapara Pro	300	450	300	200
4	Tikrapara Pro	300	350	300	150

GENERAL INSTRUCTIONS :

The Pump House should be designed to provide architectural appearance and all the related civil features should be as per appearance.

The area of the Pump House is tentative but the contractor shall prepare the plans as best fitted within the frame work of RCC Sump with all the amenities as described in latest building code and as per the need of the project.

The Pump House shall invariably RCC framed structure with brick masonry walls, plastered internally and externally, base slab and roof slab, balconies and chhajja with parapet wall, flooring with vitrified tiles, simple pop to floors, acrylic OBD inside and washable acrylic exterior painting, aluminium glazed and panelled doors and windows.

The contractor shall submit the detailed plan with building specifications for the Pump House to Engineer –in- charge and after the approval only the work shall be started

1.0 SCOPE OF WORK & SPECIFICATION OF WORK : FOR SUMPS MBR & OHSRS

1.1 THE WORK INVOLVES :

(i) Designing, Construction, testing and commissioning of 2 nos. R.C.C. Elevated Service Reservoir as MBR at Birkona having capacity 2090 & 4680 Kilo Litres over 25 m staging height each and 04 nos. R.C.C. Elevated Service Reservoir at various locations with with different staging heights with maximum water depth 7.0m for MBR & OHSR's and 5.0m for one OHSR as shown in table below and including providing and fixing of ISI mark DIDF/MSDF pipes and specials for Inlet, Outlet, scour and over flow delivering up to 5.0 metre away from R.C.C. outer columns of reservoir, ISI mark DI double flanged heavy duty specials and duck foot bends conforming to IS 1538-1976, and DI sluice valves class PN 1.6 conforming to IS 14846:2000 of IVC/Kirloskar/VAG/Durga/Upadhaya make with dismantling joints. etc. R.C.C. valve chambers with R.C.C. cover and providing and fixing of all accessories such as lightening arrestor, digital water level indicator, RCC stair case from ground level to Balcony and from balcony to roof of the O.H.T. and M.S. ladder from roof to inside floor level of tank, ventilating cowls/ shaft, manhole covers with frame and S.S. (Stainless Steel) pipe railing for stairs balcony and at roof, flooring etc. all complete as per detailed specifications on lump sum basis. The designs and drawings shall be got approved from NIT/ Govt. Engineering College and then submitted to BMC at the cost of contractor

i) Design, drawings & construction, testing & commissioning of circular RCC 1 no sump well having TOTAL capacity of 1700 KL with maximum water depth 3.0 m. all norms of OHSR shall be applied in sumpwell also. Construction of overhead pumphouse with all ancilliary items to the finished level

ii) Design, construction, testing and commissioning of 2 no RCC elevated service reservoir as Master Balancing Reservoir of capacity 2090 KL & 4680KL and 25M staging Height each to fill up all the Overhead Tanks at various locations in Bilaspur Town. Construction of Control Room below MBR of area not less than 250 Square Meters with all fixtures, valves, pipes for SCADA Monitoring.

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 7.0m in case of MBR and 5.0m for OHSR's. The foundation, columns, bracings etc. should be so designed, so as to have a provision for construction of a single story building between the G.L. bracing and first bracing with R.C.C. roof and brick walls. The live load of roof slab shall be taken as 150 kg/m² and the dead load of roof slab shall be taken as 360 kg/sqm. The position of bottom of bracing shall be so fixed that the head room of ground floor if constructed should be approximately 3.5m. The construction of such building works is not included in this lump sum contract except specified.

[Free board for the container of OHSR 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 which ever 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 **MBR & OHSR** 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.
- 2.3 The offer shall include provision for 1.2 m wide R.C.C. balcony at bottom slab level, rail balcony and at roof level, lightening arrestor, digital water level indicator, 1.2 meter wide RCC from ground level to balcony and 0.70 m (with stainless steel railing & posts including blister RCC stairs from balcony to roof of the tank. Steel ladder from roof of the tank to floor of the tank pipes and fitting (including puddle collars) up to duck foot bends and from duck foot bend minimum 5.0 meters out side the supporting structures i.e. RCC column including C.I. valve including their painting and architectural treatment, protection and drainage work .
- 3.0 **S.B.C.**
- 3.1 SBC of the soil is to be got tested by contractor by conducting suitable Soil Bearing Capacity conforming to relevant IS code, however the min SBC for design shall be 5.0 T/SqM and the max shall be 20 T/SqM for design purpose
- 3.2 **TRIAL PIT**
Contractors are advised to carry out there own trial pit section to get the idea of soil condition.
- 4.0 **STEEL :**
- 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 at ground level near the tank. 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 Stainless Steel railing 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 over head 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 arrangement it will be and washout arrangement as well By-pass Arrangement shall be made directly connecting the Inlet pipe with Outlet Pipe before Inlet pipe entering the MBR / OHSR and which shall have a controlling valve which will be closed always except when needed for Repairs, O&M of MBR / OHSR.
- 18.0 **Water level indicator** :- Digital/ mercury Water level indicator shall comprise of electronic sensor system for accurate level marking with mercury level and all the allied fittings such as electronic display board and battery backup etc complete
- 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 OHSR, exposed surface of sump well & RCC pump house shall be done with premium smooth emulsion paint 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 GL brace.**
- 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.

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.

22 MATERIAL :

22.1.1 STEEL :

All metal for reinforcement shall be free from loose mill scale, loose rusts, oil and grease or other harmful matter. The steel used for reinforcement shall be cleaned immediately before placing the concrete.

22.1.2 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.

22.1.3 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 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 TEST :

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 cost 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 required for testing of materials such as aggregate, sand, cement, steel 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/ Durga/ Upadhyay 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 OHSR should be connected to the nearest natural drain/sewerage line available with pipes and other required specials provided by the department but including testing by the contractor.
- 25.0 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 defect the Corporation/ BMC 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 the dimensions of all components and other details.
- 40.0 The contractor shall propose colour scheme with atleast three alternatives and after approval only the work shall be started.
- 41.0 All the valves and electromechanical fittings shall be SCADA & PLC compliant with actuators for implementation of SCADA.
- 42.0 The successful bidder shall assist the BMC in the process of getting the grants from State/ Central Governments.
- 43.0 The contractor has to procure and install informatory board's displaying Name of work at the location given by BMC at his own cost.

**Commissioner
Municipal Corporation
Bilaspur**

SPECIAL CONDITIONS

ANNEXURE - 'E-3'

DESIGN, CONSTRUCTION OF R.C.C. ELEVATED SERVICE RESERVOIRS INCLUDING TESTING AND COMMISSIONING

The relevant IS standard specifications shall be strictly followed.

GENERAL INSTRUCTIONS :

- 1.0 Elevated service reservoir should be designed to provide architectural appearance and all the related civil features should be as per appearance.
- 1.1 The RCC columns supporting to the tank should necessarily be round shape and not square or rectangular. The top i.e. water container may be circular/square or rectangular.
- 1.2 On the bottom floor of the water container cast iron or stainless steel grating should be provided over the supply outlet and scour outlet. This is essential to prevent any accident for the labour attending to periodical cleaning of the tanks. One such accident occurred at Sehere when two persons in succession were sucked in to the scour pipe, the top of which could not be seen because of calcium deposits due to regular use of bleaching powder. Cast Iron grating 20x20mm or stainless steel square 20x20mm can be used with square frames on top of the outlet.
- 1.3 The over flow pipe should not be connected to the distribution system. Connection of over flow pipe to the distribution system can result in over filling of the elevated service reservoir in case supply valves of the distribution system are not open. The over flow pipe should always be kept open for draining any excess storage in the tank.
- 1.4 It is extremely important to make arrangements for supply of sufficient water at the construction site for curing of the concrete. Continuous and efficient curing is extremely important for development of good compressing strength in any concrete structure.
- 1.5 It is advisable to use metal derived from igneous rock preferably of basaltic or granite origin. The coarse sand should be free from soil. This can be checked easily by half filling a transparent glass with the sand sample and the other half by clean water. Stir the sand vigorously. Silt in the sand can then be easily seen in the top water portion.
- 1.6 It is extremely essential the contractors undertaking the work should have a concrete mixer with them. No hand mixing shall be allowed. Ready Mix Concrete obtained from a Batching & Mixing Plant only shall be used for construction of all components of OHSRs & MBR from RCC foundation upwards.
- 1.7 In no case the concrete should be laid without vibration. It is desirable to keep two concrete vibrators at the construction site so that in case of a break down the other vibrator can be used. It is desirable that the divisions have with them at least two concrete vibrators, of suitable diameters which is an essential T&P for laying concrete.

FOLLOWING SPECIFICATIONS SHOULD BE STRICTLY FOLLOWED :

2.0 CEMENT AND CONCRETE :

2.1 Minimum Strength of Concrete :

Minimum strength of concrete for components of elevated tank will be as below :-

- | | |
|---------------------|---------------------|
| Columns staging | - M25 (250 kg/sqcm) |
| Tank including roof | - M30 (300 kg/sqcm) |

2.2 Minimum Cement Content

From durability considerations minimum cement content shall be as below (conforming to IS 456) :-

Concrete - M25 - 350 kg/cum
Concrete - M30 - 400 kg/cum

2.3 **Cover of Concrete :**

The minimum cover shall be 40 mm for all the reinforcement. For foundations this cover shall be 60 mm.

2.4 **Cement**

The cement shall be ordinary port land cement/port land slag cement/concrete special cement conforming to ISS.

2.5 **Water Cement Ratio :**

Water Cement Ratio shall not be more than 0.45 this means 22.5 Litres of water per 50 kg. bag cement.

2.6 **Use of Construction Chemicals :-**

When the water cement ratio is less, the strength and durability of concrete is good. It is advisable to use plasticisers in concrete and reduce water cement ratio up to 0.4. Plasticisers manufactured by reputed companies are recommended. Proportion of plasticiser to be used shall be as per the instruction manual supplied by the manufacturers.

2.8 **Construction Joints :**

Construction joints be treated in accordance with IS 456:2000. The surface of already laid concrete be cleaned by water jet and cement slurry be applied. Cement mortar 10mm thick of the same proportion as in concrete be applied and then fresh concrete of the lift be laid. The form work must overlay 100 mm on the already laid concrete.

2.9 **Minimum Dimensions and Shapes :**

Minimum Dimensions shall be as below :

Circular columns - 400 mm
Tank wall 200mm
Bottom slab/ Dome 150mm
Top slab 150 mm

Note -

Rectangular/square columns are not allowed Circular shafts are also not allowed.

Footing - The depth of footing on the face of the column shall not be less than $1/3^{rd}$ of the spread of footing from the face.

3.0 **STEEL : (Conforming to relevant IS code of water retaining structures)**

3.1 Minimum steel : Design requirements as set out in relevant codes in respect of steel shall be fully satisfied. However, following minimum steel should be provided.

(a) Vertical steel in columns 0.8% of cross sectional area actually required and 0.3% where larger section than actually required is provided.

(b) Horizontal link in columns Not less than 8 mm dia at 200mm c/c or 10 mm dia not

more than 300 mm c/c.

- (c) Exposed RCC surface On both faces when thickness is 150 mm or more
2 kg/sqm in perpendicular direction
The above requirement is satisfied if
8 mm bars @ 200mm c/c OR 10 mm bars @ 300mm c/c
are provided.
Even if design steel is less than above, the above
minimum shall be provided.
- (d) Steel in tank As per provision of IS 3370 subject to minimum as set
out in (b) above.

3.2 **Maximum spacing of reinforcement :**

Maximum spacing of main reinforcement in slab or walls shall not more than 150 mm centre to centre. The spacing of secondary bars, such as distribution steel or vertical bars in columns.

3.3 **Type of Steel :**

The steel for reinforcement shall be thermo mechanically treated bars conforming to ISS.

Detailing of Steel

Before commencing the work, Executive Engineer in-charge should study the drawing. It must be insisted that the designer provides details of the shape of each bar its diameter, length and numbers of each category in a schedule of reinforcement. This must be incorporated in every working drawing.

4.0 **Protection work Drainage :**

At the ground level, 100 mm thick cement concrete flooring in M₁₀ should be provided for an area which is 1.5metre more than the dimensions of tank on all sides. This should be laid in a slope of 1:60 from the centre and drain be constructed around for outlet of water.

5.0 **Approval of Design & Drawing :**

The contractor will submit the detail design & drawings of the R.C.C. elevated reservoirs within 30 days from the date of issue of written order to commence the work for approval of the competent authority of the Department in five copies through PDMC.

**DESIGN, CONSTRUCTION OF R.C.C. FRAMEDED SWITCH ROOM BELOW MBR
FOR MONITORING THE SCHEME**

The IS standard specifications shall be strictly followed.

GENERAL INSTRUCTIONS :

The switch room should be designed to provide architectural appearance and all the related civil features should be as per appearance.

The area of the switch room is tentative but the contractor shall prepare the plans as best fitted within the frame work of MBR with all the amnities as described in latest building code and as per the need of the project.

The switch room shall invariably RCC framed structure with brick masonry walls, plastered internally and externally, base slab and roof slab, balconies and chhajja with parapet wall, two individual sanitary units and one common wash room each for ladies and gents, flooring

with vitrified tiles, simple pop to floors, acrylic OBD inside and washable acrylic exterior painting, aluminium glazed and panelled doors and windows, two major monitoring rooms and one residential unit with a kitchen.

The contractor shall submit the detailed plan with building specifications for the switch room to Engineer –in- charge and after the approval only the work shall be started

ANNEXURE - "E-4"

Scope of work & Specifications for Water Treatment Plant 72 MLD based on Lamella Clarifier & Recirculation of Used Back Wash Water inclusive of all civil works, providing & installation of all Mechanical & Electrical Equipment including trial run for twelve months followed by 05 years of complete Operation and Maintenance including replacement and warranty.

1.0 SCOPE OF WORK:

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 72 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 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 72 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 plant 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 72mld 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 Three No. Units of total 72 MLD capacity)
- Rapid Sand gravity filters
- Disinfections arrangements
- Laboratory & Laboratory equipments
- Clear water sump well and pump house
- Used Back Wash Water Recirculation arrangement

The source of water is Khutaghat Dam with a canal intake at 1800m downstream in RBC, from which raw water will be collected into RCC Sumpwell of 1700KL. From the sump water shall be pumped to the cascade aerator of the Treatment Plant which is proposed to be constructed near the village Birkona. 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 & Laboratory equipment.

The plant should be capable of treating the raw water to get the filtered and chlorinated water 72 MLD in 22 hours excluding wash water requirement per day. It should also be possible to overload the treatment plant by 25% .

Characteristics of Raw water:

The quality of raw water to be dealt which is indicated in the analysis reports enclosed (Annexure-I) for guidance. Normally in fair weather, the water is clean, In Mansoon its turbidity ranges from 500 to 1000 ppm. The treatment Plant should be capable of dealing with such a turbidity and colors, without variation in quality of filtered water. Typical raw water characteristics in the annexure attached.

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.

Raw Water:

Raw water will be taken from the existing intake well in Harpa river just besides the WTP campus and pumped to the treatment plant. **The typical analysis for physical, chemical and bacteriological**

characteristics of raw water samples of Canal water is enclosed. The bacteriological pollution is not expected to exceed the M.P.N. count of 2400 coliforms organism per hundred Mili liters. The turbidity of raw water during dry season is as low as 5 PPM but during mansoon as high as 1000 PPM. The raw water results may deviate but in any case the standards of clear water must be achieved.

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 raw water rising main of 900 mm dia DI (Class K-9) will be laid by contractor up to the cascade aerator. The connection of this raw water rising main with the cascade aerator is included in this contract.

The raw water will be taken to casecade aerators, which will be suitably designed for dissipating the incoming hydraulic energy. The residual pressure at the end of raw water pumping main can be provided as 5.0M.

MEASURING FLUME AND EQUIPMENT: -

Design: The flume shall be designed for a flow of 72 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 parshal 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 of 72 MLD 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 falldition. It shall be ensured that the weir plates does 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 form 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 a provision of 100% over loading) 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 be 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.

(5) 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 are designed with a retention time of 60 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 72 MLD in 22 hours. 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 R.C.C. NP2 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 R.C.C. pipes class A and 250/300 mm dia 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 25% 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
- c. 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) G- ROTATING BRIDGE-

The clarifier scraper bridge structure shall be made of welded and bolted SS 304. structural. It will be a lattice girder bridge pivoted at the center and trolley fitted with pneumatic solid rubber tired wheel and resting on clarifier wall.

The bridge shall be 1.2 mt. wide made of welded and bolted R.S. section of suitable size.

The scraper arm with scraper blade of suitable size fitted with rubber squeezer shall be suspended from

the top of bridge having M.S. grill walkway 8mm thick M.S. chequered plate walk way ground Flocculator drive gear. The scraper arm shall spread across the radius of the clarifier zone and to the dia. of flocculation zone. The bridge shall be so designed that it should also act as a hand railing or otherwise additional double row 32mm. SS304 pipe railing light duty shall be provided. The driving mechanism for the bridge shall rotate over the steel fabricated track located over peripheral wall or directly over wall by rubber tyre wheel and comprise of GEC/Kirloskar/Crompton/Jyoti make A.C. motor of suitable rating, 4 pole horizontal foot mounted class 'B' insulation T.E.F.C. squirrel cage motor having degree of protection as IP 55 suitable for 415 ± 10 V-3 phase 50 Hz. having flexible coupling single speed worm reduction gear, duplex chain sprocket drive, plumber block with bearing M.S. ideal and driving shaft. The central bearing shall comprise of combined radial and thrust bearing housed in high grade CI housing with G.M. bush for rigidity.

The bridge shall be designed to take its own dead weight with uniformly distributed loading of 400kg/sqm. The bridge should be so braced that deflection at mid span is less than 80mm. The central bearing assembly shall be adequately infraction in all respect catch trays shall be provided to prevent slippage into water.

Five rings special current Collector shall be provided for each clarifier for transmission of electric power through pipe laid under floor from outside to the sub distribution board located over rotating board.

300 mm dia R.C.C. NP3 pipe and specials as required shall be provided for each clarifier under the floor slab between sludge out let channel around inlet well to sludge outlet chamber at periphery.

300 mm dia D/F PN-1 electrically/ manually operated C.I. Non rising spindle sluice valve conforming to B.I.S. standards and bearing ISI mark is to be provided for each clarifier. One M.S. steel operating shaft with 25mm dia extension complete with C.I. head stock, 200 mm dia hand wheel and brass indicator plate for operation of sluice valve for each clarifier is to be provided. The valve shall be taken into SCADA loop for automatic drain disposal

For each clarifier bridge 2 Nos. 450mm wide made out of M.S. black medium class pipe to IS 1239 rung ladder painted primer and paint, fixed to clarifier bridge structure for access inside the clarifier zone/ flocculation zone be provided.

(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 **72000 m³ in 22**

hours. Atleast 4 no of filter beds 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 average filtration rate (total flow rate through all filters divided by the filtration area of all on line filters) at maximum capacity will be not more than 12 m³/m²/hr with two filters off line for washing & maintenance. 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 constant rate and constant head type. Each filter bed self- contained and capable of working under full or part load independently of the other. Arrangement have 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 300 LPM/Sqm 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.

Piozometers should be provided to deter mint 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 kg/cm², 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.

Flitter 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 titles 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 5.0 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 Bilaspur 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 $\pm 20\%$ of the average over a filter run length. At the start of the filter run, when the bed is clear the filtration rate shall be 20% above the average value whilst at the end of the filter run the filtration rate shall be of 20% 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 20% 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 $\pm 20\%$ of the average flow through 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 brick masonry in cement mortar 1:4 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 conforming 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 conforming 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 lined 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 area of minimum 60 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 60 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 apart 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 BMC reserves the right to alter the front elevation of filtration plant/filter house if it does not appeal to the BMC 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.

6.17 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 monorail.
- 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 Dual media sand filters, 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, laboratory, 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 10 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.

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.

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.**

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.

1.3.3 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.

1.3.4 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.

1.3.5 CLEAR WATER PUMP HOUSE :

It should have sufficient space to accommodate minimum six Nos of Vertical Turbine pumps for one pumping mains for including cable ducts, surge protection (If so required), NRV, suction pipe etc. complete. It should have sufficient height to accommodate the gantry crane of suitable capacity. It should have additional **store room of minimum size 5.00x4.00x4mt. Switch Board room of size 3.00x6.00mt and office room minimum 4.00x6.00mt. in size and toiled units.**

1.3.6 LABORATORY BLOCK :

There should be one laboratory block of minimum size 10.00x6.00mtx 4m provided with one Chemist room, one office room and remaining part for storing the chemicals and conducting the test, toilet. WC block should be attached with laboratory.

1.3.7 WASTE WATER COLLECTING SUMP AND WASTE WATER LINE :

The waste water or sludge water from flocculator, Lamella clarifier and Dual Media filter plant and other units shall be collected in waste water collecting tank of at least 4 days detention time and depth according to the levels. It shall have such level that the waste clear water tank can be cleaned easily. The overflow of waste water from tank will be directly discharged by gravity away from treatment plant to the natural Drain. The chambers shall be provided at maximum 60.00 mt. Internal and at turning and where ever necessary. The diameter of pipe should be R.C.C. class NP2 or as designed by the contractor.

1.3.8 WASTE WATER PIPE FROM FLOCCULATOR, FILTER, CLEAR WATER SUMP:

The waste water line from all the units R.C.C. class NP2 up to the waste water sump shall be provided.

1.3.9 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

2.0 COMMISSIONING AND TESTING OF PLANT:

2.1 BASIC INFORMATION:

The source of water Right Bank canal located near the Regulator near Khutaghat Dam in Bilaspur District Bilaspur.

The tested quality of raw water is appended in Annexure F. **The quality of raw water for design purpose may be taken as following:**

S.No	Parameter	Units	Minimum	Maximum
Physical Characteristics				
I	Turbidity	NTU	22	1000
II	pH		8.0	8.5
III	Colour	Pt Cobalt Scale	5.0	5.0
IV	Taste and Odour	--	Unobjectionable	
Chemical Characteristics				
V	Conductivity	Micro mhos/cm	114	176
VI	Total Alkalinity	mg/l	132	76
VII	Chloride	mg/l	18	29
VIII	Nitrates	mg/l	Nil	Nil
IX	Total Hardness	mg/l	72	94
X	Calcium	mg/l	16.0	30.4
XI	Magnesium	mg/l	7.8	6.3
XII	Iron	mg/l	Nil	Nil
XIII	Fluorides	mg/l	0.1	0.11
XIV	Sulphates	mg/l	30.0	38.0
XV	Total Dissolved Solids	mg/l	150	88.0

However the firm or the contractor's are advised to assess the water quality themselves before designing the plant and its performance.

2.2 LOCATION OF TREATMENT PLANT :

Location of treatment plant is near Birkona at village Birkona, District Bilaspur and Sufficient land of 25000 sq-m area is available for this purpose.

2.3 SITE TOPOGRAPHY & GEOLOGY :

The site is normally flat with average ground level is varying from RL 276.5 to 291 m. The contour plan details of site is enclosed.

2.4 BEARING CAPACITY OF SOIL :

This is the responsibility of the contractor to test and check the bearing capacity of soil and submit it with the design. This bearing capacity should be tested by plate load bearing test method by any Govt. Engg. College.

2.5 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.

2.6 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 72 MLD (considering 22 hours pumping only). 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

2.7 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 or 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.

2.8 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 have 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.

2.9 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.

2.10 Deleted.

2.11 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.

2.12 CHLORINE RESIDUAL MONITORING

- a. One chlorine residual sampling and transmitting unit for settled water shall be provided at outlet of clarifiers. 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.

2.13 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.

2.14 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:

2.15 Raw water at the inlet works;

2.16 Clear water reservoir outlet.

The bench shall be sited in the reception area of the administration building. In addition a suitable sampling arrangement shall be included in the laboratory to enable samples to be obtained as follows :

- a. Raw water at the inlet works;
- b. Clarifier inlet;
- c. Rapid gravity filter inlet;
- d. Clear water reservoir outlet;
- e. Supernatant

The sampling arrangement shall include all interconnecting pipe work, automatic sampling pumps and taps, adequate sink and drainage, all incorporated into a satisfactory sample bench.

In addition, convenient means shall be provided to obtain samples manually from each filter beds outlets and sample cocks shall be provided locally at the clear water reservoir outlet.

2.17 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.

3.0 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.

3.1 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.

4.0 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. cowls 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 :-

- 5 A R.C.C. M-30 clear water sump of capacity with considering the 45 minutes storage capacity below invert clear water chamber should be provided. The sump should be covered at top with R.C.C. roof slab and necessary ventilating cowls, man hole with C.I. frame and cover, scour pipe with C.I. valve, inlet arrangement, Aluminium ladder, digital water level indicators etc. should be provided in the sump well. The contract also includes the construction of clear water pump house which should be suitably located near the clear water sump well. This clear water pump house shall be a part of the plant. An area of approximately 40 sqm should be provided for the

pump house to accommodate 3 nos. centrifugal pumping sets. The height of pump house should be at least 4 M. The pump house should also be capable of accommodating bus-bar channel, starter, O.C.B., sluice valve, reflux valves and flooring for electrical cables concrete work for delivery pipe line, trench etc. for clear water pumping main of 600 mm dia in the pump house and also the supporting structures for cables and pipes. The tenderer shall also quote for supply and erection of 5 M.T.Capacity electrically operated gantry Crane. Centrifugal pump sets with accessories will be installed in clear water pump house, by other agency. The foundation and floor design of pump house should be done properly and due considerations for vibration should be given in its design. The lay out of pump house should be capable for future expansion. The difference of level between the floor of pump house and the invert of sump well shall not be more than 1.0M in any case. Preferably there should be positive suction head. Further, the height of plinth of pump house above ground level shall not be less than 0.6 M. The lay out of the WTP shall be arranged in such a way that in no case the rain water can enter the pump house on the pump floor.

GENERAL

- There should be interconnecting channels, pipes, valves etc. for bye pass arrangement so that any individual unit can be put out of operation without affecting the working of others the bye pass arrangement shall also be designed to carry 25% additional flow during emergency.
- Electric Motors shall be covered in properly designed and shaped 8 gauge G.I. sheets to protect them against weather effects.
- The Treatment units shall be provided with desludging arrangement including sluice valves with operating rod and wheels and piping to lead sludge to the wash out system. There should be automatic arrangement to operate and also the manual in the case of failure of the automatic device.
- The provision of the driving units for Flash Mixer, flocculator and clarifiers shall be inclusive of all electrical connection and control, switch gear over load alarms etc. necessary for the designed efficiency and safety in working and up-keep of the plant.
- All the treatment works shall have proper walkways around the minimum width of 1.20 M and shall be shapped aesthetically. There shall be a pipe railing of architectural design and the bends, corners and vertical stays and the horizontal railing properly, finished so as to offer a fine & streamline look. The number and placing of the walkway to be such that it will enable the operating staff to approach to the electrical motors and other essential portion of treatment work easily.
- All the C.I. Pipes used in the plant shall be of double flanged class “B” conforming to I.S. 1537 latest addition duly inspected by DGS&D/SGS/RITES.
- The C.I. special should be double flanged conforming to IS 1538-1976 duly inspected by DGS&D/SGS/RITES.
The C.I. Valves should be of double-flanged class II with I.S.I. Mark duly inspected by DGS&D/SGS/RITES.
In no place operating rod of any valve or mechanism or any other obstructions shall come in 1.2 m walkway.
- Fire extinguishers for each building at every floor shall be provided, and fixed as per the relevant i.S.

Specification.

- Overflow from clear water sump shall be connected to sludge disposal system and should have free fall.
- Provision of SCADA and PLC with complete automisation of proposed WTP including the cost of Computers & peripherals, data loggers, including successful operation & maintenances.
- Provision for Plantation & Butification of WTP premises.
- Glazed tiles of best quality to all water retaining faces and filter manifold as per the directions of Engineer in Charge
- **INLET CHANNEL WITH PARSHALL FLUME IN WTP:**

Minimum Free Board	300mm
Velocity of Flow	0.5 – 0.75m/sec
Retention time	Deleted

- **PERFORMANCE STANDARDS OF RAPID GRACITY SAND FILTER:**
For rapid gravity filters, the performance standards should be in accordance with para 7.8.2 RAPID SAND FILTERS of Manual on water supply and treatment published by CPHEEO.”
- **CLEAR WATER SUMP for 72 MLD WTP:** VT pumps are provisioned in the Clear Water Sump.
- **DESIGN FLOW FOR 72 MLD WTP:**The Water treatment Plant shall be designed for 72 MLD for 22 hours running per day plus 3 % of back wash water recirculation.
- **PLC SCADA AUTOMATION SYSTEM:** **The complete SCADA-PLC Automation monitoring and control system will be provided with Uninterrupted Power Supply for trouble free operation of WTP.**
- **VALVES AND APPURTENANCES:** The CI/ DIDF valves shall be provided conforming to IS 14846:2000 as per QAP by DGS&D, RITES/SGS Third Party Inspection.
- **SLUDGE DISPOSAL STANDBY ARRANGEMENT FROM THE 72 MLD WTP:** As a standby arrangement, the wastewater and sludge disposal shall be done in the nearby nallah at a level above HFL as approved by the Engineer-in –Charge.
- **RAW WATER FOR TESTING OF WATER RETAINING STRUCTURES:** Only raw water will be made available to the contractor by BMC for hydraulic testing purpose after which the structure and pipelines are required to be disinfected by the contractor at no extra cost.
- **SANITARY BLOCK IN WTP AND RAW WATER PUMP HOUSE:** Minimum area of sanitary block shall be 9 sq-m to be provided in the proposed Water Treatment Plants and Raw Water Pump House.
- **Air Wash System IN 72 MLD WTP:** The Air Wash System is required to be designed as per para 7.6.3.13 Surface Wash. For this free air of about 36-45 m/hour (600-900 LPM/sq-m of the filter area) at 0.35 kg/sq-cm is forced through the under drains until the sand is thoroughly agitated for a duration of about 5 minutes.
- **UNDER DRAIN PIPE IN WTP FOR THE FILTER BEDS:** The M.O.C. of under drain pipe shall be UPVC Pipe Class 10 kg/cm² conforming to IS; 13592(1992)-UPVC Pipes for Soil and Waste Discharge System.
- **BACK WASHIN OF FILTERS OF WTP:** (a)Refer para 7.6.3.12 High Rate Backwash of the CPHEEO Manual according to which the pressure at which the wash water is applied is about 5 m head of water as measured in under drains .
(b)Capacity of Back Wash overhead storage tank must be sufficient to supply wash water to 2 No. filter units at a time .refer para 7.6.3.12 of CPHEEO Manual

- **WEIGHING MACHINE IN WTP:** Platform type weighing machine shall be of capacity 5MT to be provided by the Contractor at no extra cost.
- **LIME DOSAGE FOR WATER TREATMENT:** The lime dosing rate should be 20 ppm.
- **CHLORINE ROOM, STORE & CHLORINE TONNERS FOR 72 MLD WTP:** The sizes of Chlorine room, Chlorine store and numbers of tonners to be provided by the Contractor are as follows:
 - (a) Chlorine Room-- 30 sq-m
 - (b) Chlorine Store-- 20 sq-m
 - (c) No. of Chlorine Tonners—4 Tonners (1 No. tonner in reserve).
- **CLEAR PUMP HOUSE:** Carpet Area of Clear Water Pump House for 72 MLD Water treatment Plant shall be atleast 20 m x 10 m. Sump shall be of the capacity of 45 minutes storage and shall be placed in such a way to make the positive suction..
- **ADMINISTRATIVE BLOCK & LABORATORY BLOCK FOR 72 MLD WTP:** Administrative Block shall be -60 Sqm for 72 MLD WTP and laboratory shall be of atleast 60 sq-m.
- **RCC SLAB AT PLINTH LEVEL OF RAW WATER PUMP HOUSE:** The RCC slab and flooring at the plinth level will be provided as per design requirement.
- **FLASH MIXER FOR 72 MLD WTP:** (a) MOC of shaft and impeller of the Flash Mixer is SS 316.
(b) Turbine type impellers will be used in flash mixer. In the design of mechanical flash mixer unit, a detention time of 30 to 60 seconds is provided. The relatively high powered mixing devices should be capable of creating velocity gradients of 300/s or more. The usual ratio of impeller diameter to tank diameter is 0.2 to 0.4 and shaft speed of propeller greater than 100 RPM imparting tangential velocity greater than 3 m/s at the tip of the blade. Refer para 7.4.2.2 Mechanical Devices of CPHEEO Manual
- **FLOW METER FOR RAW WATER & CLEAR WATER IN WTP 72 MLD CAPACITY:**
- Ultrasonic flow meter will also be provided for flow measurement in the WTP.
-

FRONT ELEVATION

The site for construction of water treatment plant is located in village Mohara near Bilaspur town. The treatment plant should be so oriented and designed to give very good architectural view and appearance.

The front elevation shall be architectural to the satisfaction of the department and the department reserves the right to make additions and alteration in the front elevation on contractor's cost.

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. The porch must be provided to the main building having sufficient space to accommodate atleast two four wheel vehicles at a time in parallel.

SPECIFICATION FOR MECHANICAL WORKS

- Submerged structural parts (Steel) except hot rolled sections shall not be less than 6 mm thick.
- Prime movers and allied components such as electrical motors, starters, switches, reduction gears, drive mechanisms, bearings, plunger blocks, etc. shall be standard make.

- All rotating machinery, particularly gears shall be designed with adequate safety margins and service factors.
- All water submerged parts rotating mechanical parts and steel pipe under water shall be adequately protected after surface treatment. Oil, grease, dirt, soil and all surface contaminations from structural and fabricated steel parts shall be removed by cleaning with solvent vapour alkali emulsion or steam. Loose rust or paint weld spatter etc. shall be removed by hand chipping, scraping, sanding, wire brushing and grinding the bare finished shafting, finished flanges and other mechanical surface protected by grease or rust protection measures.
- Structural Mechanism support and super structures, walkway, hand rails with PVC tops Fabricated shaft etc. shall be protected with at least one coat of primer and two coats of paint IS 800-1962 (up to amended) code of practice for use of structural steel in general building construction should be followed. The department for procurement of any materials shall issue no permits.
- 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 equipments supplied and erected and they shall train the departmental staff in operation of the plant within that period. Detailed operation manual as well as the drawings of equipments supplied, should also be supplied by the contractor free of cost. The cost of electrical energy, Chlorine Gas, and payment to departmental staff for operation of the plant, WILL BE PAID by the Department during this period.

Performance Guarantee must be demonstrated by the test run for this period of three months. The tenderers must furnish bonds covering items of work like mechanical and electrical equipments, piping etc. for one year or two consecutive rainy seasons whichever is more as a guarantee of satisfactory operation and rectification of any defects in the work, material or equipment furnished by them by way of repairing or replacement at their own cost. The tenderers must furnish the service of competent representatives for this period to instruct the plant operating personnel in the maintenance and care of flow indicators, rate controller, piezometers etc. and to conduct tests.

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 relevant 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.

ELECTRICAL WORK SPECIFICATIONS:

- The scope of work shall not 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 lights of 80 watts on suitable , & work in open during rains. However the department shall have right to increase illumination level by 5% without any extra payment.
- 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 be constructed by the department in the same premises to panel in the wash water pump room and also the wiring in VIR in heavy gauge conduit from indoor motors.

- 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 29 MLD plant. He will maintain spares with stores for the proper upkeep of the WTP. List of spares is given below.

LIST OF SPARES:

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 3 ppm

Lastly the contractor shall provide the following staff for the O & M on daily basis:

I)	Superintendant Manager	-	1
II)	Junior Manager	-	1
III)	Operators	-	2
IV)	Laboratory	-	1
	a) Chemist	-	1
	b) Helper	-	1
V)	Fitter	-	2 per shift
VI)	Mechanic	-	1 per shift
VII)	Electrician	-	1 per shift.

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 Scraper 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	:

5.1 **DATA SHEET FOR RAPID GRAVITY DUAL MEDIA FILTER
(TO BE FILLED BY THE BIDDER)**

Flow rate (m ³ /h)	:
Overload (%)	:
Quantity	:
Material of Construction	:
Whether the design is for Twin Bed	:
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 Coal	:
Effective Size	:
Uniformity coefficient	:
Particle density:	:
Hardness	:
Whether nozzle system has been considered	:
Type of nozzle	:
Nozzle density	:
MOC of Nozzle	:
Size of the nozzle	:
Surface loading rate (m ³ /m ² /h)	:
Air Scouring rate	:
Air blower capacity (m ³ /h)	:
Head of Air Blower (mwc)	:
Type of Air Blower	:
Conjunctive Backwash water rate	:
Final wash water rate	:
Quantity of backwash water generated	:

1.0 LABORATORY BLOCK, OFFICE AND CONTROL ROOM :-

The laboratory block may be isolated or connected with the other units. The tentative area of laboratory block shall be 120 sqm to accommodate one A.C. Room as Control Room, Office Room, chemical room or laboratory room for testing and attached toilet block. It shall have permanent building specifications with RCC floor and roof. With RCC frame work.. The door or laboratory room & A.C. room shall be of Aluminum of size 1.20 x 2.00 Mt. self-closing type fixed with 4mm thick glass and over with rolling shutter shall be provided (only in the laboratory room). The A.C. room shall have thermocouple ceiling with steel bedding and PVC sheet over the mosaic flooring. The A.C. shall also be provided by contractor. The capacity of A.C. shall be decided by contractor and of Voltas, LG, Samsung or equivalent standard make. All around the laboratory room a platform of 1.00 Mt. wide shall be provided to put up the instruments and

in two corners of wall wash basin as per I.S. Specification fitted with water supply shall be provided. It shall have two numbers of exhaust Fan of 300mm dia Crompton, G.E.C., Bajaj, Khetan or equivalent make. Below the platform the Almira for storing the chemicals fitted with wooden frames with door shall be provided. If the laboratory block is provided isolated to the module chamber in other building then a water sampling table, for visual examination and collection of raw, settled filtered and chlorinated water shall be provided in laboratory room. The testing platform and stands shall be cladded with acid resistance tiles. The following instruments shall be provided as per I.S. Specification for laboratory by contractor.

All throughout the length and breadth of the WTP installation building IRONITE FLOORING shall be provided as per the specifications given in Annexure-E-1.

6.1 REQUIREMENT OF EQUIPMENTS FOR WATER TESTING LABORATORY

S. No.	Name of Equipment's	Required quantity
1	Refrigerator (310 Liters)	1 No.
2	Incubator 37° c±05°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 nm	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° to 180°c	1 No.
11	Water bath 6 to 8 concentric 0 to 50°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.

6.2 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.

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

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.

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.
	- 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.

6.3 REQUIREMENT OF ACCESSORIES & MATERIAL FOR LABORATORY

S.No.	Name of Equipment's	Required quantity
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1	Water Sampler (Steel) of capacity 2 Lit. - do - 5 Lit.	2 No. 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.

6.4 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.

The sub base shall be 150 mm of hard granite cubes. The base shall be two layers each a minimum of 75mm thick, the top layer shall be 40mm down graded metal of 100mm as placed thickness compacted to 75 mm, the bottom layer is 65mm down graded metal of 100mm as placed thickness compacted to 75mm. The wearing coat will be asphalt concrete 20mm thick or the contractor may choose to construct CC road.

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 BMC for the proposed WTP.

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.

8.0 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.

9.0 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 BMC.

10.0 PROCESS CONTROL :

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 Bilaspur.

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.

11.0 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 a 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
OFF	-	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%.

12.0 ELECTRIFICATION :-

12.1 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.

12.2. 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.

12.3 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 contracts 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.

12.4 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.

12.5 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 is 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 in 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.

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.

12.6 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

12.7 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.

12.8 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.

13.0 SCADA SYATEM

The SCADA System should be synchronized with the intake canal up to Cascade Aerator of the proposed WTP of 15 MLD capacity scheme and should have the devices to control discharge of canals off . The equipment manufacturing and software development centers quality management system should confirm to

ISO 9001 standards, certificate should be enclosed. The Contractor shall have wide network of multi skilled industry experienced engineers to undertake comprehensive installation, maintenance and commissioning services for water data logging applications amongst other services such as maintenance and optimization, meter verification, field tests for hydraulic modelling, network design and investigation. Engineers shall be available at locations close to the region. The consortium partner shall have well developed processes and job management systems to support efficient operation of large scale turn key projects and ongoing maintenance.

13.1 Supply of Spares and Tools:

The scope includes supply of recommended spares and set of tools as specified in the Bid document.

13.2 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	Zcnnner/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/Electrosteel/Kejriwal
Dismantling/Expansion joints	AnupEngg./ LoneStar /Vedaiita /Precise
Compression fittings, Tapping Saddles, Electro- fusion Couplets	Kimplas/,Georgeficher/Glynwed/Frialeii/Trustlene/GPS/Durafuse

ANNEXURE - "E-5"

**SPECIFICATION FOR SPIGOT AND SOCKET CENTRIFUGALLY CAST (SPUN)
DUCTILE IRON PIPE CLASS K-9 AND K-7 WITH INSIDE CEMENT MORTAR LINING
PRESURE PIPE IN PUMPING MAIN AND GRAVITY MAIN NET WORK**

1.0 SCOPE OF WORK :

The scope of work shall be as below :

- 1.1 Providing, laying, jointing, interconnection, testing & commissioning for Raw water pumping main, clear water pumping main & Clear water gravity main of D.I. pipe class K-9 & class K-7 Under Augmentation Water Supply Scheme for Bilaspur town.

Including valves, fittings, road restoration, and all allied civil works

pipe pushing for Railway, Road, Canal crossing

Providing Installing and commissioning Electromagnetic Bulk Flow Meters including 5 years operation & maintenance including replacement & warranty after one year of defect liability period

Sr. No	Particulars			Length
E 5(1)	Raw Water Pumping Main from GSR to WTP's Cascade Aerator 900mm Dia DI K-9 pipes			100M
E 5(2)	Clear Water Pumping Main from Clear water sump of WTP to 2 Nos. MBR's inside WTP campus 800mm Dia DI K-9 pipes 700mm Dia DI K-9 pipes			100M 100M
E 5(3)	Clear Water Gravity Mains from MBR's to Various OHSR's in Bilaspur Town Total Length 32870M			
	Dia of Pipe	Zone I (Left)	Zone II (Right)	
	1100mm DI K-7		2733 M	
	1000mm DI K-7		3067 M	
	800mm DIK-7		285 M	
	700mm DIK-7	89 M	2090 M	
	600mm DIK-7	2766 M	7072.M	
	500mm DIK-7		713 M	
	450mm DIK-7	1810 M	502 M	
	400mm DIK-7	438 M	3448 M	
	350mm DIK-7	572 M	1875 M	
	300mm DIK-7	1770 M	3210 M	
E 5(4)	Providing and making road and railway crossings by push through method including jacking of casing and appropriate carrier pipe for one Railway crossing and 4 road crossings			

	1. 1500mm Dia Road crossing	60M
	2. 600mm Dia Road crossing	90M
	3. 450mm Dia Road crossing	60M
	4. 300mm Dia Railway Crossing	90M
E 5(5)	Electromagnetic Bulk flow meters	36 Nos
	300 mm	23 Nos.
	400 mm	2 Nos.
	500 mm	2 Nos.
	600 mm	6 Nos.
	700 mm	2 Nos.
	1000 mm	1 Nos.
E 5(6)	Providing and constructing RCC piers with structural bridge across ARPA river for crossing 1000mm Dia Gravity main including site investigations, geotechnical investigations,	280M

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

The work shall include the following

LAYOUT DRAWINGS OF PUMPING MAINS:-

The drawings showing tentative alignment and layout of the pumping mains, ground configuration and other necessary details are enclosed along with these specifications. The contractor shall have to submit the detailed layout drawing, sufficient to show the details as mentioned below-

- R.L. of ground, invert level of pipes and H.G.L. at every 30 m interval.
- Location of horizontal and vertical bends.
- Degree of bends, degree or radius of curves, tangent distance for curves.
- Location and covering length of all valves and other appurtenances.
- Details and description of all specials.
- Location and size of supporting pillars, bridges and culverts to cross the waterways.
- Location and sizes of thrust blocks and anchor blocks.
- Location and sizes of valve chambers.
- Details, dimensions and plan including complete description of expansion joints and flanges.
- The layout plan submitted by the contractor, can be altered or modified by the Engineer-in-charge to suit the requirement depending upon the field conditions

before or even after the acceptance of the tender or during the course of execution of work and the contractor shall not claim for compensation in any way on this account.

ANNEXURE E 5(1), (2) & (3)

ISI mark socket and spigot centrifugally cast (spun) Ductile Iron Pressure pipes class K-9 and K-7 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

- 1.2 Excavation in trenches in all types of strata for laying & jointing of above pipe line with required depth and width as per specification.
- 1.3 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 Upadhaya)
 - 1.3.1 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/Upadhaya) duly inspected by DGS&D/SGS/RITES.
 - 1.3.2 Providing, laying & jointing D.I./ MJ fittings conforming to IS 9523:2000 duly inspected by DGS&D/SGS/RITES
- 1.4 Providing & fixing following kinetic Air valve duly inspected.
(Make - Kirloskar/IVC/VAG/Durga/Upadhaya)
- 1.5 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.
- 1.6 Back filling of trench as per IS:12288-1987.
- 1.7 Providing and making all interconnections as required to charge the laid pipe lines under scope of work.

- 1.8 In case, the shifting of any existing, water pipe line/sewage line is considered necessary by the Bilaspur 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. The firms/contractors are directed to submit the details plan and elevation of all the pipelines showing
- 1.9 the dimensions of all components and other details. The contractor shall set up an office with an access to BMC 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 BMC officials. The contractor shall propose colour scheme with at least three alternatives and after approval only the work shall be started. All the valves and electromechanical fittings shall be SCADA & PLC compliant with actuators (including the cost of Actuators) for implementation of SCADA in future. The successful bidder shall assist the BMC in the process of getting the approvals from State/ Central Government Departments required for execution of the work. The contractor has to procure and install informatory board's displaying Name of work at the location given by BMC at his own cost.

2.0 D.I. PIPES

2.1 MANUFACTURE :-

The pipes shall be ISI Mark and confirming to IS:8329:2000. The pipes should be duly inspected by D.G.S. & D./SGS/RITES before supply.

2.2 HYDROSTATIC TEST

- 2.2.1 Pipes shall be tested hydrostatically at a pressure of 5.0 MPa. To perform the test, pressure shall 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.

2.3 TOLERANCES :

- 2.3.1 The tolerance shall be permissible as per IS:8329-2000.

2.4 COATING :

- 2.4.1 All the D.I. pipes should be internally in 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.

2.5 MARKING :

Each pipe shall have cast, stamped or indelibly painted on it the following appropriate marks :

- 2.5.1
- 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.
- 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.
- 2.5.2 Any other marks required by the purchaser may be painted on.

3.0 DUCTILE IRON FITTINGS :

- 3.1 The Ductile Iron fittings shall be ISI mark conforming to IS 9523-2000.

3.2 COATING :

- 3.2.1 Fittings and accessories shall be normally delivered internally and externally coated.
- 3.2.2 The external coatings shall be applied with zinc rich paint with finishing layer as included in Annexure "A" of IS 9523:2000.
- 3.2.3 The internal Linings shall be applied with portland cement mortar (with or without additions) as included in Annexure "B" of IS 9523:2000.

3.3 MARKING :

- 3.3.1 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.

3.3.2 Marking may be done on the barrel of castings or on the outside of the sockets.

3.4 **BIS Certification Marking**

The fittings may also be marked with the Standard Mark.

4.0 **LAYING AND JOINTING :**

4.1 **SITE PREPARATION :**

4.1.1 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.

4.1.2 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.

4.1.3 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.

4.2 **FORMATION :**

4.2.1 **GENERAL :** Before pipe line is laid, proper formation be prepared for pipe line

4.3 Excavation and Preparation of Trenches for Laying Underground Pipe Lines.

4.3.1 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.

4.3.2 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.

4.3.3 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.

4.3.4 Care should be taken to avoid the spoil bank causing an accumulation of rain water.

4.3.5 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.

4.3.6 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.

4.3.7 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.

4.4 **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.

4.4.1 **Blasting** - Blasting for excavation shall be permitted only after securing the approval 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.

- 4.5 **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.
- 4.6 **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.
- 4.7 **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.
- 4.7.1 Suitable signs indicating that a street is closed shall be placed and necessary detour signs for the proper maintenance of traffic shall be provided.
- 4.8 **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.
- 4.9 **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.
- 4.10 **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 :
- Zone A : From the bottom of the trench to the level of the centre line of the pipe.
 - Zone B : From the level of the centre line of the pipe to a level 300 mm above the top of the pipe, and
 - Zone C : From a level 300 mm above the top of the pipe to the top of the trench.
- 4.10.1 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.
- 4.10.2 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.

4.10.3 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.

4.10.4 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.

5.0 **LAYING OF PIPES :**

5.1 **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.

5.2 **Pipe Line Anchorage -**

This shall be provided as per relevant BIS 5330:1984 with up to date amendments.

6.0 **TRANSPORTATION, HANDLING AND INSPECTION :**

6.1 **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.

6.2 **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.

6.3 **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.

7.0 **HYDRAULIC TESTING :**

7.1 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

7.2 The completed pipe line shall be tested for a pressure given in IS 8329:2000, Annexure “E” .

7.3 5% amount of complete work shall be withheld till the successful hydraulic testing of the pipeline

8.0 **FLUSHING AND DISINFECTION OF MAINS BEFORE COMMISSIONING :**

8.1 The pumping main & distribution mains shall be disinfected before commissioning as per provisions given in CPHEEO manual and IS 5822:1970.

9.0 **REMOVAL, RESTORATION AND MAINTENANCE OF PAVED FOOTPATHS ETC. AFTER LAYING OF PIPE :**

- 9.1 **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.
- 9.2 **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
- 9.3 **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.
- 10.0 **APPURTENANCES** :
- The following appurtenances shall be suitable designed and fixed on the suitable points on the conveyance main.
- 10.1 **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.
- 10.2 **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.
- 10.3 **BRANCH CONNECTIONS** :
- “T” outlet with manually operated sluice valves shall be provided in the distribution pressure Main for Branch connections.
- 10.4 The appurtenances shall be located in such a way that these are clearly and easily accessible for operation and maintenance.
- 11.0 **CONSTRUCTION OF CHAMBERS FOR APPURTENANCES** :
- 11.1 **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.
- 11.2 **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.

12.0 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 and operation & maintenance for a period of one year 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. The water for testing and commissioning of pipe line will be made available by the Deptt. free of cost at the time when convenient to the deptt. 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 six months from the date of completion of work.

13.0 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.

14. THRUST BLOCKS

- 14.1 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.
- 14.2 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.
- 14.3 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. The thrust blocks shall be designed and provided as per Appendix 6.6 of the CPHEEO Manual.
- 14.4 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.
- 14.5 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.
- 14.6 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.
- 14.7 For steeper slopes, one out of every three pipes shall be held by straps fastened to vertical supports anchored in concrete.

15 DISINFECTION OF PIPE LINE BEFORE COMMISSIONING:

- 15.1 Pipeline carrying potable water shall be suitably disinfected before commissioning as per guidelines given in

CPHEEO Manual & relevant IS codes.

16.0 Operation and Maintenance for 60 months to be carried out by the agency.

17.0 DLP for 12 months to be carried out by the agency.

3.6.3 SUPPLY AND LAYING, JOINTING OF DUCTILE IRON PIPES AND SPECIALS Standards

Except as otherwise specified, the Indian/International Standards and Codes of Practice in their latest version shall be adhered to for the design, manufacturing, inspection, factory testing, packing, handling and transportation of product. Should any product be offered conforming to other standards, the equipment or products shall be equal to or superior to those specified and the documentary confirmation shall be submitted for the prior approval of the Engineer in Charge. DI pipes of ISO standard shall also be accepted.

3.6.3.1 Casting

The pipes will be centrifugally cast (spun) Ductile Iron pipes for Water, conforming to the IS 8329. The pipes used will be with push on joints (Rubber Gasket Joints). The class of pipe to be used shall be of the class K-9.

3.6.3.2 Surface coating

The pipes shall be coated with Metallic Zinc coating as per appendix A, with a finishing layer of bituminous paint, and have factory provided cement mortar lining in the inside as per the provisions of Appendix B of the IS 8329.

3.6.3.3. Standard length

The pipes will be supplied in standard lengths of 5.50 and 6.00 meters with chamfered ends suitable for push-on jointing. Each pipe of the push on joint variety will also be supplied with a rubber EPDM gasket, conforming to the IS: 5382. Any change in the stipulated lengths will be approved by the Engineer – in charge.

3.6.3.4 Manufacture of Gaskets

The gaskets should also be supplied by the manufacturer of the pipes. They should preferably be manufactured by the manufacturer of the pipes. In case they are not, it will be the responsibility of the contractor to see that the manufacturer of the pipes get them manufactured from a suitable manufacturer under its own supervision and have it tested at his/sub contractor's premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products.

3.6.3.5 Flanged joints

The flanged joints will confirm to the Clause 6.2 of IS 8329. The pipe supply will also include one rubber gaskets for each flange.

3.6.3.6 Hydraulic test at works

Each and every pipe shall be tested hydraulically by the manufacturer as specified under clause 11 for the pressures specified in table 1 of IS: 8329. The test shall be carried out before application of surface coating and lining except Zinc coating which may be applied before the hydrostatic test.

3.6.3.7 Test for Gaskets

The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5832 and will be in accordance to Clause 3.8 and contractor shall submit the test certificate issued by the manufacturer with the pipe supply, without which payment for pipe supply shall not be released.

3.6.3.8 Third party inspection

The inspection and testing of the pipes shall be carried out by the employer and/ or inspecting agency appointed by the employer, in the manufacture's workshop. The pipes will be subjected to following tests for acceptance:

- Visual and dimensional check as per Clause 13 and 15 of IS 8329 for length, internal and external diameter, wall thickness, deviation from straight length and joviality.
- Mechanical Tests as per Clause 10 of IS 8329 for Tensile Strength and Brinell Hardness Test.
- Hydrostatic Test as per Clause 11 of IS: 8329.

The sampling for the above tests shall be as per the provisions under clause 9 of the IS:8329. All the tests shall be conducted in presence of the inspecting agency. The pipes shall be dispatched only after issue of the test certificate by the inspecting agency for satisfactory test results as required. The inspection charges for such tests shall be paid by the contractor to the inspecting agency.

3.6.3.9 Retest

If a test piece representing a batch fails in the tensile or Brinell hardness test in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same batch. If both the test results satisfy the specified requirements, the batch shall be accepted. Should either of these additional test pieces fail in the test, the batch shall be deemed as not complying the required standards and shall be rejected.

3.6.3.10 Marking

- All pipes will be marked as per Clause 18 of IS 8329 and show as below:
- Manufacturer name/ stamp
- Nominal diameter
- Class reference
- A white ring line showing length of insertion at spigot end

3.6.3.11 Packing and Transport:

The pipes should be preferably transported by road from the factory and stored as per the manufacturer specifications to protect damage.

3.6.4 SPECIFICATIONS FOR DUCTILE IRON FITTINGS (SPECIALS)

3.6.4.1 General

The Ductile Iron (DI) fittings shall be D.I. fittings shall be ISI marked as per IS : 9523-2000, suitable for Tyton joints to be used with Ductile Iron pipes with flanged and Tyton jointing system.

3.6.4.2. Types of specials

The following types of DI fittings shall be manufactured and tested in accordance with IS: 9523 or BS: 4772

- Flanged socket
- flanged spigot
- double socket bends (90⁰, 45⁰, 22½⁰, 11¼⁰)
- double socket branch flanged tee
- all socket tee
- double socket taper

All the fittings shall be of PN 1.6 pressure rating

Supply

All the DI fittings shall be supplied with one rubber ring for each socket. The rubber ring (EPDM) shall conform to IS: 12820 and IS: 5382. Flanged fittings shall be supplied with one rubber gasket per flange and the required number of nuts and bolts.

3.6.4.3 Manufacture of Fittings / Specials

The metal used for manufacture of DI Fittings / Specials shall conform to the appropriate grade as specified in IS : 1865-2005. Two side lugs shall be provided on each Socketed fitting, across all types and sizes along with Lifting loops on fitting across all types and sizes from DN 400 & above. D.I. Fittings shall also contain a Stub, minimum length -15mm x dia.- 10 mm., which can be cut at random to carry out Metallographic test to ascertain minimum 80% Graphite Nodularity as per Clause – 9.1 of IS : 1865-2005, in the form - V or VI as per IS : 7754-2003. Fittings manufactured through Induction furnace route only shall be used. The fittings should also be supplied by the manufacturer of the pipes. They should preferably be manufactured by the manufacturer of the pipes. In case they are not, it will be the responsibility of the contractor to see that the manufacturer of the pipes get them manufactured from a suitable manufacturer under its own supervision and have it tested at his/sub contractors premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products.

3.6.4.4 Lubricant for ductile iron pipes and specials

General

This section covers the requirements for lubricant for the assembly of Ductile Iron pipes and specials suitable for Tyton push-in rubber ring joint.

3.6.4.5 Specifications

The lubricant has to have the following characteristics:

- Must have a paste like consistency and be ready for use
- Has to adhere to wet and dry surfaces of DI pipes and rubber rings
- To be applied in hot and cold weather; ambient temperature 0-50°C, temperature of exposed pipes up to 70°C
- Must be non toxic
- Must be water soluble
- Must not affect the properties of the drinking water carried in the pipes
- Must not have an objectionable odour
- Has to inhibit bacterial growth
- Must not be harmful to the skin
- Must have a shelf life not less than 2 years

Acceptance tests

- They shall be conducted in line with the provisions of the IS 9523

3.6.4.6 Packing for DI specials and Rubber Gaskets

All the DI fittings shall be properly packed with jute cloth. Rubber rings shall be packed in polyethylene bags. Rubber rings in PE bags and nuts, bolts etc. shall be supplied in separate jute bags.

3.6.5 LAYING AND JOINTING OF DI PIPES AND SPECIALS

3.6.5.1. Use of tackle

Pipes should be lowered into the trench with tackle suitable for the weight of pipes. For smaller sizes, up to 200 mm nominal bore, the pipe may be lowered by the use of ropes but for heavier pipes suitable mechanical equipment have to be used.

3.6.5.2 Cleaning

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. All persons should vacate any section of trench into which the pipe is being lowered

3.6.5.3 Laying on steep slopes

On gradients of 1:15 or steeper, precautions should be taken to ensure that the spigot of the pipe being laid does not move into or out of the socket of the laid pipe during the jointing operations. As soon as the joint

assembly has been completed, the pipe should be held firmly in position while the trench is back filled over the barrel of the pipe.

The designed anchorage shall be provided to resist the thrusts developed by internal pressure at bends, tees, etc.

The assembly of the pipes shall be made as recommended by the pipe manufacturer and using the suitable tools.

3.6.5.4 Jointing

The socket and spigot ends of the pipes shall be brushed and cleaned. The chamfered surface and the end of the spigot shall have to be coated with a suitable lubricant recommended by the manufacturer of the pipes. Oil, petroleum bound oils, grease or other material which may damage the rubber gasket shall not be used as lubricant. The rubber gasket shall be inserted into the cleaned groove of the socket. It has to be checked for correct positioning. The two pipes shall be aligned properly in the pipe trench and the spigot end shall be pushed axially into the socket either manually or with a suitable tool specially designed for the assembly of pipes and as recommended by the manufacturer. The spigot has to be inserted up to the insertion mark on the pipe spigot. After insertion, the correct position of the socket has to be tested with a feeler blade

3.6.5.5 Deflection of the pipes

Deflection of the pipes -if any- shall be made only after they have fully been assembled. The deflection shall not exceed 75 % of the values indicated by the pipe manufacturer.

3.6.5.6 Anchoring of the pipeline

Thrust blocks shall be provided at each bend, tee, taper, end piece to prevent undue movements of the pipeline under pressure. They shall be constructed as per design of the Engineer according to the highest pressure during operation or testing of the pipes, the safe bearing pressure of the surrounding soil and the friction coefficient of the soil. This item shall be payable as per the provision under BOQ.

3.6.5.7 Measurement and payment

The net length of pipes as laid or fixed shall be measured in running meters correct to a cm. Specials shall be included and measured in the total length. The portion of the pipe at the joints (inside the joints) shall not be included in the length of pipe work.

3.6.5.8 Excavation and preparation of trenches for laying underground pipeline:-The trench shall be so dug that the pipe may be laid to the required alignment and at required depth. When the pipeline is under a roadway, a minimum cover of 1.2 m shall be provided, in other cases the minimum cover of 0.75 m above the crown of the pipe shall be provided. The trench shall be shored, wherever necessary and kept dry so that the workman may work therein safely and efficiently.

Recovery of other serviceable material:-

All serviceable materials such as wood work, bricks, masonry etc. recovered during the operation of cleaning or excavations, which, in the opinion of the Engineer-in-Charge are suitable for reuse in restoring the surface, shall be separately stacked and disposed-of as directed by Engineer-in-Charge.

Dewatering:-

Dewatering shall be carried out by the contractor, wherever necessary. The discharge of the trench dewatering pumps shall be conveyed either to drainage channels or to natural drains and shall not be allowed to spread over in the vicinity of work place.

Trenching:-

The excavation of trenches shall be carried out by hand or machines. The width of trench shall be kept to a minimum consistent with the working space required. At the bottom, between the faces, it shall be minimum 200 mm clearance on either side of the pipe. However this is for the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating.

Preparation of bottom of trench:-

The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline. The curvature of the bottom of the trench should match the curvature of the pipe as far as possible, subtending an angle of 120° at the centre of the pipe. Where rock or boulders are encountered, the trench shall be trimmed to a depth of at least 100 mm below the level at which the bottom of the pipe is to be laid and filled to a like depth with non compressible material like sand or crusher dust or moorum of adequate depth to give the curved seating.

Special foundation in poor soil:-

Where the bottom of the trench at subgrade is found to consist of material, which is unstable to such a degree that in the opinion of Engineer-in-Charge it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipe, consisting of piling, timbers or other materials, in accordance with the direction of the Engineer-in-Charge, shall be constructed.

Excavation in hard rock by blasting:-

Blasting for excavation shall be done only when the contractor obtains the license for the same and only when proper precautions are taken for the protection of persons and property. The hours of blasting shall be fixed by the Engineer-in-Charge. The procedure of blasting shall conform to the requirement of licensing authority. The excess excavation by blasting shall be filled up by 1:4:8 cement concrete. The contractor shall have to make his own arrangement for procurement and storing of explosives required for blasting. Rubble available from excavation of hard rock, shall be the property of the contractor, for which recovery of Rs. 65/- per cum of the quantity of hard rock excavated shall be made from his running account bills.

Braced and sheeted trenches:-

Open-cut trenches shall be sheeted and braced as required by Engineer-in-Charge and as may be necessary to protect life and property or the work. When closed sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting.

Stacking of excavated material:-

All excavated materials shall be stacked in such a manner that it does not endanger the work and avoids obstructing footpaths and roads, hydrants under pressure, surface boxes, fire, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage and natural watercourses shall not be obstructed.

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 roadway. All materials, piles, equipments and pipes, which may obstruct traffic, shall be enclosed by fences or barricades and shall be protected by proper lights when visibility is poor. The rules and regulations of the local authorities regarding safety provisions shall be observed.

3.6.7 Maintenance of traffic and closing of streets:-

The work shall be carried out in such manner that it causes the least interruption to traffic, and the road/street may be closed in such a manner that it causes the least interruption to the traffic. Where it is necessary for traffic to cross open trenches, suitable bridges shall be provided. Suitable signs indicating that a streets is closed shall be placed and necessary detour signs for the proper maintenance of traffic shall be provided.

3.6.8 Structure Protection:-

Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstruction encountered in the progress of the work shall be furnished under the direction of the Engineer-in-Charge. The structures, which may have been disturbed, shall be restored upon completion of the work.

3.6.9 Protection of property and surface structures:-

Trees, shrubbery fences, poles and all other property and surface structure shall be protected unless their removal is shown on the drawings or authorized by the Engineer-in-Charge. When it is necessary to cut roots and tree branches such cutting shall be done under the supervision and direction of the Engineer-in-Charge.

3.6.10 Avoidance of the Existing Service:-

As far as possible, the pipeline shall be laid below existing services, such as water and gas pipes, cables, cable ducts and drains but not below sewers, which are usually laid at great depth. If it is unavoidable, pipeline should be suitably protected. A minimum clearance of 150 mm shall be provided between the pipeline and such other services. Where thrust or auger boring is used for laying pipeline across road, railways or other utilities, larger clearance as required by the concerned authority shall be provided. Adequate arrangements shall be made to protect and support the other services during laying operations. The pipeline shall be so laid as not to obstruct access to the other services for inspection, repair and replacement. When such utilities are met with during excavation the authority concerned shall be intimated and arrangements made to support the utilities in consultation with them.

3.6.11 Restoration of sewerage system:

If the sewer lines are coming in the way of pipeline alignment, it shall be properly restored either by constructing manholes on both sides and connecting it with similar sewer line, so as not to disrupt the services of the sewerage system or by laying the pipeline below or above the sewerage system as per the directions of Engineer-in-Charge.

3.6.12 Preparation of Formation for Sections of pipe line to be laid above Ground:-

Formation should be prepared by cutting high grounds and filling in low areas. Care has to be taken while fixing the alignment and gradient of the pipeline, to balance the cutting and filling quantities, as far as possible, with minimum of lead. Care should also be taken to ensure that pipe rests fully either on cutting or on bank.

3.6.13 Disposal of surplus material:

Excavated material in excess than required for backfilling the trenches, shall be disposed off as per the directions of Engineer-in-Charge. Surplus excavated stuff available at one section shall be used for back filling at other reaches, wherever required.

3.6.14 Extra material required for back filling:

If in any case, it is required to bring the soil for back filling from outside, it should be of good quality and should not have chemicals e.g. sulphates, chlorides, conductivity etc., which may cause corrosion to pipes, specials and other structures, beyond the permissible limits.

3.6.15 Road, rail and river crossings: -

The mode of laying the pipeline, crossing road, railway or river shall be determined so as to satisfy the requirement of the authority concerned.

E 5(4) 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.

HIGHWAY CROSSING

Wherever it is necessary to cross the Highways, the proposed pipelines should be crossed by the trenchless method. The pipes to be crossed are for raw water, treated water and sewage pumping mains. The pipe shall be laid inside the MS pipe casing with proper slope and alignment. The necessary arrangement viz, Jacking pits & receiving pits, Equipments, including men and material required for jacking the MS sleeve pipe by trench less method and laying the pipe inside MS sleeve pipe shall be arranged by contractor.

11.1 JACKING OF STEEL SLEEVE PIPE

The hydraulic pipe jacking can start after completing the Jacking pit. The hydraulic pipe jacking by tunneling method. A guide frame is fixed on the firm support of the Jacking pit. The main jacking station with hydraulic cylinders shall be fixed on the guide frame and to the abutment structure thrust block made of concrete or steel plate at the end of the pit. Mild Steel make jacking pipes (IS 3589-2001 with material grade is Fe 450) of required dia and length as per requirements are lowered on the guide frame and jacked section wise through the ground from the Jacking pit to the Receiving pit by means of hydraulic jacks. Each length of protective steel pipe is welded to the jacked pipe. Thus, the soil is removed by hand mining under the protection of a cutting shoe and moved through the jacked section to the surface. Depending on the existing soil the jacking pipes have to be lubricated with bentonite liquid. Boulders or other obstacles can be removed with the help of winches without any handicaps. Before arriving to the receiving pit construct the receiving pit. After completion of jacking procedure cut off the cutting shoe and remove out from Receiving pit. Completion of all inspection and handing over of each Section/Package of Pipe Jacking Works with protective steel pipes to the Engineers for inspection and after approval from Engineers Contractor to install his standard sewer pipes.

11.2 GROUND SUPPORT AND DEWATERING

The excavated area will be protected by the machine's shield and subsequently the pipes in order to minimize possible settlement of ground above the pipeline. In addition to that the bore is supported by bentonite suspension, which also reduces the friction between the pipes and the soil. Any dewatering if required shall be arranged by the contractor. There is no separate payment for dewatering.

11.3 CONSTRUCTION OF JACKING PIT

Jacking pit shall be constructed, of size of min. 4.5 m x 3.5 m. This size will vary depend upon the length of MS pipe. The depth of pit shall be such that it will suit the Jacking pipe depth. Proper timbering to be provided with the support of walls & struts during excavation. Required thickness of RR stone masonry wall in cement mortar 1:4 shall be provided for all four sides of the pits. 200 mm thick M 15 PCC floor shall be provided in the pit. A 400 mm thick reinforced concrete thrust or steel plate of suitable thickness wall to be provided to resist the Jacking force. The contractor may propose the alternate construction material such as concrete wall, brick masonry etc. during construction stage. Besides, the pit dimension may be changed to suit the site condition & requirement. Therefore, it is advisable that contractor should consider all these probable changes & method of workings and quote the rate accordingly.

11.4 RECEIVING PIT

The receiving pit shall be constructed with the same material and method adopted for Jacking pit. The size of receiving pit shall be 2.5 m length x 2.5 m width. The depth of it shall be as required to suit the jacking pipe depth. The receiving pit to be constructed as per drawing and as directed by Engineer.

11.5 SEQUENCE OF WORK

- Inspection of pits (including abutment structure, as per attachment) and approval (requirements as per structural analysis).
- Installation of hoist at starting pit.
- Measurement of height and slope for jacking.
- Installation of main jacking station and guide frame.
- Fixing of frame to the firm support.
- Make opening in the wall for beginning of jacking.
- Installation and adjustment of cutting shoe.
- Installation of bentonite liquid station.
- Transportation of Mild Steel pipe from stock yard to jacking station.
- Installation and adjustment of first steel pipe (3.00 metres long) or and as directed by Engineer.
- Fixing of steel pipe and cutting shoe by welding.
- Start of jacking by hydraulic pressure from the main jacking station.
- Lubricate the annular space by the bentonite liquid.
- Excavation of soil by hand mining under the protection of the cutting shoe.
- Transportation of soil through the jacked section with the *help* of tipper to the jacking pit and remove by hoist.
- After jacking of 3.00m installation and adjustment of the next steel pipe.
- Joint both the pipes by welding.
- Continuation of jacking, hand mining and installation of steel pipes for done alignment and slope of designed sewer and as instructed by Engineer.
- Before arriving to the Receiving pit construct the Receiving pit.
- After completion of jacking procedure cut off the cutting shoe and remove out from receiving pit.
- Dismantling of jacking station and guide frame and remove out from Jacking pit.

Final Inspection of each Section /Package of Pipe Jacking Works to the Engineer, Contractor to install his standard sewer pipes.

11.6 QUALITY CONTROL

Control of dimension of Jacking and Receiving pit (as per structural analysis).

Visual checks of each Steel Pipe against damages, disturbances and irregularities as well as measurement of the dimension of wall thickness and inner width. Supervisor will keep record for the pipes delivered to site directly from the factory.

Control of jacking direction and slope as per construction drawings before and during and after jacking.

Control of welding seam (tightness and thickness)

11.7 SAFETY MEASURES

In order to ensure safety during jacking procedure for all labour and the public, the following measures will be implemented :

- j. Signal hats and/or signs have to be erected in order to warn and divert the traffic around the concerned area, where pits are opened.
- k. Pedestrians will not be allowed to enter the area closer than 3 metres to an open pit or the control unit, unless there is sufficient barricading.
- l. A gas monitor has to be used for every entrance and work into the pits or line. Before access, the monitor shall be moved down to the bottom of the pit minimum 5 minutes by rope. When poisonous condition is detected, the area will not be entered.
- m. Accessing people shall use protective clothes, gloves, rubber boots, helmet, head lamp and additional all safety measures including an oxygen bottle with rescue mask has to be available on site all the time.
- n. A ventilation blower shall be used in the jacking section.
- o. Pre-arrangements with the next hospital have to be ensured in case somebody is injured.
- p. A first aid kit must be available on site at every time.
- q. No stay below hanging goods such as pipes.

- r. Use fire extinguisher for fire protection.

11.8 MEASUREMENTS

The measurement for State Highway crossing by push through method shall be in running meters.

MS Pipes and specials underground, outer coating:

12.1 Coating

All underground buried mild steel piping shall be protected by the application of hot coaltar enamel and fibre glass wrapping.

The coating shall consist of one coaltar primer coat, one coaltar enamel coat, wrapping of fibre glass and one more coat of enamel and then a final wrap of enamel impregnated fibre glass.

Pipe surface shall be cleaned thoroughly by shot or sand blasting process. The cleaning shall ensure that the pipe surface shall be free from millscale, rust, oil, welding scale and other foreign materials.

The priming paint shall be of material recommended by the manufacturer. Freshly primed pipe shall be handled carefully to prevent damage. Any damaged areas shall be re-primed before applying enamel.

The material to be used as enamel shall be Shalimar coaltar enamel and fibre glass manufactured by Fibre Glass Pilkington of India Ltd., or approved equal.

Enamel shall be moisture and dirt free at all times prior to and at the time of heating and application. The primed surface shall be dry and clean at all times and the enamel shall be applied not later than 3 days after application of primer. Along with first flood coat of enamel, single spiral wrap of fibre glass inner wrap shall be applied overlapping at least 25 mm. It shall be seen that fibre glass impregnates in the first flood coat. Second coat of enamel and second wrap of bitumen impregnated fibre glass or kraft paper shall be applied in the same way. The total thickness of the coating shall not be less than 4 mm.

Each end pipes left bare for welding purpose shall be hand coated and wrapped after field welding is completed and the pipe has been hydro-tested.

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 allow transient pressure, due to closure, in excess of 5m above the maximal static pressure

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.

The control circuit will include a device that will extend the closure time, in a way that the inlet pressure will not generate water hammer.

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.

E 5 (5) 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 BILASPUR 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	: $3\ 5\ \mu\text{s/cm min}$
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 OC Max & PTFE: 100 OC 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 OC
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 OC / Humidity 5 to 95% non condensing

OPTIONAL

Communication Port	: RS 485 with MODBUS RTU Protocol
GSM Telemetry	: GSM Module Inbuilt in Electromagnetic Flowmeter with SMS facility & Programmable(Showing Flow rate & Flow totalizer)
ELMAG	: 200R with Remote Electronics

Note :- For process conditions other than above arising actually at site after execution of components please consult factory.

ITEM OF PROVIDING AND INSTALLING FULL BORE ELECTROMAGNETIC TYPE FLOW METER

17.1 GENERAL

- The Electromagnetic Flow Meters shall be installed for indication of flow rate and total consumption of water in a Pumping mains, Gravity mains and feeder mains of Indore city's water supply system. The location of EMF meters is as per Annexure - B.

- ii) The Electromagnetic Flow meters shall withstand maximum working temperature of about 45° C and working pressure as specified in Annexure-B.

17.2 GENERAL SPECIFICATIONS OF FULL BORE ELECTROMAGNETIC FLOW METER

- i) Full bore electromagnetic flow meters shall be designed, manufactured and calibrated according to internationally accepted ISO standards having bi-directional flow measurement and totalization facility.
- ii) Electromagnetic Flow Meter shall be a velocity sensing electromagnetic type microprocessor based signal converter, sealed housing, flanged tube meter. The meter shall be manufactured to highest standard available for EMF-meters. The meter shall be equipped with minimum eight digit digital totalizer, reading in units of kiloliters and total measuring accuracy should be +/- 0.5% of measured value. The accuracy shall be inclusive of linearity, hysteresis, repeatability and pressure effect. The meter assembly shall operate within a range of 0.3 m/sec to 10m/sec.
- iii) Volumetric Testing/gravimetric (weight) testing of all meters must be performed and approved prior to shipment. The complete meter assembly and signal converter must be wet accuracy tested and calibrated as a unit near minimum intermediate and maximum specified flow ranges of the meter (full range of flow).
- iv) Only direct volume comparison calibration method shall be used. The overall accuracy of the calibration rig shall be at least three times better than the accuracy of the full bore electromagnetic flow meter.
- v) Supplier/ Manufacturer shall have in-house calibration facility and shall give calibration certificate for all the flow meters. The flow meter shall have grounding rings only Calibration of each Meter shall be tested at in house facility of manufacturer for the sizes for which manufacturer has this facility. In case the Electromagnetic Flow Meters are to be imported by the bidder then ISO or EEC certification for such calibration is required. If manufacturer has no in house facility for calibration or does not have facilities for testing of some sizes of meters, those sizes of meter shall be tested at a place approved by manufacturer.
- vi) Supplier / Manufacturer must have test facilities, spare parts, and personnel to maintain, instruct, train or whatever is necessary to assure that meters shall be maintained throughout the maintenance contract period.
- vii) Every flow meter shall have to be tested and calibrated in the manufacturer's works in presence of Purchasers Representative.
- viii) Electronics shall be fully interchangeable irrespective of size of flow meter.
- ix) All the meters shall be provided with all accessories including software necessary to make it a complete functioning unit system.
- x) All field and in-house equipments must be protected from lightening strokes and electrical/electronics surges/harmonics. This type of lightening/Surge protection is mandatory and shall be included along with flow meter appurtenances.
- xi) Power supply if available nearby in water works then power shall be taken from their and if not available nearby then power supply shall be taken from power supply authority by contractor. The meter shall be suitable for 230 VOLTS A.C. +/- 15%, 50Hz +/- 3% supply. The sensor and converter shall be able to withstand variation in electric supply. The necessary equipment / device for protection against voltage & frequency fluctuations shall be provided.
- xii) The meter shall measure flow of potable chlorinated water having chlorine concentration up to strength of 5 PPM and turbidity upto 50 NTU. For meters to be installed on Raw Water Mains, it shall measure flow of water of turbidity upto 5000 NTU.
- xiii) The flow meter performance shall be independent of any electromagnetic and electrostatic interference and shall have perfect grounding / earthing system.
- xiv) The Flow meter software shall incorporate multi-password protection to prevent inadvertent or fraudulent programming or unit measurement changes.
- xv) The repeatability of the system shall be within $\pm 0.1\%$ of reading.

17.3 TECHNICAL SPECIFICATIONS OF FULL BORE ELECTROMAGNETIC FLOW METER

- i) Meter Tube (Sensor) Shall be fabricated from stainless steel tube SS 304. Meter tube shall have a constant nominal inside diameter, offering no obstruction to the flow. The electrode shall be self-cleansing type or electro-cleaning circuit type.
- ii) Coil Housing shall be fabricated from stainless steel SS 304 for corrosion resistance and welded to the tube providing a completely sealed environment for all coils, electrode connections and wiring harness capable of submerged or buried operation. The outer coil housing and the connection / junction box shall be made up of corrosion resistant material equivalent of SS304. To avoid ingress of water in the sensor housing, sensor has to be of fully welded construction.

- iii) Signal Converter shall be pulsed DC coil excitation type with auto zeroing. The signal converter shall be remotely mounted away from the meter. The converter shall indicate direction of flow and provide a flow rate indication and a total of flow volume for both forward and reverse directions.

The converter shall provide an isolated 4-20 mA output into minimum 500-ohm load and a frequency output of a maximum of 0-10 KHZ and a scaled pulse output. The microprocessor based signal converter shall have a self-diagnostic test mode and a backlit display that continuously displays 'Rate of Flow' and 'Total Volume'.

The converter shall be compatible with Microsoft Windows and other software programs with built in terminal communication capabilities of RS 485, HART or other protocols for interface. Converter shall be supplied with a programmable low flow drop out and empty pipe zero return. The converter cum transmitter shall be fully I programmable from the front facia.

The meter shall be possible to have a seperation between the flow sensor and the ' \signal converter/transmitter upto a maximum of 300 meters without the need for any signal boosters. The sensor cable length to be provided for each transmitter shall be as per individual site requirement.

The signal converter shall be microprocessor based fully programmable through built-in keypad. It shall have display for flow direction indication, actual flow rate, flow totaliser. The units for the same shall be selectable like MLD, MLH. Cu.M/Hour etc.

Output signals: 1 x 4-20mA current output, 1 x Pulse output, HART communication protocol and the RS-485 communication with all desired output codes which can communicate with serial port shall be given. These codes from the RS-485 will be processed in the form of graphical representation and tabular form to have periodical report generation.

- iv) The Flow meter shall have flanges as per IS 1538 or equivalent specification.
- v) Sensor cable shall be capable of transmitting low signal voltage U (milli volts, pica watts) via a armored shielded cable from the primary head to the signal converter. The cable shall be suitable to resist the interference from external magnetic fields. The cable shall be suitable for laying underground and under water installation.
- vi) Battery Backup system
The battery backup shall be used to operate electromagnetic flow meters during power failure. The technical specification shall be as follows:
- | | |
|----------------|---|
| Make | Preferably APC make, ISO 9002 & 14001 series certified. |
| Type | Online or line interactive |
| Capacity | 500 VA wave form type Sine wave |
| Input voltage | 180-280 volts |
| Batteries | External batteries-SMF |
| Control panel | Voltage correction, overload indicator alarm |
| Battery backup | 6 hours |
- vii) Meter size
Meter size is designated by the nominal diameter (ON) of the flange.
- viii) Overall length
For each meter size designation, there shall be a corresponding fixed overall length and tolerance.
- ix) Connections
The Flow meter shall be provided with flanges at both ends, the internal diameter of which shall be equal to the nominal size of the meter. The dimensions and drillings of the flanges shall be in accordance with IS 1538.
- x) Rubber Gasket
The flat rubber gasket shall be 3/6 mm dual thickness of EPDM material and shall be suitable for making flange joints. The quality of flat rubber gasket shall be as per IS: 5382 and drilling of holes shall be as per IS: 1538.
- xi) Nuts and bolts
Nuts and bolt shall be of best quality carbon steel, machined on the shank and under the head and nut. Nuts

- and bolts shall be electro-galvanized. Bolts shall be of accurate length so that only one thread shall show through the nut in the fully tightened condition. Nuts and bolts shall conform to IS : 1363 and IS: 1367.
- xii) **Material Supply**
All the Flanged meters shall be supplied with one rubber gasket per flange and the required number of nuts and bolts as per the meter size. Matching pair of grounding rings shall be supplied with all the meter tube.
- xiii) **Packing**
All the flow meters shall be packed in polyethylene bags. Smaller size meters shall be packed in cardboard boxes. The larger size bulk flow meter shall be packed in separate wooden crate, according to the size. Rubber gasket and nuts, bolts etc. shall be supplied in separate jute bags.

17.4 DATA SHEET OF FULL BORE ELECTROMAGNETIC FLOW METER

Sr. No.	Particulars	Details
A Process Liquid		
a.	Liquid Type	Potable water/raw water
b.	Type of Solid	Silt particles
B. Operating Condition		
a.	Operating pressure	Max. up to 1.65 Mpa
b.	Operating temperature	0° C to 45° C
C. Flow Meter		
a.	Type	Pulsed DC excitation
b.	System	Separate with cable output
c.	End connectors	Flanges of carbon steel
d.	Power supply	230 V AC, 50 Hz
e.	Flange Rating	PN 16 - Upto size 1000 mm PN 10 - from 1100 mm to 1200 mm
f.	Electrode material	SS 416 (stainless steel)
g.	Meter tube	SS 305 (stainless steel)
h.	Lining material	Hard Rubber (EPDM)/PTFE
j.	Protection Category	IP 68
k.	Measuring accuracy	+/- 0.5% of Measured Value inclusive of Linearity, repeatability, Pressure Effect and Hysteresis between 0.3 - 10 m/s velocity.
l.	Coil housing	SS 304 with fully welded construction
m.	Connection/Junction Box	SS 304
n.	Earthing	Grounding Rings in SS 316
o.	Fluid Conductivity	> 5 µ Siemens/cm
p.	Marking	Direction of flow with arrow, size, Sr. no. make
D. Flow Transmitter/Converter		
a.	Type	Microprocessor based, Modular Design, remote mounting
b.	Display language	English
c.	Ambient temperature	0° C to 45° C
d.	Display	Min. 3 line back lit. LCD for indication of actual flow rate, forward, reverse, sum totalizes
e.	Outputs	One current output (4-20 mA)
f.	Protection	IP 65
g.	Enclosure	Die Cast Aluminium with polyurethane finish
h.	Programming	Through Key/Keypad on front facia/ optical touch key
i.	Power Supply	230 V AC, 50 Hz
j.	Cable Gland	1/2" NPT (4 glands of double compression type)
k.	Mounting	Wall mounted in cabinet
l.	Interface	RS 485, based on EIA R 422/485 standard, or

Sr. No.	Particulars	Details
		HART
m.	Power failure mode	Provision on RAM/FROM to store parameter entered and measured flow data during power failure
n.	Max. Separation	Upto 300 mtrs. between sensor and transmitter without any signal boosters
o.	Terminals	Shock - Hazard - protected push lock terminals
p.	Error Identification	0/3.6/22 m Amp
q.	Interchangeability	Fully interchangeable with all sizes of flow sensors
r.	Safety classification	General purpose certification
s.	Flow Indicator Totalizes	Internal, 5 mm high, LED display with 8 digit lcd

17.5 METER ROOM

A meter room of size 3.0 x 3.0 and room height of 3.05 m for housing the display unit and battery back up shall be constructed near the rising main alignment as directed by the engineer-in-charge. The meter room shall be located above H.F.L. so as to avoid submergence. The meter room will be a framed structure with brick masonry paneling. The flooring shall be of white marble mosaic tiles including skirting. The internal walls of a meter room shall be provided with 12 mm thick cement plaster in C.M. 1:4 and external sand faced plaster as directed by the Engineer-in-charge. The doors and windows shall be of aluminum with full glass shutters including locking arrangement etc. complete. Internally Oil Bound Distemper shall be applied and externally Water Proof Cement Paint shall be applied of approved colour and shade as directed by the engineer-in-charge. The item of providing and installing of full bore electromagnetic type flow meter is inclusive of cost of construction of a meter room.

17.6 MODE OF MEASUREMENTS AND PAYMENT

The measurements will be taken on number basis for the installed Full Bore Electromagnetic Type Flow Meters including Meter Room as per approval given by Engineer-in-charge. 90 % payment will be made after providing and fixing of Full Bore electro Magnetic Type Flow Meter including constructing Meter Room Complete in all respect and the balance 10 % payment will be made after testing and commissioning the work.

E 5-(6)

Specifications for structural bridge across Arpa river to cross the 1000mm Dia clear water gravity main.

- 1. The contractor shall coordinate with the BMC and PWD for getting the best suitable alignment to cross arpa river and carry out the geotechnical investigations such as trial bores for foundations and flood assessment survey to finalise the deck level of the bridge.**
- 2. The contractor shall design the size of piles, pile caps, piers, pier caps, spans and the structural steel truss bridge aesthetically as well as structurally alongwith the specifications of the materials to be used and get it vetted form Govt. Engineering college/ NIT and submit the same to BMC and PWD for approval.**
- 3. The bridge bottom shall be kept atleast 1.0M above the HFL and the span shall be kept as per the site requirement.**
- 4. The width of the bridge shall be kept in such a way to accomodate the pipe of 1.0M dia with additional width of 0.6m for the inclined height for the chairs on which the pipes shall rest. In addition to this there shall be atleast 1.20M wide walkway provided with chequered plates of minimum 8mm thickness. A projection shall be kept at every joint with railing for attending the leakage of joints if occured in future.**
- 5. The protection and locking arrangement shall be provided at both the ends for restricted entry of O & M staff.**
- 6. Complete structure shall be painted with three coats of weatherproof enamel paint of approved quality and colour.**
- 7. Provision of cathodic protection and lightning arrestoe shall be made in the bridge.**
- 8. All the works shall be completed as per the instructions and to the satisfaction of Engineer in charge.**

3.4 APPROACH REINFORCED CEMENT CONCRETE ROAD BETWEEN CANAL INTAKE AND RAW WATER PUMP HOUSE:

A R.C.C approach road of length 200 M from intake well to nearest GL above HFL is to be constructed. The width of the road shall be 7.0 mt shall be designed . The return on approach side is also included in this contract. The scope of this work includes the detailed geo technical investigation, design drawing, construction, load testing etc. for this work.

Plant Roads, Culvert / Cross Drainage, Roadside Drains and Ground Pathways

Plant Roads

The roads shall consist of the following crust or layers. These are the minimum specified; however, the thickness and number of layers may change as per the design requirements:

1. Soil sub-grade shall be well compacted and tested at OMC to 97% Proctor density. The soaked CBR value of re-moulded sub-grade soil samples at the specified dry density-and-moisture-content- shall not be less than 7% (average of atleast 3 specimens), unless specified otherwise.
2. The Water Bound Macadam – shall consist of minimum following layers:
 - a. Grading-1 - one layer of 100 mm compacted thickness of aggregate size ranging from 90 mm to 45 mm graded.
 - b. Grading-2 - One layer of 75 mm compacted thickness of aggregate size ranging from 63 – 45 mm graded.
 - c. Grading-3 - One layer of 75 mm compacted thickness of aggregate size ranging from 53 – 22.4 mm graded.
2. Screening to fill the voids in the coarse aggregate shall be clean, dry stone dust / moorum other non plastic material having liquid limit and plasticity index below 20 and 6 respectively provided fraction passing 75 micron sieve does not exceed 10%.

Binding material to prevent releveling of WBM shall consist of fine grained material possessing P.I Value upto 6. Application of binding material shall not be necessary where murrum or gravel is used as screenings.

- 3 Construction of earthen shoulders of approved design shall progress side by side with WBM construction. These shall be raised as the constructed height of road progresses. The top surface of the shoulder shall consist of 80 mm thick Paver blocks manufactured in minimum M 40 grade concrete (approved make – **NIMCO/HINDUSTAN TILES/ PAVERS INDIA LTD / ACME CC PRODUCT** as approved by the Engineer) laid over fine sand of 50 mm compacted thickness. The top surface of interlocking Paver Blocks shall be flushed with Bituminous road surface on one side and top of drain on the other side.
- 4 Top layer shall be 200 mm thick M-20 concrete (BMC) with 0.12 % steel reinforcement in both directions laid properly with formwork and using vibrator with a suitable consistency.

The initial or break down rolling shall be done with 8–10 tonne dead weight smooth-wheeled rollers. The intermediate rolling shall be done with 8–10 tonne dead weight or vibratory roller or with a pneumatic tyred roller of 12 to 15 tonne weight having nine wheels ,with a tyre pressure of atleast 5.6 kg/sq.cm. The finish rolling shall be done with 6 to 8 tonne smooth wheeled tandem rollers. The schedule of rolling shall be as directed by Engineer.

Road Side Drains

The scope of work covered under this specification in general shall comprise of construction of rectangular surface drains. Surface drains shall be provided along the sides of the roads or pavements to collect surface water. Minimum size of drain shall be 300 mm wide & 300 mm deep. The surface drain should have sufficient capacity and longitudinal slope to carry away all surface water collected. The side drains shall be

provided at the edges of right of way. The outfall shall be towards the existing nallah / effluent plant drain or any natural surface drain. The longitudinal bed slope not milder than 1 in 1000 shall be provided for the side drains.

All buildings and paved areas in the plant area shall be provided with catch drains for collecting the roof top and surface water. All the drains and catch pits shall be covered with factory made precast perforated RCC slabs. Wherever the drains have to cross the road way, cross drainage such as slab or pipe culverts should be provided. All drains having depth less than 0.75 m shall be in brick work and greater than 0.75m shall be constructed in RCC. The contractor shall carryout structural designing of the drains and shall submit design and drawings to the Engineer-in -charge for approval.

In addition to above, provision shall be made for collection of roof top rain water from all the buildings in the Rain Water harvesting Chambers and transferred into the ground through Rain Water harvesting system.

In case of RCC drains, the bottom slab and side walls shall be of 100 mm thick (minimum) or as per designs and drawings approved by the Engineer in RCC of grade M-25.

In case of drains constructed in brick work the internal surface shall be plastered and finished with a floating coat of neat cement.

Cable and Pipe Trenches

As far as possible, the alignment of the cable route shall be decided after taking into consideration the present and likely future requirements of other services like drains, water supply pipelines, etc. This aspect shall be brought to the notice of the Engineer-in-charge while planning the works and approval be taken.

Cable trenches should be constructed in such a manner that sharp bends are avoided, however, at the same time route should be kept shortest. Separate trenches shall be provided for LV/MV and HV cables, however, if there is restricted space then provision for fixing different level cable trays be made and LV/MV cables shall be laid above HV cables.

Cable and pipe trenches shall generally be constructed in reinforced concrete, however, 500 mm x 500 mm size or smaller trenches, not on fill may be constructed in 350 mm thick brick masonry in 1:4 cement mortar. The brick trenches will be plastered internally with cement mortar 1:4 and externally in cement mortar (1:3) as directed by engineer-in -charge . The cable trench work shall have recess (monolithic with drain structure) for placing top covers. Necessary fasteners shall be fixed at the time of construction itself for supporting the cables or cable trays.

Trenches within the buildings or plant areas not exposed to direct rain shall be covered with M.S chequered plates, suitably painted and those outside the buildings shall be covered with factory made precast concrete covers as directed by engineer. The trenches shall be suitably sloped to drain rain water to a designated outlet point connected to the plant sewerage or storm water drain system. In case the location of trench does not permit direct connection with plant drainage system then a catch pit should be constructed at the lowest point with necessary dewatering arrangement.

Toilets

All the toilets (One in Raw water sump cum P/House) shall be of a minimum size of 2m X 3m and shall have two WC., one European and one Indian style , One Urinal , One sinkwith taps including a drinking water tap and a 1000 liter HSPE tank place on roof along with P /S traps vent pipes etc.

CCTV cameras

Providing, installation and testing of day/night surveillance cameras near the security guard room, Pump floor level of raw water sump-cum pump house, Motor floor level and Electrical Panel.. The cameras shall be placed in such a manner so as to cover the entire area required to be secured.The system will be used for monitoring at a predetermined place within the plant. The proposed surveillance system shall consist of camera and DVR (Digital Video Recorder). The DVR unit should direct recording of cameras in real time. The resolution of the picture should be high and have clarity in pictures. Multiple monitors should be used for effective monitoring. The operator should have the facility to choose any given camera for viewing on

the other monitor. Each image should be recorded with a camera number, title, time, date and recording speed.

Camera water proof level of the cameras shall be as per IP66, minimum illumination 0.5 Lux/F1.2, 3.14 Megapixel – 2048(H) x 1536(V), Lens – IRIS and CS interface more than 2.0 Mpega, power supply AC/DC = 10 – 24V, power < 2.5 W, S/N ratio > 60dB, WDR 80 dB, video format – 1080P50/60; 1080P25/30; 1080I50/60; 1500P25/30; 1500p50/60 and video output 1 channel SDI interface. The contractor shall provide the data sheet to the engineer for approval. Approved makes are Sony, Panasonic and LG.

3.5 ELECTRIFICATION

Electrification of pump house inside and outside will be done in such a manner that standard level of illumination is obtained at all places. Proper earthing arrangements as per relevant IS specifications are to be provided. The wiring shall be in concealed only. The total number of light points shall be such that minimum 300 Lux illumination inside pump house is available, Sufficient Power points, 15 Amp, each at motor and pipe floor will be provided. Both inside the Pump House and in its surrounding outside LED lamps will be provided . On Approach road decorative lighting suitably spaced is provided on each side **11 kV/415 V**

3.6 RAW WATER RISING MAIN WORK :

From the manifold, DI (Class K-9) Rising main of suitable size, thickness and numbers shall be designed for approximate length of 6400 m to be provided up to the proposed Water treatment Plant of 72 MLD at Birkona Village.

DI (Class K-9) rising main shall be as per IS Code 8329. Necessary Civil works such as excavation, construction of concrete pedestals(/below ground level) below rising main pipes and providing necessary kinetic air valves, scour valves, NRVs valve chamber thrust blocks, DI bends, DI specials as per ground profile providing necessary surge protection equipment, and construction of structures along rising wherever required, back filling the rising main trench after testing and formation of service road along the rising main up to Cascade type aerator of the proposed Water treatment Plant of 72 MLD are included in the scope of work.

The velocity in the rising main pipe shall be limited to 1.75 m/s. The exit end of Raising main pipe shall be kept 0.15 m above FSL of Cascade Type Aerator . Rising main pipes should enter the delivery chamber from the bottom side and raised above the FSL with funnel arrangement.

3.6.1 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.

All around the Raw Water Pump House, RCC road 3.5 wide shall be provided to avoid any settlement due to movement of vehicles or heavy machinery load.

20.0 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.

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) **Lightening conductor, Water level indicator, Aluminum 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 aluminium ladder form 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 @ 250-mm. c/c as foot rests. Ladder shall be rigidly fixed.

Railing :-

Railing should be provided on the top of roof slab along the whole circumference and the sides of staircase. The height of angle post including grouting shall be 1.20 m Angle iron posts shall be of ISA 65x65x6 mm shall be in grade M-25 provided at spacing 1.8 m c/c. 3 rows railing of 25 mm GI pipe medium class welded at sockets & holes shall be provided.

Manhole covers :-

Manholes of minimum size 1.0mx1.50m shall be provided. The covers shall comprise of suitable angle iron frame and 10 gauge thick MS sheet, crossed by suitable flat inside, with locking arrangement.

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 sump :-

Protection work all around the sump 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 6”
RAW AND CLEAR WATER PUMPING MACHINERY

Sr. No.	Particulars	Location
1	Raw water Pumping Machinery on Sumpwell 4 Nos. (2W+2S) VT pumps having discharge 1696840 LPH against a head of 11M	At WTP site
2	Clear Water Pumping Machinery on Clear Water Sump of WTP 4 Nos. (2W+2S) CF pumps having discharge 1690295 LPH against a head of 40M	At WTP site
3	Raw & Clear water Electric Substation Capacity 1500KVA/33/3.3KV	At WTP Site

DETAILED TECHNICAL SPECIFICATIONS FOR MECHANICAL WORKS

SPECIFICATIONS FOR PUMPING MACHINERY

SCOPE OF WORK & SPECIFICATION OF WORK :

SCOPE OF WORK

Design, Supply, Erection, Commissioning, Testing and trial run for 3 months complete for following works under Augmentation Water Supply Scheme for Bilaspur :-

Four nos. Raw Water VT pumping sets of having discharge 471.34 LPS and 11 m head for Bilaspur WSS

AND

Four Nos. clear water horizontal split casing centrifugal pumping sets each of discharge capacity 469.52 LPS with 40 m head

Along with suitable 0.415 KV LT motors with allied electrical and mechanical equipments, control panel, cable, manifold pipe system, valves etc. complete along with 33/0.415 KV electric substation consisting of 1 nos. 33/0.415 KV, **500 KVA** capacity outdoor transformer, isolator, lightning arrestor, control panel, etc. all related complete work at W T P site under Bilaspur Augmentation Water Supply Scheme.

The main items of works are given in annexure E-1.

PART “A”

DETAILED SPECIFICATION OF RAW WATER PUMPSET

1 VERTICAL TURBINE PUMPS:-

The pumping capacity and length of column assembly of each pump is as **specified in annexure “E-1”**.

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.

The pump should be of efficiency of 80% or above at duty point.

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.

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	=	± 10%
Frequency	=	± 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 in **annexure E-1**, which ever is higher among the three option.

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 SPDP (IP23).

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.

4. 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 trust 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

- Each pump shall be provided with Sluice valve to be provided on delivery side of size as specified in **annexure “E-1”**.
- On manifold pipe line one numbers of sluice valve is to be provided of size as specified in **annexure “E-1”**.

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/cm ² (5 min) – For PN 1.6
Body	:	24 Kg/cm ² (5 min) – For PN 1.6

- Each pump shall be provided with Non Return valve to be provided on delivery side of size as specified in **annexure “E-1”**.
- On manifold pipe line one numbers of Non Return valve is to be provided of size as specified in **annexure “E-1”**.

6. 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 specified in **annexure “E-1”**.

➤ **VALVE ACTUATOR**

Providing, erecting electric Valve actuators totally enclosed, weather-proof and dust proof construction with IP-67, protection class suitable for installation in any position without lubrication, leakage or other operational difficulty with special grease filled gear box and hand wheel for emergency manual operation which will automatically dis-engage on restoration of power to motor and with 10 watt single phase space heater and continuous local mechanical position indicator and individually replaceable counter gear assembly and with two torque and four limit switches with S.S. flap and operated with gear driven cams and of rating 250 Volt, 5 Amp. AC/DC, torque switch dial and with TEFC squirrel cage induction motor working on 440Volt +/- 10%, 3 phase, 50Hz AC of intermittent duty rating S-2, insulation class “F” and temp rise restricted to class “B” with IP-67 protection class suitable for DOL starting and with three thermostat and 30% over load margin. The torque rating of reduction gear box shall be at least 1.5 times max. torque required for opening and closing of valve.

7. **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 specified in **annexure “E-1”**.

8. **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 specified in **annexure “E-1”**. 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.

9. **COMMON MANIFOLD PIPES:**

All the pumps delivery pipeline shall be connected to common manifold pipe which is to be provided as per size as specified in **annexure “E-1”**.

10. **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.

1 x 3½ core x of size as specified in **annexure “E-1”**–

Providing, and laying 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 Panel to Motor.

1 x 3½ core x of size as specified in **annexure “E-1”**–

11. **FLOWMETER :-**

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.

TECHNICAL SPECIFICATION FOR ELECTROMAGNETIC FLOW METER SHALL BE AS UNDER:-

The diam. of electromagnetic flow meter should be equal to the Header size of pipe line to be erected between pipe line with two sides flanged. The meter should provided with 25 mtr. Cable and signal convertor should be mounted separately on the nearest wall in the pump house.

Electromagnetic Flow Sensor

Type	: Pulsed DC
Flow tube	: SS 304
Coil housing	: Fully welded Sheet Steel, PU coated
Liner	: Hard Rubber
Electrodes	: SS 316
Grounding type	: Rings
Grounding ring material	: SS 316
Process connection	: Flanged PN10.
Flanges	: CS, SORF
Area classification	: Non-Hazardous
Protection class	: IP 68

Electromagnetic Signal Converter

Mounting	: Separate
Type	: Microprocessor Based
Output	: 4-20mA, HART + Pulse/Frequency + Status

Accuracy	: $\pm 0.5\%$ of measured value
Max load	: approx..500 Ohms,
Power consumption	: 10 VA
Display	: Large back lit LCD Display
Parameters	: Actual flow rate, totalized flow (8 digit), flow direction, flow Velocity.
Diagnostics	: Empty pipe detection
Local indication	: Programmable
Power supply	: 230 VAC
Housing	: Die cast Aluminum with PU finish
Cable entry	: M20 x 1.5
Area classification	: Non-Hazardous
Protection class	: IP 67
Interchangeability	: Fully Interchangeable with all sizes of flow sensors

12. **CONTROL PANEL BOARDS:**

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.

2 Nos. of Incoming feeders each comprising of:-

- 1 No. 630 Amps MCCB.
- 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.
- 1 No. Multifunction meter.
- The bus bar shall be suitable for full load of Ampere of MCCB of incomer.

1 No. Bus couplar between 2 incoming feeders comprising of

1 No. 630 Amp. MCCB with interlocking arrangement both electrical as well as mechanical.

Outgoing feeder with front operated rotary handles facilities shall be provided as under:

- 4 Nos. of 315 Amps MCCB for out going with over load and short circuit protection
- 2 Nos. of 32 Amps 4P MCCB for auxiliary loads.
- 2 Nos. of 63 Amps 4P MCCB for auxiliary loads.
- 4 Set. of Ampere Meter for motor with selector switch.
- 4 Sets. of Capacitor of 50 KVAR with 125 Amp. MCCB fuse links.
- 4 Nos. 4P MCB for valve actuators.

The bus bar shall be suitable for 3 phase, 4 wire and shall be of 250 amps. 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 shall also provide rubber hand gloves, rubber mattings in front of panel boards.

13. **SOFT STARTERS**

The soft starter panel shall be suitable on operating voltage $415V \pm 10\%$ 3ph., 4 wire and $240 V AC \pm 10\%$

control supply voltage at 50Hz \pm 5% to be provided on line side of motor for pump application as per IS 5553 (part 3) of 2mm thick CRCA sheet, with IP 41 protection, natural air cooled, duly epoxy power coated, with bottom side removable cable gland plates of non magnetic material.

The Starter should limit the starting current of motor between 3 to 3.5 of full load current, with Start/Stop/Reset – Push buttons, Bus bar shall be of Electrolytic Copper Conductor, of suitable capacity with 'H' class insulation with temperature rise limit upto class 'B' & 50° Amp. temperature.

The starter should have power contactors as a by pass device having following protection relay (O/L, SP, EF, LR, UC) 1) U/O voltage relay. Indications by LED type indicating lamps.

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.

L.T. Panel board incorporating ammeter
voltmeter, switches, starter, earth
leakage
circuit breakers, single phasing preventer
water level guard, capacitor etc.
EOT Crane
Tools, Spares and lifting arrangement

PART "B"
DETAILED SPECIFICATION OF CLEAR WATER PUMPSET

1. **PUMP:-**

The pumping capacity of each pump will be as given in **annexure "E-1"**.

1.1 **GENERAL DESIGN CONDITIONS:-**

The pumps shall Horizontal split casing type of Single/Two Stage Centrifugal type. The pumps shall be designed to operate satisfactory while handling positive or negative suction as specified in **annexure "E-1"** 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 75% and HP of motor as given in **annexure "E-1"** 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 of Bronze.

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.

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.

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 specified in **annexure "E-1"** 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 specified in **annexure E-1**, which ever is higher among the three option.

5.4 **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 TEFC.

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 dielectrical 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.

5. 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 no 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.
- H. The valve shall generally conform to relevant C.I. BS:5155 Wafer (Short), Valve shall be **warm gear operated** for smooth operation.

DATA

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

3. SHOP TESTING:

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

- Each pump shall be provided with BUTTERFLY valve to be provided on delivery side of size as specified in **annexure “E-1”**.

- **VALVE ACTUATOR**

Providing, erecting electric Valve actuators totally enclosed, weather-proof and dust proof construction with IP-67, protection class suitable for installation in any position without lubrication, leakage or other operational difficulty with special grease filled gear box and hand wheel for emergency manual operation which will automatically dis-engage on restoration of power to motor and with 10 watt single phase space heater and continuous local mechanical position indicator and individually replaceable counter gear assembly and with two torque and four limit switches with S.S. flap and operated with gear driven cams and of rating 250 Volt, 5 Amp. AC/DC, torque switch dial and with TEFC squirrel cage induction motor working on 440Volt +/- 10%, 3 phase, 50Hz AC of intermittent duty rating S-2, insulation class “F” and temp rise restricted to class “B” with IP-67 protection class suitable for DOL starting and with three thermostat and 30% over load margin. The torque rating of reduction gear box shall be at least 1.5 times max. torque required for opening and closing of valve.

6. 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/cm ² (5 min) – For PN 1.6
Body	:	24 Kg/cm ² (5 min) – For PN 1.6

- Each pump shall be provided with Non Return valve to be provided on delivery side of size as specified in **annexure “E-1”**.
- On manifold pipe line one numbers of Non Return valve is to be provided of size as specified in **annexure “E-1”**.

7. SLUICE VALVES:

1. DESIGN REQUIREMENT:

- A. Sluice valves shall be I S I mark and conforming to IS 14846, 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. Valves 300 mm dia & above shall be provided with an antifricition device/ ball trust bearing arrangement to minimize friction between spindle collar and casting. These should be housed away from wet chamber and should have facility for periodic grasing.
- d. Valves of size 350 mm dia and above shall be provided with enclosed, grease packed spur/ worm gear box.
- e. Valves 450 mm dia and above shall be provided with a drain and air plug.
- f. 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.
- g. All valve doors when fully closed, would ensure door faces are riding on body seat ring by atleast 50% of the width of seat ring and there is sufficient room for wear travel.
- h. All face and seat rings will be force/press fitted and additionally riveted (300 NB & above) to the recess in the CI casting.
- i. 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

- Each pump shall be provided with Sluice valve to be provided on suction side of size as specified in **annexure “E-1”**.
- Each pump shall be provided with Sluice valve to be provided on delivery side of size as specified in **annexure “E-1”**.
- On manifold pipe line one numbers of sluice valve is to be provided of size as specified in **annexure “E-1”**.

8. **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.

9. **SUCTION & DELIVERY PIPES:**

Providing, laying & jointing of D/F, M.S. Suction & Delivery pipes of lengths as per site requirement and

size of pipe shall be as specified in **annexure E-1**.

10. ENLARGER:

Each pump shall be provided with M.S. D/F Eccentric Enlarger of size as specified in **annexure E-1** x suction size of pump.

Each pump shall be provided with M.S. D/F Concentric Enlarger of size as specified in **annexure E-1** x outlet size of pump.

11. DISMANTLING JOINT:

Each pump suction and delivery pipe line and one numbers on manifold pipe line shall be fitted with D/F dismantling joint of size as specified in **annexure E-1**. 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.

12. BENDS:

Each pump Suction pipe and delivery pipe may have to be provided with D/f bend as per site condition of size as specified in **annexure E-1**.

13. COMMON MANIFOLD PIPES:

All the pumps delivery pipeline shall be connected to common manifold pipe which is to be provided as per size as specified in **annexure E-1**.

14. 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.
2 x 3½ core x of size as specified in **annexure E-1**–

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 Panel to Motor.
1 x 3½ core x of size as specified in **annexure E-1**–

15. FLOWMETER :-

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.

TECHNICAL SPECIFICATION FOR ELECTROMAGNETIC FLOW METER SHALL BE AS UNDER:-

The diam. of electromagnetic flow meter should be equal to the Header size of pipe line to be erected between pipe line with two sides flanged. The meter should provided with 25 mtr. Cable and signal convertor should be mounted separately on the nearest wall in the pump house.

Electromagnetic Flow Sensor

Type	: Pulsed DC
Flow tube	: SS 304
Coil housing	: Fully welded Sheet Steel, PU coated
Liner	: Hard Rubber
Electrodes	: SS 316
Grounding type	: Rings
Grounding ring material	: SS 316

Process connection : Flanged PN10.

Flanges : CS, SORF

Area classification : Non-Hazardous

Protection class : IP 68

Electromagnetic Signal Converter

Mounting : Separate

Type : Microprocessor Based

Output : 4-20mA, HART + Pulse/Frequency + Status

Accuracy : $\pm 0.5\%$ of measured value

Max load : approx..500 Ohms,

Power consumption : 10 VA

Display : Large back lit LCD Display

Parameters : Actual flow rate, totalized flow (8 digit), flow direction,
flow Velocity.

Diagnostics : Empty pipe detection

Local indication : Programmable

Power supply : 230 VAC

Housing : Die cast Aluminum with PU finish

Cable entry : M20 x 1.5

Area classification : Non-Hazardous

Protection class : IP 67

Interchangeability : Fully Interchangeable with all sizes of flow sensors

16. CONTROL PANEL BOARDS:

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.

Incoming feeders comprising of:-

Incoming feeders comprising of with LSIG Protection:-

- 2 Nos.1600 Amperes Air circuit brakers.
- 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.
- 1 No. Multifunction meter.
- The bus bar shall be suitable for full load of ampere of ACB of incomer.

1 No. Bus couplar between 2 incoming feeders comprising of

1 No. 1600 Amp. ACB with interlocking arrangement both electrical as well as mechanical.

Outgoing feeder with front operated rotary handles facilities shall be provided as under:

- 4 Nos. of 800 Amps. Air circuit brakers
- 2 No. of 32 Amps MCB for auxiliary loads.

- 2 No. of 63 Amps MCB for auxiliary loads.
- 2 No. of 125 Amps MCB for auxiliary loads.
- 4 Sets. of Ampere Meter for motor with selector switch.
- 4 Sets. of Capacitor of 100 KVAR with MCCB of 250 Amp. Each.
- 4 Nos. 4P MCB for Valve actuators.

The bus bar shall be suitable for 3 phase, 4 wire. 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 shall also provide rubber hand gloves and rubber mattings in front of Panel Boards.

17. SOFT STARTERS

The soft starter panel shall be suitable on operating voltage $415V \pm 10\%$ 3ph., 4 wire and 240 V AC $\pm 10\%$ control supply voltage at $50Hz \pm 5\%$ to be provided on line side of motor for pump application as per IS 5553 (part 3) of 2mm thick CRCA sheet, with IP 41 protection, natural air cooled, duly epoxy power coated, with bottom side removable cable gland plates of non magnetic material.

The Etaster should limit the starting current of motor between 3 to 3.5 of fault load current, with Start/Stop/Reset – Push buttons, Bus bar shall be of Electrolytic Copper Conductor, of suitable capacity with ‘H’ class insulation with temperature rise limit upto class ‘B’ & 50° Amp. tempreture.

The starter should have powe contactors as a by pass device having follosing protection relay (O/L, SP, EF, LR, UC) 1)U/O voltage relay. Indications by LED type indicating lamps.

18. 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. |

PART "C"

DETAILED SPECIFICATION FOR VARIOUS ITEMS FOR SUB- STATION.

1. TRANSFORMER:

GENERAL REQUIREMENT:

Sub-station shall be provided with 2 Nos. **1500 KVA** for Clear Water capacity transformer given in **annexure E-1** 33/0.415 kV double copper wound outdoor type transformer. The transformer of sub-station shall be installed on the specially constructed open to sky. Stage of about 1.0-1.5 M. height above ground level connected hence the entire cable connection arrangements of these transformer shall be closed type.

Voltage ration	:	33/0.415 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	:	± 7.5% of rated voltage.
b.	Frequency variation	:	± 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 shock 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 valve 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 at the bottom and at the top of the tank diagonally opposite corners shall be provided. The valve 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 lited 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.

3½ core x of size as specified in **annexure E-1**–

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 as specified in **annexure E-1** 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 30 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.

5. 33 KV DROP OUT FUSE –.

Each Transformer shall be provided with DO Fuse set as per enclosed tentative drawing attached.

6. 33 KV GANG OPERATED A B SWITCH:

Each Transformer & Incoming of electricity board line shall be provided with 33 KV up right mounted Horizontal or Vertical rotating single break A b switch which should be compact in design, operated with manual handle, confirming to IS:9921 (Part I to V) 1981.

7. ACRS CONDUCTOR –.

This shall be used for transmitting line from electricity board connection to Transformer for 33 KV line of 48sq.mm.

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 for additional earthing of Transformer, panel etc.

G.I. STRIP:

Supply & fixing of G.I. Trip 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.

8 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.
- 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.
- 6 pole structure for transformer
- Control room 20 Sqm
-

9 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.

10 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. 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.

16. 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.

17. Work of erection (as per IE rules) of entire sub station equipments and allied works.
18. Work of drawing preparation, commissioning along with obtain of charging permission from electrical inspector as per IE rules.

PART- A

SCHEDULE FOR ITEMS FOR RAW WATER VT PUMP SET.

S.No	Particulars.	Qty.
	DESIGN, SUPPLY, FIXING, COMMISSIONING, TRIAL RUN OF FOLLOWING AS PER DETAILED SPECIFICATIONS GIVEN ON ANNEXURE "E"	
1.	V.T pump for 471.34 LPS at 11 Mtr. total head as per detail specification along with column pipe of size 450 (pipe)x 43 (shaft) mm column assembly. of 6 MTR length I/c bowl assembly, Foundation bolts for above pump set along with required HP VHS Electric Motor 3 phase, 415 volts, 1450 RPM Speed as per detail specification. Pump efficiency minimum 80% at duty point.	4 Set.
2.	Vertical Hollow Shaft motor, SPDP, 1450 RPM suitable to operate on 415V + 10%, 3P, 50Hz, AC supply having 'F' class insulation temp. rise limited to 'B' class with continuous duty, conforming to IS-325	4 Nos.
3.	Butterfly valve electrically operated of PN 1.0 size 450mm for delivery side of pump as per detail specification.	4 Nos.
4.	Sluice valve of PN 1.0 size 450mm for delivery pipe as per detail specification.	4 Nos.
5.	Non-Return valve of PN 1.0 size 450mm for delivery side of pump as per detail specification.	
6.	Sluice valve of PN 1.0 size 800mm for manifold pipe as per detail specification.	1 No.
7.	Non-Return valve of PN 1.0 size 800mm for common manifold pipe line as per detail specification.	1 No.
8.	D/f Flow meter of electromagnetic type for installation on manifold pipe as per detail specification.	1 No.
9.	Pressure gauge of dial size 150mm dia 0-4 kg/cm ² for delivery side of pump as per detail specification	4 Nos.
10.	M.S./ CI Dismantling Joint of 450 mm for delivery side of pump as per detail specification.	4 Nos.
11.	M.S./ CI Dismantling Joint of 800 mm for common manifold pipe.	1 No.
12.	M.S. D/F Pipe for delivery of 450mm size of 8 mm long thickness along with flanges & hardware like Nut, Bolts, Washers & Rubber Sheet, complete for joining pipes, valves, etc.	500 Kg
13.	M.S. D/F 450 x 500 distance prices on delivery size of pump along with flanges, nutbolts etc.	4 Nos.
14.	M.S. S/F 450 mm Bend of 90/45 deg for jointing to common main fold and pump outlet.	4 Nos.
15.	M.S. D/F Pipe for common manifold of 800mm size of 8 mm thickness and of lengths as required along with flanges & hardware like Nut, Bolts, Washers & Rubber Sheet complete for joining pipes, valves, etc.	2500 Kg
16.	3½ core x 400sq.mm Aluminum Armored cable from MCCB to pump hose MCCB including accessories like lugs, gland. For connection of Transformer MCCB Panel to Motor Panel.	300 Mtr.
17.	3½ core x 120sq.mm Aluminum Armored cable from Panel to motor including accessories like lugs, gland. For connection of Panel to Motor.	200 Mtr.
18.	HOT Crane 3 Ton capacity with 6 mtr. span & 6 mtr. lift of chain & 40 x 40 mm sq. bar etc. complete as per specification.	1 Set
19.	MOTOR CONTROL PANEL: Motor control panel shall be as per detail specification along with soft starters 4 nos. as per specification	1 Set
20.	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Strip 25 x 5 mm, Complete alongwith coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete	4 Nos.
21.	Tools accessories as per specification.	1 Set

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

22.	Installation and commissioning of all above items including painting, trial run of 3 months and testing	1 Job
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PART - B

SCHEDULE FOR ITEMS FOR CLEAR WATER PUMPSET

S.No	Particulars.	Qty.
	DESIGN, SUPPLY, FIXING, COMMISSIONING, TRIAL RUN OF FOLLOWING AS PER DETAILED SPECIFICATIONS GIVEN ON ANNEXURE "E"	
1.	Centrifugal pump for 469.52 LPS at 40 M total head with suction positive as per detail specification along with Coupling, Coupling guard, Base Plate & Foundation bolts for above pump along with suitable HP Electric Motor 3 phase, 415 volts, foot-mounted TEFC 1450 RPM type as per detail specification. Pump efficiency minimum 85% at duty point.	4 Set.
2.	Suitable HP Electric Motor 3 phase, 415 volts, foot-mounted TEFC 1450 RPM type as per detail specification.	4 Nos.
3.	Sluice valve of PN 1.0 size 450mm for suction side of pump as per detail specification.	4 Nos.
4.	Non-Return valve of PN 1.0 size 450mm for delivery side of pump as per detail specification.	4 Nos.
5.	Sluice valve of PN 1.0 size 400mm for delivery side as per detail specification.	4 Nos.
6.	Sluice valve of PN 1.0 size 800mm for manifold pipe as per detail specification.	1 No.
7.	Non-Return valve of PN 1.0 size 800mm for common manifold pipe line as per detail specification.	1 No.
8.	Pressure gauge of dial size 150mm, 0-7 kg/cm ²	4 Nos.
9.	D/F Flow meter of electromagnetic type size 800mm for installation on manifold pipe as per detail specification.	1 No.
10.	M.S. D/F Pipe for suction as per site requirement of 450mm size along with flanges & hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	800 Kg
11.	M.S. D/F 450mm Bend of 90/45Deg for suction side.	4 Nos.
12.	M.S./ CI Dismantling Joint of 450 mm for suction side of pump as per detail specification.	4 Nos.
13.	M.S. D/F Pipe for delivery of 400mm size along with flanges & hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	800 Kg
14.	M.S. D/F 450mm Bend of 90° for jointing to common main fold and pump outlet.	4 Nos.
15.	M.S. D/F Pipe for common manifold of 800mm size and of following lengths along with hardware like Nut, Bolts , Wickers & Rubber Sheet complete for joining pipes, valves, etc.	2500 Kg
16.	3½ core x 400sq.mm Aluminum Armored cable including accessories like lugs, glands. For connection of Transformer MCCB panel to Motor Panel.	200 Mtr.
17.	3½ core x 240 sq.mm Aluminum Armored cable from starter to motor including accessories like lugs, gland. for panel to Motor.	200Mtr.
18.	HOT Crane 3 Ton capacity with 6 mtr. span & reqd. lift of chain & 40 x 40 mm sq. bar etc. complete as per specification.	1 Set
19.	MOTOR CONTROL PANEL: shall be as per detail specification, with 4 Nos. Soft starters as per specification.	1 Set
20.	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Earthing wire 12 SWG, 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.	4Nos.
21.	Accessories as per specification.	1 Set
22.	Installation and commissioning of all above items including painting, trial and testing	1 Job

PART – C

SCHEDULE FOR ITEMS FOR CLEAR WATER PUMPING STATION SUB STATION.

S.No.	Particulars.	Qty.
	DESIGN, SUPPLY, FIXING, COMMISSIONING, TRIAL RUN OF FOLLOWING AS PER DETAILED SPECIFICATIONS GIVEN ON ANNEXURE “E”	
1	33/0.415 kV 1500 KVA Transformer having as per detail specification.	2 No.
2	33 kV Lightning Arrestor.	6 Set.
3	33 kV DO Fuse Unit.	4 Set.
4	33 kV A.B. Switch Complete with Rod/ Handle.	2 Set
5	ACRS Conductor.	300 M.
6	33 kV Pin Insulator.	18 Nos.
7	33 kV DISC Insulator.	54 Set.
8	Hardware kit, compete for laying of ACSR Conductor & inter connection from A/B Set, L/A Set, D/O Set, Pin & Disc Insulator upto transformer.	2 Set.
9	3½ core x 400 sq.mm Aluminum Armored cable from Transformer to MCCB panel including accessories like lugs, glands.	150 M.
10	Main panel having 400 Amp MCCB for fixing near transformer.	2 Set
11	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Strip 25 x 5 mm, Complete hardware of earthing like coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete	14Nos.
12	I Section 200 x 100 - Length as required . Channel 100 x 50 , etc. – as required.	4700 Kg.
13	Fencing work using 50 x 50 x 5mm size vertical post of 3 Mtr. length and 50 x 50 x 5mm size struts for even corner of 3 Mtr., Wire mesh of 3mm thick with netting size of 100 x 100mm of height 2 Mtr., M.S. Flats of size 25 x 3mm size for vertical & horizontal support., Hardware material, like Nut, Bolt, G.I. Wire, etc. for fencing., Gate of 3.5 Mtr. Wide & height of 1.5 Mtr. of Iron Steel.	51 RM
14	Metalling	1 Lot.
15	Street lighting poles of height – 8.5 Mtr. Sodium Vapor Lamp of 250 Watts & fitting for Sodium Vapor lamp with hardware complete.	4 Nos.
16	Cables of 2.5sq.mm x 2 core copper armored cable for street lighting load.	300mtr
17	Drawing preparation for sub – station and approval from safety electrical inspector.	1 Job
18	Charging permission for sub – station and approval from safety electrical inspector.	1 Job
19	All civil work relating to erection of poles, fencing work, construction of platform for transformer, earth pit chambers.	1 Job
20	Installation and commissioning of all above items including painting, trial and testing	1 job
21	ACCESSORIES	
	Rubber Hand Gloves.	1 Set.
	Ball Pin Hammer with Wooden Handle.	1 Set.
	Screw Driver 8” & 12”	1 Set.
	Shock Treatment Chart.	4 Nos.
	Danger Notice Board.	1 Nos.
	Fire Stand with Fire Bucket in sub-station.	1 Nos.
	Insulated Player.	1 Set.
	Fire extinguisher 4.5 Kg.	1 Set.
	D.O. Operating rod 33 kV fiber H.D.	1 Set.
	Discharge rod with accessories fiber.	1 Nos.
	Helmet H.D.	1 Set.

ANNEXURE
SPECIAL CONDITIONS FOR WORK

1. Work is for complete design, supply, installation & commissioning of all items, as per detail specification given in Annexure – “E” shall only be followed.
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 “H”. 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
Bilaspur**

ANNEXURE - "E-7"

Provision of PLC SCADA Based Automation for 72 MLD WTP

SCOPE OF WORK

1.0 GENERAL

The scope of work includes design, supply, installation, commissioning and maintenance for 10 years of SCADA Automation of Water Supply scheme of Bilaspur consisting of

- (a) proposed WTP 72 MLD capacity including clear water sump-cum pump house, Raw Water sump-cum Pump House,

The work include providing redundant PLC's / RTU's to collect the data and transmitting it on GSM backbone to LCS to be installed at 2 No.pumping stations and further transmitting the data on GPRS backbone to MCS to be installed at WTP Birkona village , Bilaspur.

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 72 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 12 months and commissioning to Engineers and Process Operators.

Instrumentation at new WTP (72 MLD) 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
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 /	Required

Sl. No	Description / Component	Requirement
	transmitters	
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 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.
- b) 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
- c) 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 it's 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.

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.

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 converters. 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
<u>III) pH Transmitter</u>		
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 (RCl) measuring system shall consist of RCl transducer, RCl transmitter, digital RCl indicator and any other item required to complete the RC measuring system.

RCl transducer shall be rugged in construction and shall be suitable for continuous operation. RCl 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 RCl analyzer equipment and RCl transmitter.

The RCl 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 RCl transmitter output shall be suitable for transmitting over long distance.

<u>D) General</u>		
1	Overall accuracy of measurement loop	± 5% of measured value
<u>II) Residual Chlorine Sensor</u>		
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 ratiometric 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.

I) General		
1	Overall accuracy of measurement loop	±2%
II) Turbidity Sensor		
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:

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

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)
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.

Sr. No.	Description
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.

Operation and Maintenance

Contractor has to run the SCADA automation system for 12 months trial period after successful completion of the project.05 years O& M including replacement and warranty shall start thereafter.

The contractor shall provide 2 years spares at the SCADA station proper upkeep of the SCADA automation station. List of spares shall be as follows:

For any one day non functioning of the SCADA system will result in the deduction of 1/30th of the monthly payment due to the contractor.

Atleast two trained supervisors shall be deputed by the contractor for proper functioning and preparation and supervision of the daily reports indicating treatment efficiency of each unit

Daily reports shall be submitted to the Engineer in Charge.

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, Amco
Battery Charger	Chaabi Electrical, Masstech
Ultrasonic Type Level Measurement	Endress+Hauser / Krohne Marshall / Hycontrol

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

Device	UK.
Pressure switch	Indfoss, Switzer, Tag Process Instruments
Pressure gauge	WAREE, WIKA, AN Instruments, Guru, Hitek
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"

SPECIAL CONDITIONS FOR WORK

12. Work is for complete design, supply, installation & commissioning of all items, as per detail specification given in Annexure – “E” shall only be followed.
13. Electrification work shall be done as per I.E. Rules only.
14. Electrification work shall be done by “A” class contractor, whose certificate to be produced before commissioning of work.
15. 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.
16. 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.
17. Contractor/firm shall also get permission for commencing the sub-station by safety electrical inspection authority of Govt.
18. Contractor/firm shall offer their prices on basis of specification given as per Annexure – “E” only.
19. This office shall only accept items of makes specified in the tender documents as per Annexure “I”. All other items whose makes has not been specified should be as per IS specification.
20. Contractor/ firm shall have to submit manufacturers test certificate for items like, Pumps, Motors, Valves, Panel, Transformer and ACB.
21. Contractor would be provided with desired certificate for consumption of items as per Annexure “E- 1” for this project.
22. 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
Bilaspur**

ANNEXURE E-8 **REFORM WORKS**

Scope of Work

Name of Work:- Reform work of 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, Supply installation and training of international standard GIS software, Digitization of satellite image includes collection of DGPS points of important level marks geo referencing of satellite image, creation of base map and mapping of existing and proposed water supply scheme for BILASPUR Town. Procurement of Quick bird / geo eye-1 fresh bundled, high resolution data with 0.6 m resolution for the area of the town inclusive of sub works under Augmentation Water Supply Scheme for BILASPUR town Under AMRUT MISSION

1. The Site shall be handed over to the successful contractor by RMC. The contractor has to coordinate with the the distribution network contractor, as per the instructions of RMC 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 RMC for approval in writing and after the approval of RMC 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 depute dedicated site teams for making awareness in the public about the advantages of the meters and how they can bring the monthly charges down by using water sensibly. 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 RMC 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 RMC and produce the same for release of installation amount.
4. 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 RMC as a submission / completion report.
5. The lumpsum item to include
Item No.1:

CONSUMERSURVEY

SCOPE OF WORK: OBJECTIVES:-

The objectives of the survey are:

- ① Details of consumption of water by different beneficiaries, i.e. Domestic, Industrial Commercial, non-domestic etc.
- ① Determine the perception of water services received.
- ① Provide facts for formulation of policy for Water billing and revenue collection
- ① Provide information and measures to be taken to improve the efficiency and financial performance of the Water distribution system.
- ① Evaluate the quality of service when reporting problems or making enquiries.
- ① Determine the level of awareness of promotional water conservation initiatives.
- ① Identify issues relating to payment and billing for services.

COMPONENT INCLUDES Survey of the Utility

1. Survey of Consumers in all households in Municipal Corporation water Distribution area (Residential consumption) and number of house hold in the city. This should be correctly given in consumer survey report, Also when the survey report is being prepared it should clearly state number and name of ward, number of house hold, number of commercial properties, number of institutional, number of industries properties and other if any.
2. Survey has to be conducted in all non-domestic consumers like hotels, Lodge, shops (Commercial consumption) and no of such properties like institutional, commercial, industrial etc. & their demand in various stages.
3. Survey has to be conducted in all institutions like Schools, hostels, Bus stands, Government offices, hospitals, etc (Institutional consumption).
4. Survey has to be conducted in industrial area. (Industrial consumption)
5. Survey has to be conducted at all public stand posts (public stand post consumption) No. of properties dependent on stand posts should be found out, Also No. of stand post working/non-working should be noted during surveys.

DATA COLLECTION

Survey form has main five categories as below

1. Identification–

Under this category basic information has to collect his house number, complete address, telephone number, etc.

2. Economic status-

Under this category data has to be collected like name of respondent, sex, education, occupation, family income and size of family etc.

3. Details of House/ Building–

Data to capture in this section are type of building, where they live, and construction of building. Also information about number of water closet, number of total taps use in house, use of water like whether they use water for gardening.

4. Connection Details

In this data collect information of the customer / owner on whose name the connection is Register. Bill connection no. of connection name must be fill accurately.

5. Quantity and use–

Use of water for daily activities in liters from various

6. Health Information:

Information of main diseases occurred in last one year.

METHODOLOGY

Survey has to be conducted house to house

The survey has to simply design to collect information about customer perceptions, their billing habits, their water consumption and usage, their understanding about the water tariff and system, their satisfaction area.

Methodology is an operational framework within which facts are placed so that their meaning may be seen more clearly. The scientific method is further a systematic and organized series of steps that ensures maximum consistency and objectivity in researching a problem.

This survey has to be conducted in which data collectors have to participate as facilitators to the respondents. Data has to be collected by utilizing structured interviews conducted for a total number of households recorded in Municipal Corporation.

A disadvantage of employing interviews to gather data is that the responses given may not be accurate and may not reflect real behavior. Respondents may also provide wrong information and may forget or lack the information required. These disadvantages of the selected data gathering method may well influence the findings of this survey. The surveyor should take care of such matters.

The interview schedules/questionnaires for the structured interviews have to be supplied by the Water Supply and Sanitation Department. These schedules and survey approach have to be kept consistent for all areas and wards.

Properties shall be taken as per the property register of Municipal Corporation.

If a single property/building contains no. of flats, then the nomenclature of flat in the buildings shall be represented as 300/1, 300/2 and so on. RDBMS shall be developed. For Chawls and or tenants within a property extra numbers to be obtained.

1. Preparing the rehabilitation plan by necessary replacement of pipe and valve etc. using the hydraulic model, running the model.
2. Preparation of report, drawing and printing the same in presentation form.

Detailed immediate recommendation to rectify the existing water supply network and suggestion to convert the intermittent W.S. to continuous water supply stage wise also shall be included in report.

The diagram of water supply scheme network and zones and other ancillary input data for design and analysis shall be got approved from Engineer-in-charge etc. complete.

Item No.3:

Digitisation: 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 including mapping of existing and proposed water supply scheme of BILASPUR Town. 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. Creation of data base for existing and proposed pipe network and updating it during execution as per the actually laid pipes and synchronising all the data base with SCADA & PLC upto OHSRs for regular maintenance and operation

Item No.6:

Supply of GIS software: Supply and installation of GIS software of international standard of single user includes such as software capable of handling GIS features like query, buffer analysis, listing of data base etc. and should support co-ordinate system as per detailed specifications, including training for 5-10 persons with taxes viz. sales tax, custom duty but excluding octroi, which shall be charged extra as applicable including handling, freight and insurance charges etc. complete.

Item No.7: Procurement of Quick bird / geo eye-1 fresh bundled, high resolution data with 0.6 m resolution for the area of the town inclusive of sub works upto headworks if possible from National Remote Sensing Centre (NRSA), Hyderabad for fresh acquisitions, including handling charges as per direction...etc. complete.

BILASPUR MUNICIPAL CORPORATION

Consumer Survey Form

GridNo.: _____

AssessorName: _____

Plot Details:

G.I.S.Plot ID:	CityName:	PlotName:
WardName:	WardNo.:	DMANo.:
OperationZone:	Property/CitySurveyNo.:	StorageFacility: (1-UGTonly,2-OHSR, 3-both,4-none)
No.ofConnection:	Source: (1-Open Well, 2-Bore Well, 3-Both, 4-Public standpost,5-None)	TankerSupply(1-Yes,2-No)
ForSchool:No.ofStudents_____ForHospitals:No.ofBeds__Foroffices:No.ofEmployees_ForHotels:No.ofChairs/Beds_		
ForSlums:No.ofStandPosts_____No.ofGroupConnections_ Nooffamiliesononestandpost_ No.offamiliesongroupconn		

Connection Details:

GISPlotID:	Conncount:	BillConn No.:
Conn FirstName:	PlotNo.StreetName:	ConsFamily Size:
ConnMiddleName	AreaName,Location:	City:
ConnLastName:	ContactNo.:	Pin:
E- Mail:	Source:(1-municipalsupply, 2-MJP)	Connection(1-Legal,2-Illegal)
ConnectionType: (1-Metered,2-unmetered)	ConnectionSize: (15mm-1,20mm-2, 35mm-3,32mm-4,40mm-5)	ConnectionUse: (1-domestic,2-NonDomestic,3-institution)
ConnectionMeterNo.:	MeterMake:	MeterStatus: (1-working,2-nonworking,3-disconnected)
BillingPeriod: (1-monthly,2-bimonthly,3-quarterly,4-halfyearly,5-yearly)	BillingMethod: (1-asperquantity,2-flat rate)	TotalChargesiffflatrate(Rs.)
Conn.Distance(inmeter)	Meterownership(1-own,2-Corporation,3-MJP)	SupplyHrs.
WaterQuantity: (1-Excess,2-Adequate,3-Insufficient)	WaterQuantity: (1-Satisfactory,2-NotSatisfactory)	WaterPressure: (1-High, 2-Medium,3-Low)

Flat Details:

FormNo.: _____

AssessmentDate:

GISFlatID:	FlatID:	FlatNo.:
FlatFirstName:	FlatMiddle Name:	FlatlastName:
FlatFamilySize:	HouseLocked (1-Yes, 2-No)	TapsTotal:
Education: 1-Illiterate2-Literatebutnotformal schooling,3-Schoolingupto4years,4-Schoolingbetween 5-10Yrs,5-upto HSSC,6-Graduate,7-Postgraduate,8- PhD.	Occupation: 1-SelfEmployee,2-PrivateSectorEmployee,3-Govt.Employee, 4-HouseWife, 5-Unorganised sector, 6-other,	AnnualIncome: 1-LowIncome(<1,00,000),2-Middleincome Group(1,00,000to3,00,000),3-HighIncome Group(>3,00,000)
Building Type: (1-House,2-Bunglows,3-Flat,4-Chawl,5-Slumtenement,6-Industry,7-Hospital,8-Dispensary,9-Shop,10-School/College,11-Hostel/Lodge,12-ReligiousInstitutions, 13-GovernmentOffice,14-GovernmentQuarter,15- Cattles Shed,16-Others)	TotalFloors	FloorNo.:
	ConnectionRequirement:(1-Yes,2-No)	

Remark

(1-MunicipalConnection,2-NonRegisteredConnection,3-NoConnection,4-houseLocked,5-PermanentLocked,6-NoCo-operation,7-WaterusefromNeighbor Tap,8-BillNotReceived,9-NoBilling,10-NewConnection,11-UnderConstruction,12- DemolishProperty)

Name of Investigator:

Date:

Special clauses:

- (33) **PREPARATION OF GIS BASED MAP:** Contractor has to prepare a entire layout plan of indicating the complete integrated water supply scheme including canal intake works, raw water sump-cum pump house, 72 MLD WTP, Intake well and all OHSRs (existing and proposed) , , clear water pumping station, all rising mains, gravity feeders , distribution network (existing and 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.
- (34) **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. “
- (35) **LIST OF SPARES TO BE MAINTAINED DURING O &M period of 72 MLD WTP:**
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 72 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 72 MLD WTP
- (i) Flash Mixer
 - (d) Motor----1 no of each capacity of motor
 - (e) Bearing----1 set for each type of pump and motor
 - (f) Shaft----1 set for each type of pump of specified MOC
 - (ii) Clarifloculators
 - (c) Motor Shaft--1 set for each type of motor
 - (d) 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 ≤ 2 ppm

(36) 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 both 72 MLD Water Treatment Plants.

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 ≤ 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.”

- (37) As regards the provision of HSC including the installation and commissioning of consumer water meters the onus lies on Municipal Corporation to provide the site to the contractor. In case six months after the completion of the entire Lump Sum Contract work except the provision of HSCs the Municipal Corporation fails to hand over the balance complete site of HSCs to the contractor, the contractor is at liberty to apply for extension of PDC(probable date of Completion) or he can request for determination of the contract.

ANNEXURE E-9 **ANCILLARY CIVIL WORKS**

Scope of Work

The entire scope of work has been as indicated below:

1. Design and Construction of allied civil works as follows:

Security Guard Rooms (2 No.), Boundary Wall (2.5 m high) all around including Steel gate , RCC path , Solar Photovoltaic Lamp poles complete for the following installations:

a. 72 MLD WTP in village Birkona(3.5 wide road) & Raw Water Sump-cum Pump House.

b. RCC Approach road (7.0 m wide , 200m length from Canal Intake to Raw Water Sump-cum-pump House

2. Providing supplying erecting and commissioning computer, peripherals and furniture and other miscellaneous items including communication telephone and Internet connection

3. Plantations, landscaping and beatification at construction sites

4. Provision of Solar Photovoltaic Lamps for proposed 72 MLD WTP(45 No.), Raw water p/House(30), Electric Sub Stations (2 No.--20 Solar lamps) , all OHSRs(20 N0.),GLSR premises(5 N0.), Intake works (5 N0.)complete including 5 years warranty and 12 months trial run

1.0 SCOPE OF WORK & SPECIFICATION OF WORK :

Designing, providing and constructing allied civil work such as i) Compound Wall at 72 MLD WTP and Raw Water sump-cum Pump House with main iv) Design and Construction of Gurad Room at WTP and Raw water Sump-cum House v) Designing and Constructing Cement Concrete Road at WTP site.(v) Provision of

The scope of work includes but not limited to as listed below:

- Construction of boundary wall with chain linked wire fencing, gate, watchman room, landscaping including internal roads, drains (With RCC pipes upto plot boundary)
- The open space between Inlet works, Lamella Clarifier, Filter House, chemical house and Back wash reservoir and other vacant portion between the units shall be finished with pavers block, of minimum 1.8m width
- Providing dormitory unit with a lavatory for accommodation of guards, near the guard room.
- Provision of internal pathways (concrete chequered tiles) by the side of Aerator, parshall flume, flash mixer, Lamella Clarifier, filter house for ease of accessibility.
- All the vacant spaces other than different units in the Water Treatment Plant is to be developed, upgraded & beautified by proper gardening installation of fountains, statues, etc. A proposal in this regard is to be submitted by the successful bidder. The whole area of the WTP shall be levelled and beautification plan shall be submitted before taking up the work.
- Preparation of As-built drawings after completion of the works, duly approved by the Engineer-in-charge.
- Earthwork in excavation / Cutting / Dismantling of road crust upto required level for laying of pipes / pipeline including de-watering, removal of soil and disposal.
- Backfilling inlayers, Road restoration, including re-laying of bituminous / concrete roads, as applicable, as per site conditions

Supply, Installation, testing and commissioning of LED based Solar Photovoltaic garden Lighting system as per the requirement spelt out in the scope of work. Supply, Installation, Testing & Commissioning of Solar--

-----Photovoltaic (SPV) GARDEN LAMP POST system, LED based 18 watts as per MNRE specification and as per the drawings and including 5 years warranty including replacement and warranty

- Preparation and submission of “As Built Drawings” for approval of the Engineer-in-charge.
- All works shall be executed as per the directions of the Engineer-in-charge.

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 p[ump 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 coarse shall also be considered for designing.
- 1.5 Guard room both at WTP 72 MLD and Raw water sump-cum pump house is to be constructed with all water supply and electrification and all its fixtures. All standard items shall be incorporated in the Design and must be got approved from Engineer –in- charge prior to structural designing. The execution shall be strictly as per the then approved design and drawing only and as per the fixtures and fastening proposed thereof and decision regarding the quality and make of such fixtures and fastening shall be solely on Engineer –in- charge.

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 includes 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 Quarter 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 confirm to IS 383 and test for conformity shall be carried out as per IS 2386 (Part I to VIII). The finess modulus of fine aggregate shall neither be less than 2 nor be greater than 3.5.

Well graded B. T. metal confirming 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 confirming 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) 4.40 bags	1:2:4 (M-15) 6.40 bags	1:1.5:3 (M-20) 7.9 bags	1:1:2 (M-25) 8.90 bags
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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. It 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 conform 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.

Bar 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....

- d. Cleaning useful excavated material, braking of clods, Removal of stone. Etc.
- e. Conveying the useful excavated material up to 200 M and filling in layers, watering and compacting.
- f. All labour, equipment and other arrangements necessary for the satisfactory compaction and completion of the item.

Surplus excavated material is the property of BMC. 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 "joining" 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

MARBLE MOSAIC TILES

Marble Mosaic tiles shall generally conform to IS: 1237-1980. Unless otherwise specified, the tiles shall be supplied initial grinding and grouting wearing layer.

The size of tiles shall be as given in Table 22-2 or as shown in the Drawings or as required by the Engineer. Half tiles for use with the full tiles shall be such as to make two half tiles when jointed together, match with dimensions of one full tile.

Length	Nominal Breadth	Nominal Thickness not less than
250 mm	250 mm	22 mm

TOLERANCE

1. Tolerances on length and breadth shall be plus or minus one millimeter, and tolerance on thickness shall be plus 5 mm. The range of dimensions in any one delivery of tiles shall not exceed 1 mm on length and breadth and 3 mm on thickness.
2. The tiles shall be manufactured in a factory under pressure process subjected to hydraulic pressure of not less than 140 kg per square centimeter and shall be given the initial grinding with machine and grouting of the wearing layer before delivery to site. The wearing layer shall be free from projections, depressions, depressions, cracks, holes, cavities and other blemishes. The edges of wearing layer may be rounded.
3. The proportion of cement to aggregate in the backing of tiles shall be not leaner than 1:3 by weight. Where colouring material is used in the wearing layer, it shall not exceed 10 per cent by weight of cement used in the mix.
4. The finished thickness of the upper layer shall not be less than 5 mm for size of marble chips from the smallest upto 6 mm and also, not less than 5 mm for size of marble chips ranging from the smallest upto 12 mm, and not less than 6 mm for size of marble chips varying from the smallest upto 20 mm.

LAYING

Base concrete of RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tiles shall be with lime mortar of any of the following Specifications prepared in conformity with provisions in relevant Clauses of 'Mortar'.

The ingredients shall be thoroughly mixed by volume in dry form. Care shall be taken to ensure that there are no hard lumps present. Water shall then be added and the ingredients thoroughly mixed.

The bedding for tiles shall be cement mortar 1:4 (1 cement: 4 coarse sand) bedding may also be used with prior approval of the Engineer.

The average thickness of the bedding mortar shall be 30 mm and the thickness at any place shall not be less than 10 mm.

Lime mortar bedding shall be spread, tamped and corrected to proper levels and allowed to harden for a day before the tiles are set. If cement mortar is laid in bedding the terrazzo tiles, these shall be set immediately after laying the mortar. Over this bedding neat grey cement slurry of honey like consistency shall be metre over such an area as would accommodate about twenty tiles. Tiles shall be washed clean and shall be fixed in this grout one after another, each tile being gently tapped with a wooden mallet till it is properly bedded, and in level with the adjoining tiles. The joints shall be kept as thin as possible not exceeding 1.5 mm and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge atleast 2 metre long, so as to obtain a true surface with the required slope.

Where full tiles of half tiles cannot be fixed, tiles shall be cut (sawn) from full tiles to the required size and their edges rubbed smooth to ensure a straight and true joint;

Tiles which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster, skirting or dado. The junction between wall plaster and tile work shall be finished neatly and without waviness.

After the tiles have been laid, surplus cement grout that may have come out of the joints shall be cleared off.

CURING, POLISHING AND FINISHING

The day after the tiles are laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall than be grouted with grey or white cement mixed with or without pigment to match the shape of the topping of the wearing layer of the tiles. The same cement slurry shall be applied to the entire surface of the tiles in a thin coat with a view to protect the surface from abrasive damage and fill the pin holes that may exist on the surface.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be grounded evenly with machine fitted with coarse grade grit block (No 60). Water shall be used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. It shall then be covered with a thin coat of grey or white cement, mixed with or without pigment to match the colour of the topping of the wearing surface in order to fill any pinhole that appear. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit block (No.120).

The final grinding with machine fitted with the finest grade grit blocks (No.320) shall be carried out the day after the second grinding described in the preceding para or before handing over the floor, as ordered by the Engineer.

For small areas or where circumstances so require, hand polishing may be permitted in lieu of machine polishing after laying. For hand polishing the following carborundum stones, shall be used:

1. 1st Grinding - Coarse Grade Stone (No.60)

2. Second Grinding - Medium Grade (No.80)

3. Final grinding - Fine Grade (No.120)

In all other respects, the process shall be similar as for machine polishing.

After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square meter sprinkled with water and rubbed hard with a 'namdah' block (pad of woolen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished.

The finished floor shall not sound hollow when topped with a wooden mallet.

ITEM OF WATER PROOF CEMENT PAINT

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. Splashings and droppings, if any shall be removed by the Contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings 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 distemping the walls, but if distemping 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 ENGINEER IN CHARGE’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 ENGINEER IN CHARGE’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 m/m.k	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 Bhoruka. 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 ENGINEER IN CHARGE'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
Two point nose handle with striking plate	1	2
Peg Stay 300mm	1	2

SOLAR PHOTO VOLTAIC LIGHTING SYSTEM-The Garden lighting system will be supplied by the finalized bidder as per the MNRE Guidelines Each Solar photo voltaic Lighting System mainly will consist of the following parts and as per the drawings.

Model-I : 18 W-LED Model

1. SPV Module
2. 12 V 40 AH Battery
3. Complete Luminary with LED
4. B Class ISI Mark GI Pole with Module Frame and Arm.
5. Tin coated Copper wire set
6. Battery Box
7. Spare set of fuse
8. O&M manual both in Hindi and English language

Each SPV Module should be individually packed for safe transportation. Item No 3, 5 and 7 should be packed in one package properly stuffed with thermocol/ suitable material for safe transportation. 12V Battery should be packed separately.

List of Make for Solar Photo Voltaic Lighting System

S.No.	Component	Recommended Makes
1	Solar Street Light	Tata Power Solar Ltd.
		SIGNET ENGINEERS
		Forus Electric Pvt. Ltd
		Jakson Engineers Ltd.
		Eleccsol
		Photon Energy System Ltd

The offered PV Modules should be as per IEC61215 edition II / BIS 14286 from an NABL or IECQ accredited laboratory standards having test certificates prescribed by MNRE. The valid test certificate with authorization letter of the manufacturer should be uploaded as annexure. The offered PV Modules should be Crystalline Silicon PV Modules as per IEC 61215 Standards or IS14286 and having test certificates prescribed by MNRE.

In addition, the modules must conform to IEC 61730 part I – requirement for construction and part – II requirement for testing, for safety qualification or equivalent IS. The offered modules shall be of standard make, specifications of any reputed brand approved by MNRE having test certificates issued from MNRE specified test laboratories.

The bidder has to supply the modules of same make, specifications and standard brand for which test reports submitted in the tender otherwise the work order & agreement shall be terminated, the security deposit shall be forfeited and the bidder firms shall be black listed. However, bidder can submit test certificates and authorization letter from three manufacturers and has to submit the authorization from each of the manufacturer along with the test certificate.

The **Comprehensive Maintenance** Contract shall include servicing & replacement guarantee for parts and components (such electronics, Inverter, PV modules and other hardware) . PV modules shall be warranted for 25 years. The date of CMC maintenance period shall begin on the date of actual commissioning of SWPS. It is mandatory for the contractor to carry out CMC regularly and submit report to the client quarterly. Failure to submit quarterly CMC reports timely shall invite penalty and action.

Preventive/Routine Maintenance: This shall be done by the supplier/contractor at least once in every three months and shall include activities such as, cleaning and checking the health of the SPV system, cleaning of module surface, tightening of all electrical connections, regular checks to identify any leakage of electricity, changing of tilt angle of module mounting structure and any other activity that may be required for proper functioning of the

Solar Water Pumping System. The maintenance record should be kept properly and to be submitted at Municipal Corporation office time to time. CMC documents should be certified by Beneficiary.

Breakdown / corrective Maintenance: Whenever a complaint is lodged by the user the bidder shall attend the same immediately. It is clarified that effective CMC means that the bidder should ensure 24 hours smooth working of all the solar street lighting throughout the CMC period and therefore, if any complaint in this level of service is found by the Municipal Corporation officials and if the bidder do not attempt the rectification of any such defect within three days of communication of such complaint to the bidders, the bidder will be liable for a penalty of Rs. 250.00 per day beyond three days of reporting of such complaint.

PRODUCT SPECIFICATIONS of Computer Hardware , Software and Peripherals required :

TECHNOLOGY

Printing Method On-demand inkjet (Piezo electric)
Minimum Droplet Size 3 pl, With Variable-Sized Droplet Technology
Ink Technology Dye Ink
Printing Resolution 5,760 x 1,440 dpi

PRINT

Printing Speed ISO/IEC 24734 9.2 Pages/min Monochrome, 4.5 Pages/min Colour
Maximum Printing Speed 33 Pages/min Monochrome (plain paper), 15 Pages/min Colour (plain paper), 69 Seconds per
10 x 15 cm photo (Epson Premium Glossy Photo Paper)
Colours Black, Cyan, Yellow, Magenta
For detailed information on printing speeds please visit <http://www.epson.eu/testing>.

SCAN

Scanning Resolution 1,200 dpi x 2,400 dpi (Horizontal x Vertical)
Scanner type Contact image sensor (CIS)

PAPER / MEDIA HANDLING

Number of paper trays 1
Paper Formats A4, A5, A6, B5, C6 (Envelope), DL (Envelope), No. 10 (Envelope), Letter, 10 x 15 cm, 13 x 18 cm, 16:9, User defined, Legal
Duplex Manual
Paper Tray Capacity 100 Sheets Standard, 100 Sheets maximum, 20 Photo Sheets

GENERAL

Energy Use 11 W (standalone copying, ISO/IEC 24712 pattern), 1.3 W (sleep mode), 3.6 W (Ready), 0.3 W
Product dimensions 482 x 300 x 145 mm (Width x Depth x Height) or compatible
Country of Origin Philippines
Pallet Size Euro 40 Units

HP LaserJet Pro M1213nf Multifunction Printer(CE845A) **or Equivalent**

Functions

Functions

- Print, copy, scan, fax
Multitasking supported
- Yes

Printing specifications

Print speed black:

Normal: Up to 18 ppm

(Exact speed varies depending on the system configuration, software program, and document complexity.)

First page out (ready)

Black: As fast as 8.5 sec

(Exact speed varies depending on the system configuration, software program, and document complexity.)

Duty cycle (monthly, A4)

Up to 8000 pages

(Duty cycle is defined as the maximum number of pages per month of imaged output.)

Recommended monthly page volume

250 to 2000

(HP recommends that the number of pages per month of imaged output be within the stated range for optimum device performance, based on factors including supplies replacement intervals and device life over an extended warranty period.)

Print technology

- Laser
- Print quality black (best)
- Up to 600 x 600 dpi (1200 dpi effective)
- Resolution technology
- HP FastRes 1200, HP FastRes 600
- Print languages
- Host-based
- Display
- 2-line LCD
- Processor speed
- 400 MHz
- Automatic paper sensor
- No
- Replacement cartridges
- HP LaserJet Black Print Cartridge CC388A

(Average introductory cartridge yield 700 standard pages. HP LaserJet Black Print Cartridge CC388A replacement cartridge yields approximately 1500 pages (average cartridge yield 1500 standard pages. Declared yield values in accordance with ISO/IEC 19752).)

Connectivity

HP ePrint capability

- No
- Mobile printing capability
- HP ePrint, Apple AirPrint™
- (May require a firmware upgrade to be HP ePrint or AirPrint™ compatible, download at <http://www.hp.com/go/support>)*
- Additional information about Eco
- <http://www.hp.com/ecosolutions>
- Wireless capability
- No
- Connectivity, standard
- Hi-Speed USB 2.0 port
- 10/100Base-T Ethernet network port
- RJ-11 Telephone port
- Network ready
- Standard (built-in Ethernet)
- Connectivity, optional

- None
- Minimum system requirements
- Microsoft® Windows® 7, Windows Vista®, Windows® XP, Windows® Server 2003: 1 GHz processor, 1 GB RAM, 700 MB free hard disk space, SVGA 800 x 600 with 16-bit colour display, Internet Explorer 5.5 or higher, USB or Ethernet port

- Mac OS X v 10.4, v 10.5, v 10.6
- PowerPC G3, G4, G5, or Intel processors
- 1 GB RAM
- 200 MB available hard disk space
- CD-ROM drive
- USB or network port
- Compatible operating systems
Windows 8, Windows 7, Windows Vista, Windows XP, Windows Server 2008, Windows Server 2003
Mac OS X v10.4, v10.5, v10.6
Linux (see hplip.net)
(For Windows® Server 2003 and Windows® Server 2008, add Print and Scan drivers only)

Memory specifications

Memory card compatibility

- No
- Memory, standard
64 MB
- Maximum memory
64 MB

Scanner specifications

Scanner type

- Flatbed, ADF
- Scan file format
- JPEG, TIF (compressed and uncompressed), PDF, GIF, BMP
- Scan resolution, optical
- Up to 1200 dpi
- Scan size (flatbed), maximum
- 216 x 297 mm
- Scan size (ADF), maximum
- 216 x 356 mm
- Scan size ADF (minimum)
- 152 x 114 mm
- Scan speed (normal, A4)
Up to 7.4 ppm (b&w), up to 3 ppm (color)
(Scan speeds measured from ADF. Actual processing speeds may vary depending on scan resolution, network conditions, computer performance, and application software.)
- Duplex ADF scanning
- No
- Automatic document feeder capacity
- Standard, 35 sheets
- Digital sending standard features
- Scan to E-mail
- scan to application
- scan to file
- File formats, supported
- PDF
- TIF
- BMP
- GIF
- JPG

Scan input modes

- Scanning via HP LaserJet scan application or TWAIN—or WIA-compliant application software

Copier specifications

Copy speed (normal)

Black: Up to 18 cpm

Copy resolution (black text)

- Up to 600 x 400 dpi
- Copy resolution (color text and graphics)
- Up to 600 x 400 dpi
- Copy reduce / enlarge settings
- 25 to 400%
- Copies, maximum
- Up to 99 copies

Fax specifications

Faxing

- Yes
- Fax transmission speed
33.6 kbps
(Based on standard ITU-T test image #1 at standard resolution. More complicated pages or higher resolution will take longer and use more memory.)
- Fax memory
- Up to 500 pages
- Fax resolution
- Up to 300 x 300 dpi
- Speed dials, maximum number
- Up to 100 numbers

Items to be provided are as follows:

S.R No	Particulars
1	Provision for Compound wall along with Brick masonry at OHSR's, electric sub station. WTP 4x75 m Raw Water Sump-cum Pump House 4 x 50m
2	(A)Provision for Main Gates (2 No.)-6 m width and 2.5 m height: (i) 72 MLD WTP WTP 2 Nos of size 5 x 2.5m (ii) Raw water sump-cum Pump House 2 Nos of size 5 x 2.5m (B)Wicket Gates (i)WTP 2 Nos of size 1.5 x 2.0m (ii) Raw water sump-cum Pump House 2 Nos of size 1.5 x 2.0m
3	Provision for Computers, peripherals & Furniture and other Misc items like telephone connection, internet etc. List of Furniture required ⊕ OF approved Make in writing by the Enginner-in-Charge)

S.R No	Particulars																						
	1. Working Table---3 No.s 2. Sitting Chairs---6 No.s 3. Computer Table---1 No. 4. Computer Chair --- 1No. 5. Almirah /Steel Cupboard-- 3 No. (The furniture items shall be of Teak wood make for everlasting use as approved by Engineer-in-charge)																						
	Computer hardware and peripherals required⊗(Make—HP) HP Pavilion Slimline s3360in PC (GX748AA) Desktop PC or Equivalent(3 No. Desktops) Product Specification <p style="text-align: center;">Processor, operating system and memory</p> <table border="0"> <tr> <td style="vertical-align: top;">Processor type</td> <td>Intel® Core™2 Duo processor E4500 • 2.20 GHz, 2MB Advanced Transfer Cache, 800 MHz</td> </tr> <tr> <td style="vertical-align: top;">Operating system installed</td> <td>Genuine Windows Latest version</td> </tr> <tr> <td style="vertical-align: top;">Chipset</td> <td>NVIDIA® nForce™ 630i chipset</td> </tr> <tr> <td style="vertical-align: top;">Standard memory</td> <td>1024 MB</td> </tr> <tr> <td style="vertical-align: top;">Memory type</td> <td>DDR2-SDRAM</td> </tr> <tr> <td style="vertical-align: top;">Memory slots</td> <td>2 DIMM sockets</td> </tr> </table> <p>Internal drives</p> <table border="0"> <tr> <td style="vertical-align: top;">Internal hard disk drive</td> <td>320 GB</td> </tr> <tr> <td style="vertical-align: top;">Hard disk controller</td> <td>SATA 3G Hard Disk Drive</td> </tr> <tr> <td style="vertical-align: top;">Hard disk drive speed</td> <td>(15000 rpm)</td> </tr> <tr> <td style="vertical-align: top;">Optical drive type</td> <td>SuperMulti SATA Drive</td> </tr> <tr> <td style="vertical-align: top;">Optical drive speed</td> <td>SuperMulti SATA Drive with Lightscribe Technology , Double Layer (8.5GB) 16x DVD+R, 16x DVD-R, 8x DVD+RW, 6x DVD-RW,</td> </tr> </table>	Processor type	Intel® Core™2 Duo processor E4500 • 2.20 GHz, 2MB Advanced Transfer Cache, 800 MHz	Operating system installed	Genuine Windows Latest version	Chipset	NVIDIA® nForce™ 630i chipset	Standard memory	1024 MB	Memory type	DDR2-SDRAM	Memory slots	2 DIMM sockets	Internal hard disk drive	320 GB	Hard disk controller	SATA 3G Hard Disk Drive	Hard disk drive speed	(15000 rpm)	Optical drive type	SuperMulti SATA Drive	Optical drive speed	SuperMulti SATA Drive with Lightscribe Technology , Double Layer (8.5GB) 16x DVD+R, 16x DVD-R, 8x DVD+RW, 6x DVD-RW,
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S.R No	Particulars
	<p>8x DVD±R DL, 12x DVD-RAM, 16x DVD-ROM (max speed); 40x CDR, 32x CDRW, 40x CDROM (max speed); data transfer rates up to 6,000 KB/s (CD read/write) and 21,632 KB/s (DVD read/write)</p> <p>System features</p> <p>Memory card device 15in1 memory card reader</p> <p>Network interface Integrated 10/100 BaseT network interface (Broadband Ready)</p> <p>Video capture interface IEEE 1394 FireWire® Interface</p> <p>Video adapter nVIDIA GeForce 7100</p> <p>Video RAM with 64MB shared graphics memory. Up to 319MB Total Available Graphics Memory as allocated by Windows Vista®</p> <p>Internal audio Integrated Intel® High Definition Audio - 5.1 Surround Sound Ready</p> <p>Audio connectors 1 Line-in, 1 Line-out, Headphone, 2 Microphones (1 in front), Side Spkr L/R, Rear Spkr L/R, Central/ Subwoofer, SPDIF-Out, S-Video-Out</p> <p>Keyboard HP low profile Multimedia Cordless keyboard (2.4GHz) with one-touch Command Center and HP Cordless, optical, 2-button scroller mouse</p> <p>External drive bays 1 external optical drive bay, 1 internal HDD bay, 1</p>

S.R No	Particulars	
		Pocket Media Drive bay
	Expansion slots	1 PCI Express (x16), 1 PCI Express (x1)
	External I/O ports	6 USB 2.0 ports (2 in front), 1 FireWire® IEEE 1394 ports, 2 PS/2, LAN
	Software	
	Software - education / reference / entertainment	Cyberlink Power Cinema: Experience home theater audio and virtual surround sound, Create photo slideshows, rip CDs and listen to music, Watch DVDs with unsurpassed video and audio quality; HP DVD Play
	Software - internet & online	Microsoft® Internet Explorer
	Dimensions / weight / warranty	
	Weight	6.56 kg
	Dimensions (W x D x H)	105 x 340 x 275 mm
	Package dimensions (W x D x H)	322 x 492 x 218 mm
	----BSNL Broadband connection(UNLIMITED) with booster ---PENDRIVES-16 GB(3 No.) ----HP DESKJET Printer-cum- photocopier and scanner (A4) size.	
	Warranty statement	1 year (onsite) limited warranty with up-and-running phone support for first 30 days

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

S.R No	Particulars
4	Provision for plantation around OHSR and Head works site. including landscaping and beautification of construction site
	Providing and fixing M.S. flat iron tree guard 60cm dia. and 2m height above ground level formed of 4 nos. 25x6mm and 8 nos. 25x3mm vertical M.S. flats rivetted to 3 nos. 25x6mm M.S. flat iron rings in two halves, bolted together with 8mm dia. and 30mm long bolts including painting two coats with paint of approved brand and manufacture over a coat of priming, complete in all respects.
5	Plants of Regular varieties of 5 Ft. Height(50 NO.) including Transport
6	Construction of Guard rooms at 72 MLD WTP & Raw water sump-cum Pump House Site including necessary excavation, RCC work, Brick Work, Plastering, Painting and all Other allied works.(total Plinth area 30 Sqm each)including sanitation facilities, internal electrification and plumbing for water supply etc complete.
7.	RCC Roads
	Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications including Providing and placing in position cold twisted or un-coated HYSD steel Brand hot rolled deformed steel reinforcement for R.C.C.work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage (i)WTP site 700m x 4.0m (ii) Raw water-sump-cum pump House 300m x 4.0m wide (iii) Approach Road from Canal Intake to raw water sump cum Pump House—7.0 m wide , 200 m length

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 Bilaspur Municipal Corporation (BILASPUR 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 BILASPUR 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 BILASPUR 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.

Soil investigation

The Contractor shall carry out Soil Investigation work. The investigation results shall be used to establish the soil and parameters are to be adopted for the design of various structures as per relevant IS codes:

- Soil investigation work shall be carried out for all major structure of Water Treatment Plant.
- The soil investigation is necessary for finalization of the type of foundation of the structure and hence all necessary parameters like SBC, N-Value etc. are required to be determined for design purpose.
- All the Soil Test Reports are to be submitted in a separate booklet containing details of soil characteristics, testing details and results, foundation design and recommendations.

The Contractor shall do confirmatory bore log exploration work at locations indicated by the Engineer-in-charge upto a depth of **30m below GL** at the location of the Treatment plant / Units. The available information after bore logging shall be submitted to the Engineer-in-charge in 3 hard copies and one soft copy.

The location of bore holes is to be finalized in consultation with the approval of the Engineer-in-charge. For all borings, necessary information as detailed below shall be given. A site plan showing the location of the bore holes shall also be attached. Following information shall be included:

- Agency
- Location with reference map
- Pit/ borehole number
- Reduced level (RL) of ground surface or other reference point (the RL shall be with respect to GTS datum)
- Dates of starting and completion
- Name of supervisor
- Scales of plans and sections
- General description of strata met with and RLs at which they are met
- The level at which the sub-soil water is met
- Visual description of strata and soil classification
- Any other information and remarks
- Standard Penetration Test value
- Tests on disturbed and undisturbed samples

Upon removal of sampling tube, the length of the sample in the tube and the length between the top of the tube and the top of the sample in the tube shall be measured and recorded. The Contractor shall submit a geotechnical exploration report incorporating the investigation results.

The soil investigation works shall be carried out by reputed agencies, with the written approval of the Engineer-in-charge. The soil investigation report shall include specific recommendations for the safe bearing capacity of the soil at various depths.

The information regarding the Soil investigation Report as provided in the tender are indicative only. The Contractor shall carry out confirmatory survey and investigation to confirm the sizes of each component by their own design. The Contractor shall submit the Survey and Soil Investigation data / report same to Engineer-in-charge for written approval before construction. No extra claim shall be entertained for any variation in size of units by the Contractor.

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, drivesetc) 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	600 Sqm
4	Staff Quarters (Two storied),	600 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:

2. Utilize safety awareness procedures in every element of Operation and Maintenance.

3. Give emphasis to site safety including :
 - a) Safe working procedures.
 - b) Cleanliness and care of site 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 ENGINEER IN CHARGE 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 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.
- (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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE. The personnel engaged by the Contractor should follow /abide by the instructions of the ENGINEER IN CHARGE.
- (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 ENGINEER IN CHARGE. 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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE. 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.

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.

ANNEXURE - "E-10"

Scope of Services

The Contractor shall operate and completely maintain the the following installations for 05 years including warranty and replacement :

- 1) Proposed Water Treatment Plant near village Birkona- Khamtarai (72 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.
- 2) Raw water sump cum-Pump House including civil structures all pumps and panel etc complete for a period of 5 years including replacement and warranty.
- 3) The complete system which has been executed by the contractor to their rated capacities

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 72 MLD WTP including clear water pump house , Raw water sump –cum pump house, the Contractor shall operate and maintain :

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 cpost to the Municipal Corporation.

The tasks of the Contractor shall broadly be to:

- Operate and maintain the proposed WTP of 72 MLD WTPcapacity, raw water sump- cum- pump house, for 05 years from the date of taking over (immediately after the 12 months trial run period).
- Operate and maintain PLC SCADA Automation System installed and commissioned proposed 72 MLD WTP complete for 05 years including replacement and warranty.
- Keeping the down time of any equipment as low as possible but at least below the desired level including operating the plants at the design capacity.
- Communication and co-ordination with the adjacent related facilities and concerned agencies, as required.

The complete operation and maintenance, services shall be performed according to the following principles/ specifications:

Minimum down time 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 (ENGINEER IN CHARGE) at least one month in advance.

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.

Operation of the plant The WTP shall be operated according to the rules and procedures laid

as per O&M Manual	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.
Awareness & Cleanliness	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.
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	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 ENGINEER IN CHARGE. No extra payment shall be made for any repairs (including E & M, Civil) & replacement.
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 ENGINEER IN CHARGE.</p>
Civil Structures and Civil Works	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 ENGINEER IN CHARGE.
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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE.
- (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 ENGINEER IN CHARGE.
- (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 ENGINEER IN CHARGE 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 physic-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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE, 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 ENGINEER IN CHARGE.

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	-	2 Nos.	Each day

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Position	Minimum Qualification	Nos.	Requirement
cleaning			
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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE before procurement.

The Curriculum Vitae of the Contractor's personnel shall be submitted to the ENGINEER IN CHARGE 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 ENGINEER IN CHARGE. A rotating shift schedule shall be established by the Contractor and approved by the ENGINEER IN CHARGE 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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE and may have to be modified from time to time as required and approved by ENGINEER IN CHARGE. Contractor may have to prepare and submit additional reports on particular matter and incidents as and when required by the ENGINEER IN CHARGE.

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 ENGINEER IN CHARGE:

Sl No.	Name of Register/ Log book	Contents	Frequency of Record keeping

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 ENGINEER IN CHARGE. These shall include but not limited to <ul style="list-style-type: none"> - Voltage - Current - Power - Power factor - Pressure - Water level - Duration of operation of each filter bed - Flow - Other physical, electro-mechanical and hydraulic characteristics. 	Hourly
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 ENGINEER IN CHARGE
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 ENGINEER IN CHARGE. 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 ENGINEER IN CHARGE. 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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE.
- (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:

- 4. Utilize safety awareness procedures in every element of Operation and Maintenance.
- 5. Give emphasis to site safety including :
 - e) Safe working procedures.
 - f) Cleanliness and care of WTP 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 ENGINEER IN CHARGE 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:

- (e) **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.
- (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 in 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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE. The personnel engaged by the Contractor should follow /abide by the instructions of the ENGINEER IN CHARGE.
 - (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 ENGINEER IN CHARGE. 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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE 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 ENGINEER IN CHARGE. 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.
- (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 Bilaspur Municipal Corporation would approve the list of spares which is to be submitted by the contractor. Operation and Maintenance for 10 Years
- (p) 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 72 MLD Water Treatment Plants. He will maintain spares with stores for the proper upkeep of the WTP. List of spares is given below.**

LIST OF SPARES:

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.

- ii) **Residual chlorine at outlet of clear water pump house \leq 3 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 120 months.
2. Maintenance costs for the WTP including associated works and maintenance of existing facilities within the WTP as described for a period of 120 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 ENGINEER IN CHARGE / 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 (ENGINEER IN CHARGE) 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

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"-1”(Main) : Price Schedule

PAC GENERAL ABSTRACT

S.R No	Name of components of the Scheme	Percentage on PAC %
	SUB WORK - A	
1	RCC SUMP: RCC SUMP AT CHAINAGE 1800 M OF RBC FOR TRANSFER OF WATER FROM CANAL TO GRAVITY PIPE LINE OF 15.0 X8.55 M SIZE	0.102
2	Raw Water Gravity main:- RAW WATER GRAVITY MAIN CLOSED CONDUIT OPEN CHANNEL FLOW FROM CANAL INTAKE TO GSR @ WTP Dia: 1500 mm MS pipe 10 mm Thick 26630 m long	52.98
3	SUMP WELL WITH PUMP HOUSE: CONSTRUCTION OF SUMPWELL WITH PUMPHOUSE AT WTP SITE 1700 KL Capacity GSR at WTP site	0.390
4	RAW WATER PUMP: RAW WATER PUMPING MACHINERY ON GSR @ WTP SITE Provide 140 BHP (2W + 2S) set of Vertcal turbine pumps to discharge 472 lps against total head of 11 m with 100% standbye	0.789
5	Raw water Pumping main:- RAW WATER PUMPING MAIN from Sump Well to WTP 900 mm dia DI pipe 100 m 1900 mm dia DI K-9 100 m long	0.159
6	ELECTRIC SUB STATION: CONSTRUCTION OF ELECTRIC SUB STATION AT WTP SITE 1 1500 KVA	0.945
7	WATER TREATMENT PLANT: WATER TREATMENT PLANT 72 MLD CAPACITY Including valve Actuators, PLC SCADA, & Control system Automisation & Recirculation arrangement for waste water and sludge.	6.623
8	CLEAR WATER PUMP; CLEAR WATER PUMPING MACHINERY AT WTP Provide 510 BHP (2W + 2S) set of Centrifugal pumps to discharge 470 lps against total head of 40 m	2.293

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S.R No	Name of components of the Scheme	Percentage on PAC %
9	CLEAR WATER PUMPING MAIN CLEAR WATER PUMPING MAIN FROM CW SUMP TO MBRS FOR LEFT & RIGHT ZONE 800 & 700 mm dia DI K-9 pipe 100 +100 m length	0.236
10	CONSTRUCTION OF MBR CONSTRUCTION OF MBR FOR LEFT ZONE 2090 KL 25 M STAGING & FOR RIGHT ZONE 4680 KL 25 M STAGING AT WTP SITE	2.215
11	CLEAR WATER GRAVITY MAIN CLEAR WATER GRAVITY MAIN FROM MBRs AT WTP SITE TO BILASPUR CITY LEFT AND RIGHT SIDE ZONES OFF ARPA RIVER 300 to 1100 mm dia DI K-7 pipe L =32870 m with 1000 mm dia MS pipe 12 mm thick crossing over River Arpa over newly constructed bridge adjacent parallel to Gaman Bridge	23.373
12	CONSTRUCTION OF OHSR OVER HEAD TANKS IN BILASPUR ON LEFT & RIGHT SIDE OF ARPA RIVER ZONE 3, 2850 KL, ZONE 4, 820 KL & in ZONE 7 880 & 600 KL at two locations	2.401
13	RAILWAY & N.H.CROSSING PIPE PUSHING FOR ONE RAILWAY, 4 ROAD CROSSINGS	1.042
14	ALLIED WORKS ALLIED CIVIL WORKS, internal roads, compound walls, landscaping etc.	1.969
15	BULK FLOW METER BULK FLOW METER AT EACH ZONE INLET JUNCTION 300 mm 23 Nos. 400 mm 2 Nos. 500 mm 2 Nos. 600 mm 6 Nos. 700 mm 2 Nos. 1000 mm 1 Nos. Total 36 Nos.	0.896
16	PLC - SCADA PLC & SCADA OF ENTIRE SYSTEM under THE PROJECT	1.562
17	REFORM WORKS (GIS Mapping & GIS S/W)	0.222

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

S.R No	Name of components of the Scheme	Percentage on PAC %
18	STRUCTURAL BRIDGE: STRUCTURAL STEEL BRIDGE ACROSS ARPA RIVER 300 M LONG FOR GRAVITY PIPE CROSSING	1.792
	TOTAL Of "A"	100.00
	SUB WORK - B	
1	Operation and Maintenance of existing 24 10 Mld WTPs and proposed 17 Mld WTP including PLC & SCADA monitoring & control system (covering all WTPs, all WPS, CWPS, valve actuators , OHSR's, FCV's & electromagnetic bulk flow meters) and all new RWP's & CWP's including replacement & warranty for 5 years. O & M per Year ---- . For First Year 18% For Second Year 19% For THird Year 20% For Fourth Year 21% For Fifth Year 22%	100.00
	TOTAL Of "B"	100.00

IMPORTANT NOTE

The payment of R.A. Bills shall be made as per SOR for pipe line works (PHED, PWD & WRD with all uptodate amendments), with percentage below or above of contractor's lumpsum offer with respect to PAC. However, in any case, the total payment made to the contractor shall not exceed the amount fixed by percentage of pipe line works. The final payment shall be equal to the amount fixed by percentage of pipe line works. In case of additional/ reduced work, the additional payment/ deduction shall be made as per SOR of PHE/ PWD/ UADD. No percentage above below shall be applicable on additional work/ reduced work.

Secured advance

Advances to contractor are as a rule prohibited, and every endeavor should be made to maintain a system, under which no payments are made for unmeasured work except for work actually done. Exceptions are, however permitted in the following cases. Cases in which a contractor whose contract is for finished work, requires an advance on the security of materials brought to site, Commissioner may in such cases sanction advances up to an amount not exceeding **75%** of the value of material and **90%** in the case of steel (as assessed by the Executive Engineer) provided that the rate(s) of allowed in no case is/are more than the rate payable for the finished item as stipulated in the contract of such materials, provided that they are of imperishable nature and that a formal agreement is drawn up with the contractor under which Nagar Nigam Bilaspur secures a lien on the materials and is safeguarded against losses due to the contractor postponing the execution of the work or to the shortage or misuse of the materials, and against the expense entitled for their proper watch and safe custody. Payment of such advances should be made only on the certificate of an officer not below the rank of Executive Engineer, that the quantities of materials upon which the advances are made have actually been brought to site, that the contractor has not

previously received any advance on that security and that all the materials are required by the contractor for use on items of work for which rates for finished work have been agreed upon. Recoveries of advances so made should not be postponed until the whole of the work entrusted to the contractor is completed. They should be made from his bills for work done as the materials are used the necessary deductions being made whenever the item of work in which they are used; are billed for. Before granting the above-secured advance the contractor shall sign the prescribed Indenture Bond in the prescribed form.

Annexure - "F-1 A (RCC Sump at Canal Intake)" : Price Schedule

TABLE-A

PERCENTAGE Break-up of payment of 0.102 % of LUMP SUM OFFER for RCC Sump at canal tapping

Break up of Payment Schedule for Individual RCC Sump

Sl. No	Description	Breakup of Payment
1	Design, Construction, , topographical survey ,geotechnical investigation (determination of SBC)Testing, Commissioning of underground RCC sump including providing pipes, valves, testing, and commissioning all complete as per specifications at:	
	1 No RCC sump at canal tapping point	
i	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 sump complete	5%
ii	After casting of foundation including columns & Beams	10%
iii	After casting of 50% of RCC walling height complete.	30%
iv	After completion of casting of complete RCC work including roof slab	30%
v	On supply and fixing of pipes & specials , valves , water level indicators, railing , interconnection with WRD structure complete at site including approval by the Third Party Inspection.	15%
vi	After finishing, epoxy painting from inside oil bound distemper painting from outside to structure above G.L.& successful hydrotesting of work and commissioning.	10%
	Total	100%

**Annexure - "F-1 B (RCC Raw Water Sump-cum-Pump House at WTP)" : Price
Schedule**

PERCENTAGE Break-up of payment of 0.390 % of LUMP SUM OFFER for RCC Sump at canal tapping

TABLE-A

PERCENTAGE Break-up of payment for the Construction of RCC Raw Water Sump-cum-Pump House

Sl. No	Description	Percentage amount for the Reservoir on completion
1.	Approval of structural drawing & design including , topographical survey ,geotechnical investigation (determination of SBC),excavation, dewatering etc and laying of PCC 1:4 :8 at bottom	5%
2.	Civil work (Raw Water Sump- cum- Pump House) Construction of foundation	20%
3.	Upto half height of the discharge floor level	13%
4.	Construction of discharge floor slab	13%
5.	Construction of motor floor slab	13%
6.	Completion of pump house with RCC roof slab	13%
7.	Approach road from canal Intake to Raw water Sump-cum-Pump House	1%
8.	Mechanical & electrical works complete in all respects including installation.	9%
9.	Inside & outside painting	5%
10.	On testing of structure & all other equipments etc. Including 12months trial period	8%
	TOTAL	100%

ANNEXURE –“ F-2” A (RAW WATER GRAVITY MAIN) PRICE SCHEDULE
PERCENTAGE Break-up of payment of 52.987 % of LUMP SUM

RAW WATER GRAVITY MAIN CLOSED CONDUIT OPEN CHANNEL FLOW FROM CANAL INTAKE TO SUMP AT WTP

S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
1	Earthwork in excavation for pipe trench of soil and WBM in areas watering and ramming and disposal of earth lead upto 50m & lift upto earth to be levelled, neatly dressed Lift 0.0 to 1.5 m (CG PHE SOR P.19 It.No. 2.1) Lift 1.5 to 3.0 m Lift 3.0 to 4.5 m Lift 4.5 to 6.0 m Lift 6.0 to 7.5 m (CG PHE SOR P.19 It.No. 2.6.1)	42655.4	144.00	cum	6142370.00
		33233.73	192.00	cum	6380875.00
		5783.087	48.00	cum	277588.00
		2716.38	48.00	cum	130386.00
		6952.288	240.00	cum	1668549.00
2	Earth work in excavation for pipe trench of rocks in areas including dressing, useful material and disposal of up to 50 m lead and lift up to 1.5 m. (a) with or without blasting or bituminous cement concrete road. (CG PHE SOR P.19 It.No. 2.5a) Lift 0.0 to 1.5 m Lift 1.5 to 3.0 m Lift 3.0 to 4.5 m Lift 4.5 to 6.0 m Lift 6.0 to 7.5 m (CG PHE SOR P.19 It.No. 2.6.2) for	8862.327	420.00	Cum	3722177.00
		1542.157	506.00	Cum	780331.00
		724.368	592.00	Cum	428826.00
		1390.458	678.00	Cum	942730.00
3	Earth work in excavation for pipe trench soft rocks in are as including dressing, useful material and disposal of up to 50 m lead and lift up to 1.5 m. Hard rock requiring chiselling / where prohibited (CG PHE SOR P.19 It.No. 2.5c) Lift 1.5 to 3.0 m Lift 3.0 to 4.5 m Lift 4.5 to 6.0 m Lift 6.0 to 7.5 m (CG PHE SOR P.19 It.No. 2.6.2) for extra lift	2843.69	476.00	Cum	1353596.00
		2215.582	562.00	Cum	1245157.00
		385.5391	648.00	Cum	249829.00
		181.092	734.00	Cum	132922.00
		347.6144	820.00	Cum	285044.00

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4	Cutting of WBM road including disposal of material within 50 m lead Within 50m lead (CG PHE SOR P.20 Item No -2.17)	111.846	236.00	cu	26396.00
		111.846	99.75	m	11157.00
5	Cutting of Bituminous road including disposal of material within 50m lead Within 50m lead (CG PHE SOR P.20 Item No -2.18) Extra for carriage upto 5 kms	27.9615	317.00		8864.00
		27.9615	99.75		2789.00
6	Pumping out water caused by springs, tides or river seepage, broken water mains or drains. 26.63 km x 3.0 m x 1.0 m depth of water 79890 kl	79890	51.00	KL	4074390.00
7	Providing and Supplying of following M.S. pipes 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 1500 mm dia MS Pipe 10 mm th (CG PHE SOR It.No.17.13.1)	27162.60	21945.00	Mtr	596083257.00
8	Fabrication of M.S. pipes & specials 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 for direction including cost of MS plate of Engineer-in-Charge. (CG PHE SOR It.No.17.13.1 + cost of pipes) 1500 mm dia MS Pipe 10 mm th 8 to 12 mm thick	201	64308.00	Mton	12925908.00

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S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
9	Carriage of Material by Mechanical transport including loading unloading & stacking etc. R.C.C., Pipes, Steel Pipes, ACP pipes, CI & DI Pipes 1500mm dia (CG PHE SOR P. 330 It.No. 32.15.5.11) Distance 1 Km 1500 mm dia MS Pipe 10 mm th	9846	3,580.00	Mton	35248680.00
10	Labour Only for lowering & laying of M.S. Pipes on pedestals or chairs upon prepared formation including all site arrangements complete. 8 to 12 mm thick 1500 mm dia MS Pipe 10 mm th	26630.00	642.00	Rmt	17096460.00
11	Labour Only lowering & laying of M.S. M.S.specials such as distance pieces, straps etc. including all site arrangements complete. 8 to 12 mm thick 1500 mm dia MS Pipe 10 mm th	543.00	225.00	Rmt	122175.00
12	Providing and applying of elastomeric (450% elongation) thermo plastic fire retardant, skin tensile strength 18 to 21 kg/csqm anti fungal graft co polymer coating on external pipeline laid/ unlaidd condition after proper cleaning Samicron Dye Film thickness of self bonding with metallled surface , 50 micron of diff top coat (Epoxy painting) From outside for above ground pipes Water pipe in laidd condition (MJP CSR 2015-16 SEC-H I.No.25)	47295.89	663.00	sqm	31357175.00
13	Hydraulic testing of MS Pipeline to specified pressure including cost of all material and labour and water for testing for the length upto 1.0 Km, using reciprocating type pumps pumps which should be able to provide specified test pressure, gauges and other necessary equipments, labour, operation charges, required for testing etc				

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S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
	Above 1050 to 1200 mm dia 1500 mm dia 26.63 Km (MJP CSR 2015-16 SEC-H I.No.17)	26.630	2,555.33	Km	68048.00
14	Supply of Single Chamber D.I. Air valve with body and cover in ductile iron of grade SG50 or equivalent grade as per I.S. 3896 - part2 -1985 and subsequent revisions. All internal parts such as float shell etc. all cover bolts of stainlesssteel and gaskets and seals of EPDM. Epoxy powder coating (EP-P) inside and outside colour blue . Drilled as per IS:1538. (CG PHE SOR 2013 It.No. 8.35)	53.00	69475.00	No.	3682175.00
15	Labour for laying and fixing of Cast Iron double airvalves, flanged with out in-built isolating valve.(PN- 1.0/ PN-1.6) (CG PHE SOR P.217 It.No. 17.3.1) 200 mm diameter (PN 1.0)	53.00	152.00	No.	8056.00
16	Providing & fixing of Cast iron double flanged sluice valves as per I.S.:14846-2000 fitted with cast iron cap including jointing & testing with cost of jointing material such as bolts, nuts, rubber insertions etc. all complete. (Steel Spindle) (CG PHE SOR 2013 It.No. 8.34) Butterfly valve one at every 3 Scour valve aprox one at every 1 Km or in nallah		10226.00 423467.00	No. No.	132938.00 1270401.00
17	200 mm dia Scour valve 1500 mm dia Sluice valve Labour for laying & fixing of cast iron valves including jointing & testing but without cost of jointing materials (CG PHE SOR 2013 It.No. 8.13) 200mm diameter 1500mm diameter	13 3 13 3	129.00 2099.00	No. No.	1677.00 6297.00

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S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
18	Providing Fabricating & fixing expansion joints for pipelines as per the drawing. The rate to include machining the strakes and steel ring as shown in the drawing and welding on either automatic welding machine or manually. Rates include plates and flats required for expansion joint and all other materials such as synthetic rubber, rubber ring etc complete. including packing as per specification grease, bolts and nuts, etc complete. (MJP CSR 2015-16 SEC-I It.No.1)	5	122085.00	No.	610425.00
19	Welding in all position with required no. of runs for M.S pipes including gauging, fixing appurtances and other accessiries in connection with pipes laying work as per specification (CG PHE SOR 2013 It.No. 17.10.1) 10 mm Butt Joint 1500 mm dia 26630 /6 x 3.14 x 1.5 x2 10 mm Lap Joint 10% of Butt joint	41809.1 41809.1 4180.91	325.00 364.00	Rmt Rmt	13587958.00 1521851.00
20	Gas cutting holes upto 50mm dia. (either square cut or v cut) pipe, plates etc of thickness 12 mm (MJP CSR 2015-16 SEC-I It.No. 12) Above 5 mm to 10 mm	4000	88.00	Rmt	352000.00
21	Providing and applying pipe coating of fibres, coaltar and solvent based rubber modified bituminous primer of density 0.92 gms/cu cm and viscosity of 1000-2000 cps @ 150 gms/sqm followed by seven layers (4mm thick) of polythene polymerised bitumen and polyester of local 7 layers pipe coat 4mm should conform to requirement of IS-10221 and AWWA c-203 for per- fabricated tapes including covering cost on pipe coating. Rates shall including cost of material coating and wrapping over the pipes, handling charges, preparation of pipe surface, all labour, material, etc. complete. (MJP CSR 2015-16 SEC-H It.No. 19)	127099.7	430.00	Sqm	54652856.00

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S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
22	<p>Providing and making inner cement mortar lining to M.S pipes with mechanical devices in cement mortar 1:1 proportion including cost of all materials labour special and reuired machinery power generation and taking necessary openings and manholes as directed by Engineer Incharge and rewelding the same after done with doubler plates including necessaty excavation , refilling concrete,breaking and repainting in 3 coats all dewatering including emptying refilling after done with water (to be supplied by depat free of cost within k5 km lead all all other arrangements to be done by agency)</p> <p>(MJP CSR 2015-16 SEC-H It.No. 19)</p> <p>1500 mm dia 26630 12 mm thick above 700 mm dia</p>	125507.2	362.00	sqm	45433603.00
23	<p>Blast cleaning the surface of the old or new pipeline internally to remove all rust etc. complete, including providing sand, machinery, labour, cutting of pipes at required places and rewelding the same etc, complete as directed by Engineer-in-charge.(pipes pieces if required for rewelding of old pipeline shall be paid separately.)</p> <p>(MJP CSR 2015-16 SEC-I It.No. 2)</p>	127099.7	81.00	Sqm	10295073.00
24	<p>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</p> <p>(CG PHE SOR 2013 It.No. 2.10.1) Available excavated earth Deduct</p> <p style="text-align: right;">Total Refilling</p>	57501.1806	59.00	cum	3392570.00
25	<p>Filling with murum / river sand for pipe bedding or over the pipe including supply</p> <p>26630 *0.15 * 1.2</p> <p>Sand encasing half height in acute water logged area</p>	6655.99	620.00	Cum	4126713.80

S.N.	PARTICULARS	QTY	RATE	PER	AMOUNT
26	Providing and laying in position machine Batched ,machine mixed and machine vibrated design mix cement concrete of specified grade for reinforced cement concrete work including concrete laying, cost of centring, shuttering, finishing and including Admixtures in recommended proportions as per IS9103 to accelerate, retard setting of concrete, improve work ability without impairing strength and durability as per direction of Engineer -in- charge. M- 30 grade design mix reinforced cement concrete by using 405 kg. of cement per cum of concrete. All work upto plinth level excluding the cost of reinforcement. (For Valve Chambers, Thrust Blocks & Pipe Pedestals) PHE SOR 2013 Item no.2.22				
27	Providing and placing in position cold twisted or un coated HYSD steel bar and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage. PHE SOR 2013 Item No	5,88,996	55.00	kg	32394769.00
28	Steel work is welded in built-up section tee & frame i/c cutting hoisting/fixing and painting with red lead paint. (i) In R.S. Joint in flat iron /angle / channel / bar. For Bridge/Support/Stays 20 m x 500 Kg per RMT (CG PHE SOR P.23 It.No. 2.25.4)	10000.00	71.00	Kg	710000.00
29	Providing & fixing in position air valve shaft including providing & fixing G.I. medium class or 6mm M.S. shaft 2.7m long over branch flange of A.V. tee ,providing P.C.C. block of M-150 concrete including encasing of vertical shaft in M-150 as shown in type design together with providing & making flanged joints wherever required & fixing air valve over the shaft excluding cost of air valve & A.V. tee etc complete as per type design. For Kinetic Double Ball Air Valve				

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S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
	hard strata 450 to 900 mm Foundation in B.C.soil or any other soil 450 to 900 mm (M.J.P C.S.R 2014 -15 P.NO. 141,142 / It. No. 17 a, ii)	53.00	12616.00	No	668648.00
30	Providing and constructing RCC valve chamber with 15cm thick 1:3:6 proportion PCC bedding excluding excavation, cement concrete grade M-15 (Nominal mix) with stone aggregate 20 mm Nominal size for benching, precast RCC frame as directed by Engineer-in-Charge. (Note :- Wall thickness : 0.2 M for depth of 1.2M and 0.35 M for balance depth exceeding 1.2M. 12 mm plaster 1:3 inside chamber). Size 2.5m x2.5m, depth 3.5 M with cover	16	146375.70	each	2342011.14
31	Excavation in Soil (by Manual Means.) 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 5000 meters as per relevant clauses of section 300. (CG PWD SOR 3.1 & 4.1.ii)	223.692	140.00	cum	31316.88
32	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 For Sub-base cum drainage layer or upper sub-base with Grading-VI Material (CG PWD SOR 4.1.b.ii) The quantity excavated is filled with this item 50%				
33	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the				

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

S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
	The quantity excavated is filled with this item 50%	111.85	1434.00	cum	160387.16
34	Prime coat (Providing and applying primer coat with oil based bitumen emulsion (SS-1, grade confirming to IS:8887) on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means 26630 2.1 /0.10x0.5% for area arrival on WBM/WMM surface @0.85 Kg/sqm (CG PWD SOR 5.1)	279.615	64.00	sqm	17895.36
35	Bituminous Macadam (Providing and laying bituminous macadam as per clause 504 with mixed prepared in minimum 40-60 TPH capacity hot mix plant using crushed aggregates of specified grading premixed with bituminous binder, transported to site, laid over a previously prepared surface with paver finisher to the required grade, level and alignment and rolled to achieve the desired compaction) With mechanical paver finisher (ii) for Grading-II(19 mm nominal maximum size, bitumen content 3.40%) only 5 cm thick topping	13.98075	6255.00	cum	87449.59
36	Semi-Dense Bituminous Concrete (Providing and laying semidense bituminous concrete with minimum 40-60 TPH capacity using crushed aggregates of specified grading, premixed with bituminous binder @ 4.50 to 5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction With mechanical paver finisher for Grading II (10 mm nominal size) with bitumen 5.0 %, only 2.5 cm thick spray	6.990375	8468.00	cum	59194.50
37	Providing and laying Pitching on slopes laid over prepared filter media including boulder apron laid dry in front of toe of embankment complete as per drawing and Technical specifications as per section 2504.				

TENDER DOCUMENT FOR BILASPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
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S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
38	Providing permanent test points on the pipe line as per drawing and as directed by Engineer-in-charge including providing and fixing sluice valves, road boxes for sluice valves of size 80 mm to 250 mm in one brick masonry chamber 300 mm x 300 mm clear thick etc. complete as specified and directed. (MJP CSR 2015-16 Section-I I.No. 15)	5	2568.00	No.	12840.00
39	Disinfecting C.I. water mains by flushing with water containing bleaching powder at 0.5 gms per liter of water and cleaning the same with fresh water, operation to be repeated three times including getting the sample of water from the disinfected main tested in the Govt. / Municipal / Authorised laboratory : As per IS : 12288 : 1987 chapter 9 1500 mm dia 26630 266.3 (CG SOR 2016 I.No. 32.13)	266.3	6447.76	100 Rmt	1717038.76
40	Restoration of Canal in its original shape as per the direction of WRDeptt. Of CG to the fullest satisfaction as per drawing and estimates with earthwork for embankment, consolidation, ramming to the profile with 23 / 30 cm thick pitching, inside lining s practiced in WRD complete at Crossing the Right Bank Canal towards Birkona from Crossing the main canal and following the alignment of Branch Canal nearly around cutting the profile of Main Canal, no push through, as pipe being laid at a gradient of 1:4000 slope.	1	2000000.00	Job	2000000.00

Total 950195229.66

Say 9501.95

ANNEXURE F-2 'B' Percentage Break-up of payment of 1.791 % of LUMP SUM

**STRUCTURAL BRIDGE ACROSS ARPA RIVER L=300 M FOR CROSSING
OF GRAVITY MAIN**

Itn. No	Particulars	Quantity	Rate	Per	Amount (Rs. in Laacs)
1	2	7	8	9	10
1	Providing, constructing coffer dam in river basin/dam storages as per type design including excavation, filling the middle portion with B.C. soil (in gunny bags if required). Providing impervious/semipervious materials on both side of B.C. soil (in gunny bags if required) including ramming compacting to the satisfaction of Engineer-in-Charge, till the completion of work including dismantling coffer dam after completion of works and disposing off the materials as directed by the Engineer-in-charge. (PHE SOR I. No. 24.1 of P. No. 268)				
	For constuction of coffer dam	5220	540.00	Cum	28.19
2	Bored cast-in-situ M35 grade R.C.C. pile excluding reinforcement complete as per drawing and technical specifications and removal of excavated earth with all lifts and lead upto 1000 m as per section 1100 and 1700 - 750 mm dia				
	Pile diameter-750 mm	580	7830.00	Rmt	45.41
	(PWD Bridge SOR 2.17)				
3	Pile Load Test on single Vertical Pile in accordance with IS:2911 (Part-IV) in static load method only				
	Initial and routine load test Tonne 1500	1450	1500	Tonne	21.75
	(PWD Bridge SOR 2.21.i)				
4	Cement concrete for reinforced concrete in pile cap complete as per drawing and Technical Specifications per clause 1100,1500 and 1700.				
	Using Batching Plant, Transit Mixer and Concrete Pump				
	RCC Grade M35	58	5960.00	cum	3.46
	(PWD Bridge SOR 2.22.B.iii)				
5	Pumping out water caused by springs tidal or river seepage, broken water main or drains and like				
	2 nos. Pumps of 15 KL/hr discharge run for 8 hr for 10 days (PWD SOR I.No.9 P.No.10)	27840	51	K L	14.198

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Itm. No	Particulars	Quantity	Rate	Per	Amount (Rs. in Lacs)
1	2	7	8	9	10
6	Furnishing and Placing Reinforced/ Prestressed cement concrete in super-structure as per drawing and Technical Specification sections 1500, 1600 and 1700 (Newly laid concrete shall be covered by gunny bags). RCC/PSC Grade M35				
	Using Batching Plant, Transit Mixer and Concrete Pump				
	Height upto 5m	72.848	7354.00	Cum	5.36
	Height 5m to 10m	72.848	7653.00	Cum	5.58
	Beam	31.32	7952.00	Cum	2.49
7	Supplying, fitting and placing HSD (High Strength Deformed Steel) bar reinforcement in super-structure complete as per drawing and technical specifications wastage. (PHE SOR I. No. 2.25.1(2.25.1.1) of P. No. 23) Sub Structure 1% of R.C.C. work M-35 For piles (PWD Bridge SOR 4.2)	63.98 21.49	70101.00 70101.00	MT MT	44.85 15.07
8	Steel work is welded in built-up section tee & frame i/c cutting hoisting/fixing and painting with red lead paint. (i) In R.S. Joint in flat iron /angle / channel / bar. (PHE SOR I. No. 2.25.4 of P. No. 23)	143778.5723	71.00	Kg	102.08
9	Providing and laying boulders apron on river bed for protection against scour with stone boulders weighing not less than 40 kg each complete as per drawing and Technical specification as per relevant clauses of section 2503 (PWD Bridge SOR 5.1)	145.00	2413.00	cum	3.50
10	Providing and laying Pitching on slopes laid over prepared filter media including boulder apron laid dry in front of toe of mbankment complete as per drawing and Technical specifications as per section 2504. (PWD Bridge SOR 5.1)	180.00	2413.00	cum	4.34
11	Provision for painting, Railing, finishing, street light LED electrification and other anciliery items etc complete	Job	25.00	LS	25.00
Total					321.27

Annexure - "F-3 (OHSR, MBR & GLSR)" : Price Schedule

CONSTRUCTION OF MBR's

TABLE - A

PERCENTAGE Break-up of payment of 0.215 % of LUMP SUM OFFER for 2 No. OHSRs

Sl. No	Description	Percentage amount for the OHSR on completion
1	Design, Construction, , topographical survey ,geotechnical investigation (determination of SBC)Testing, Commissioning of Overhead Service reservoir as a MBR including providing pipes, valves, flow-meters, testing, disinfection and commissioning all complete as per specifications at:	
(i)	2090 KL St. Ht.25 M Depth of water in container shall not more than 7 M	0.78 %
(ii)	4680 K1 St. Ht.25 M Depth of water in container shall not more than 7 M	1.435%
Total		2.215%

ANNEXURE F-3

TABLE-B

PERCENTAGE Break-up of payment of 2.401 % of LUMP SUM OFFER for 4 No. OHSRs

Sl. No	Description	Percentage amount for the OHSR on completion
1	Design, Construction, , topographical survey ,geotechnical investigation (determination of SBC)Testing, Commissioning of Overhead Service reservoir including providing pipes, valves, flow-meters, testing, disinfection and commissioning all complete as per specifications at:	
(i)	Chantidih 2850KL St. Ht.21 M Depth of water in container shall not more than 7 M in Zone -3	1.328 %
(ii)	PTC 820 Kl St. Ht.21 M Depth of water in container shall not more than 7 M in Zone no.4	0.38%
(iii)	Torwa 880 Kl St. Ht.21 M Depth of water in container shall not more than 7 M in zone -7	0.413%
(iv)	Tarbahar 600 Kl St. Ht.21 M Depth of water in container shall not more than 5 M in Zone- 7	0.28 %
Total		2.40%

TABLE-C

Break up of Payment Schedule for Individual OHSR

Sl. No	Description	Breakup of Payment
1	Geotechnical investigations for determination of SBC including approval of Design and Drawings and construction of levelling course of PCC(1:4:8) for foundation of OHSR complete	5%
2	After casting of foundation including columns upto GL	10%
3	After casting of 50% of RCC complete staging	12%
4	After completion of casting of complete RCC staging	13%
5	After completion of casting of Ring Beam & Bottom Slab	10%
6	After completion of casting of vertical walls of reservoir/container complete	15%
7	After completion of casting of staircase , top dome /slab	10%
8	On supply and fixing of pipes & specials , valves , water level indicators, railing , lightning arrestor & Earthing (as per IS-3043) complete at site including approval by the Third Party Inspection.	15%
9	After finishing, distempering and painting & successful hydrotesting of work and commissioning.	10%
	Total	100%

Annexure –“F-4 (Water Treatment Plant-72 MLD)”’: Price Schedule

TABLE-A

PERCENTAGE Break-up of payment of 6.623 % of LUMP SUM OFFER FOR WTP

S. No.	Description	Breakup of Percentage
1.	Design , Construction , Testing and commissioning of 72 MLD Water Treatment Plant including Clear sump cum pump House based on Lamella Clarifier and recirculation of used back wash water including trial run of 12 months	6.623%
GRAND TOTAL		100%

NOTE:

For Sl. No.: 1 and total LUMP SUM amount is to be quoted by the Bidder.

For Sl. No.: 2, LUMP SUM amount is required to be quoted by the Bidder for 05 years of O&M services as per Item description and technical requirements.

Annexure: F-5/1: Design, Construction, Testing and Commissioning of 72 MLD WTP including trial run for 12 months

S. No.	Component	Break Up (As % of LUMP SUM offer for 72 MLD WTP)
1	Civil Works	45%
2	Electro-Mechanical Works	40%
3	Installation, Commissioning, testing and trial run for 12 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	Ist. 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 complete	20%
3	P.C.C. complete	20%
4	Foundation complete	20%
5	Walling complete	33%
6	Water tightness test & 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 complete	15%
3	P.C.C. complete	10%
4	Complete foundation complete	38%
5	Complete walling	30%
6	Water tightness test and all remaining works complete	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	Water tightness test and painting & all remaining works	2%
		100%

Item no.6: Construction of Clear Water Sump

(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	Water tightness test	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 complete	10%
3	Foundation complete	20%
4	Complete supporting structure up to bottom slab	20%
5	Bottom slab complete	20%
6	Vertical wall complete	20%
7	Roof slab complete	13%
8	Water tightness test & 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. complete	10%
4	Foundation complete	18%
5	Complete columns & beams complete	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. complete	10%
4	Foundation complete	30%
5	Column & beam complete	21%
6	On its complete construction	22%
7	All remaining works complete	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.)—	30%	37%

	(a) Flocculator with paddle drive-----10% (b)Lamella Clarifier-----10% (c)Sludge pipes with specials -----10%		
4	FILTERS AND FILTER HOUSE (DUAL MEDIA 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)	20%	57%
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 & 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.

<u>Note</u>	1. On supply of Mechanical and Electrical. Equipment	---	90%
	2. On Errection, testing and commissioning of Equipment & Trial run for 12 months	-----	10%

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**List of Laboratory Equipments/Glassware/Chemicals required for 72 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 clamp) 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
20.	Pipette Stand Horizontal		4
21.	Whatman Fiter (1) NO. 40 ,15 cm		01
		100 nos	01pkt

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

	(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.
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 Suplhate	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 gmas.	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 Suphate	500 gms.	01 nos.

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Annexure - "F-5 (Raw Water , Clear Water Rising Mains, Gravity feeders): Price Schedule

PERCENTAGE Break-up of payment of 0.159 % of LUMP SUM

TAAABLE -A

RAW WATER PUMPING MAIN from SUMP TO WTP

S.N.	PARTICULARS	QTY	RATE	PER	AMOUNT
1	Excavation : Earthwork in 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 50m & lift upto 1.5m, disposal earth to be levelled, neatly dressed (CG PHE SOR P.19 It.No. 2.1)	237.00	144.00	Cum	34128.00
2	Earth work in excavation for pipe trench in all kinds of soft rock in areas i/c dressing, watering and ramming and disposal of excavated earth lead upto 50 meters & lift upto 1.5m, disposal earth to be leveled, neatly dressed, including dismantling of CC (CG PHE SOR P.19 It.No. 2.5a)				
3	Pumping out water caused by springs, tides or river seepage, broken water mains. (CG PHE SOR P.20 It.No. 2.9)	1000	51.00	KL	51000.00
4	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 (Push on) joints as per IS:5382/85 including testing of joint (laying Conforming to IS 12288 : 1987)				
	900mm Dia. DI K-9 Additional 2% for breakages during laying (CG PHE SOR P.74 It.No. 6.51)	102.00	18443	Mtr	1881186.00
5	Add 10% for MS Specials for DI pipes (CG PHE SOR P.74 It.No. 6.49.1)	2553.50	109.00	kg	278331.50
6	Providing & fixing of Cast iron double flanged sluice valves as per I.S.:14846-2000 fitted with cast iron cap including jointing & testing with cost of jointing material such as bolts, nuts, rubber insertions etc. all complete. (Steel Spindle) 900 mm PN1.6 with Bypass (CG PHE SOR It.No. 8.34)	1	403927	each	403927.00

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

S.N.	PARTICULARS	QTY	RATE	PER	AMOUNT
7	Filling with murum / river sand for pipe bedding or over the pipe including supply . 100 x 1.50 x 0.15 (CG PHE SOR It.No. 2.11)	22.5	620.00	Cum	13950.00
8	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 up to 50m and lift up to 1.5m in all kinds of soils (CG PHE SOR P.20 It.No. 2.10.1)	221.42	59.00	Cum	13063.49
9	Construction of Rcc valve chamber with Rcc precast covers 100mm to 600mm dia For 300mm - 800 mm dia (cost as per annexure II enclosed)	1	146375.7	each	146375.70
				Total	2845508.68

ANNEXURE –F 5 B

PERCENTAGE Break-up of payment of 0.236 % of LUMP SUM

TABLE -B

CLEAR WATER PUMPING MAIN FROM SUMP TO MBR FOR LEFT & RIGHT ZONE

S.N.	PARTICULARS	QTY	RATE	PE	AMOUNT
1	Excavation: Earthwork in 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 50m & lift upto 1.5m, disposal earth to be levelled, neatly dressed (CG PHE SOR P.19 It.No. 2.1)	334.75	144.00	Cum	48204.00
2	Earth work in excavation for pipe trench in all kinds of soft rock in areas i/c dressing, watering and ramming and disposal of excavated earth lead upto 50 meters & lift upto 1.5m, disposal earth to be leveled, neatly dressed, including dismantling of CC Road.(CG PHE SOR P.19 It.No. 2.5a)				
3	Pumping out water caused by springs, tides or river seepage, broken water mains. (CG PHE SOR P.20 It.No.	750	51.00	KL	38250.00
4	Providing, laying and jointing socket & centrifugally cast (Spun) Ductile Iron pressure pipes with inside cement mortar lining (class Conforming to IS 8329/2000 with suitable Gasket (Push on) joints as per IS:5382/85 including testing of joint (laying Conforming to IS 12288 1987) 800mm Dia. DI K-9 700mm dia D.I K - 9 700mm dia D.I K - 9 Additional 2% for breakages during laying (CG PHE SOR P.74 It.No. 6.51)	51 51 204.00	12301 12301	Mtr Mtr	627351.00 627351.00
5	Add 10% for MS Specials for DI & PCCP pipes for (CG PHE SOR P.74 It.No. 6.49.1)	3700.00	109.00	kg	403300.00
6	Providing & fixing of Cast iron double flanged sluice valves as per I.S.:14846-2000 fitted with cast iron cap including jointing & testing with cost of jointing material such as bolts, nuts, rubber insertions etc. all complete. (Steel Spindle) 700 mm PN1.6 (CG PHE SOR P.121 It.No. 8.34)	2	264088.0	each	528176.00

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

S.N.	PARTICULARS	QTY	RATE	PE	AMOUNT
7	Filling with murum / river sand for pipe bedding or over the pipe including supply . (CG PHE SOR It.No. 2.11)	40.5	620.00	Cum	25110.00
8	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 up to 50m and lift up to 1.5m in all kinds of soils (CG PHE SOR P.20 It.No.	462.28	59.00	Cum	27274.52
9	Providing and laying mechanically mixed reinforced cement concrete of grade M-20 excluding centering, shuttering and reinforcement in foundation, plinth and in superstructure. For thrust blocks	8.48	4484.00	Cum	38009.75
10	Providing and placing in position cold twisted steel and hot rolled deformed steel reinforcement for RCC work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage 8.48 x 80 Kg /cum (CG PHE SOR P.23 It.No. 2.25.1.2	678.14	55.00	per Kg	37297.70
11	Construction of Rcc valve chamber with Rcc precast covers 100mm to 600mm dia				
	For 300mm - 800 mm dia (cost as per annexure II enclosed)	2	117536.3	each	235072.66
				Tota	4234323.82

4234323.82
42.34
Lakhs

ANNEXURE –F 5 C

PERCENTAGE Break-up of payment of 23.373 % of LUMP SUM

**PURE WATER GRAVITY MAIN FROM MBRs AT WTP SITE TO BILASPUR CITY LEFT AND RIGHT SIDE
ZONES OF ARPA RIVER**

S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
1	Excavation Earthwork in 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 50m & lift upto 1.5m, disposal earth to be levelled, neatly dressed	33647.22	144.00	cum	4845200.00
2	Extra for every additional lift of 1.5m or part there of for all kind of soils. Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of material and disposal of unserviceable one up to 50 m lead and lift up to 1.5 m. (a) Soft rock with or without blasting or bituminous pavement / cement concrete road. (CG PHE SOR P.19 It.No. 2.5a)	8739.538	334.00	Cum	2919006.00
2(a)	Extra for every additional lift of 1.5m or part there of for all kind of soils.	2270.271	86.00	Cum	195243.00
3	Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of material and disposal of unserviceable one up to 50 m lead and lift up to 1.5 m.				
3(a)	Hard rock requiring chiselling / where blasting prohibited (CG PHE SOR P.19 It.No. 2.5a)	1310.931	476.00	Cum	624003.00
3(b)	Extra for every additional lift of 1.5m or part there of for all kind of soils.	340.5407	86.00	Cum	29286.00
4	Cutting of WBM road including disposal of within 50 m lead Within 50m lead Extra for carriage upto 5 kms	7581.59 7581.59	236.00 99.75	Cum Cum	1789255.00 756264.00
5	Cutting of Bituminous road including disposal of material within 50m lead Within 50m lead Extra for carriage upto 5 kms	3417.515 3417.515	317.00 99.75	Cum Cum	1083352.00 340897.00
6	Dismantling/Demolishing of ancillary works Stone Masonry Works within 50m lead (CG PHE SOR It.No. 2.12) Brick Masonry Works within 50m lead PWD SOR 2009, Item 16.3 Extra for carriage by mechanical means upto 5 Kms PHE SOR 2013, Item	218.49 436.98 655.47	378.00 153.00 40.00	cum cum cum	82589.00 66858.00 26219.00

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

S.N.	PARTICUL	QUANTI	RATE	PER	AMOUNT
7	Pumping out water caused by springs, tides or river seepage, broken water mains or drains. (CG PHE SOR P.20 It.No. 2.9)	100000	51.00	KL	5100000.00
8	Providing, laying and jointing socket & spigot centrifugally cast (Spun) Ductile Iron pressure pipes with inside cement mortar lining (classK-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) 300 mm dia DI K-7 350 mm dia DI K-7 400 mm dia DI K-7 450 mm dia DI K-7 500 mm dia DI K-7 600 mm dia DI K-7 700 mm dia DI K-7 800 mm dia DI K-7 1000 mm dia DI K-7 1100 mm dia DI K-7 Add 2% for breakages (CG PHE SOR Pit.No. 6.50)	5080.00 2496.00 3964.00 2358.00 727.00 10035.00 2223.00 291.00 2771.00 2788.00	2631.00 3346.00 4280.00 4968.00 5816.00 7310.00 10627.00 13859.00 20309.00 22009.00	Mtr Mtr Mtr Mtr Mtr Mtr Mtr Mtr Mtr Mtr	13365480.00 8351616.00 16965920.00 11714544.00 4228232.00 73355850.00 23623821.00 4032969.00 56276239.00 61361092.00
9	Providing and supplying DI specials and fittings (push on/flanged pipes) for all types of specials, bends, tees etc. DI pipe dia 5% of L Wight/m (CG PHE SOR 2013 It.No. 6.49.1) 80mm to 300mm dia 300 0 249.02 43.14 350mm and above dia	Weight 10742.72 192426.2	70.00 109.00	K g	751991.00 20974457.00
10	Supply of Single Chamber D.I. Air valve with body and cover in ductile iron of grade SG50 or equivalent grade				
	I.S. 3896 - part2 -1985 and subsequent revisions. All internal parts such as float shell etc. all cover bolts of stainlesssteel and gaskets and seals of EPDM. Epoxy powder coating (EP-P) inside and outside colour blue . Drilled as per IS:1538. (CG PHE SOR It.No. 8.35) 50 mm diameter (PN 1.0) 80 mm diameter (PN 1.0) 100 mm diameter (PN 1.0)	19.00 1.00 14.00	28931.00 42571.00 47189.00	No. No. No.	549689.00 42571.00 660646.00
11	Labour for laying and fixing of Cast Iron double flanged with out in-built isolating valve.(PN- 1.0/ PN-1.6) 50 mm diameter (PN 1.0) 80 mm diameter (PN 1.0) 100 mm diameter (PN 1.0) (CG PHE SOR 2013 It.No. 8.18)	10.00 1.00 14.00	47.00 51.00 71.00	No. No. No.	708.00 51.00 994.00

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

S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
12	Supply of FCV with level control complete as specifications including transportation to site storage safety installations testing, commissioning, making connections including excavations at site cuts in the pipe system dewatering reinstating the same after completion of installation as per specification including all taxes with flow transmitter / converter, microprocessor based modular design display to Line back lit LCD, for indication of actual flow rate / forward, reverse, sum totalizer, perfection category IP 65 dia of FCV with altitude control valve size should be suitable to connected pipe size. (As per Market Rate)				
	300mm diameter	15	620916.00	No.	9313740.00
	350mm diameter	3	666617.00	No.	1999851.00
	400mm diameter	2	977901.00	No.	1955802.00
	450mm diameter	1	1540268.00	No.	1540268.00
	500mm diameter	1	1622494.00	No.	1622494.00
	600mm diameter	4	1688568.00	No.	6754272.00
	Providing & fixing cast iron butterfly valves 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) (CG PHE SOR 2013 It.No. 8.39)				
13	150mm diameter Scour Valve (Sluice Valve)	4	4146.00	No.	16584.00
	200mm diameter Scour Valve (Sluice Valve)	3	7894.00	No.	23682.00
	700mm diameter PN 1.	1	276909.0	No.	276909.00
	800mm diameter PN 1.	1	398416.0	No.	398416.00
	1100mm diameter PN 1.	1	760233.0	No.	760233.00
14	Labour for laying & fixing of cast iron valves jointing & testing but without cost of jointing materials (CG PHE SOR 2013 It.No. 8.13)				
	150mm diameter				
	200mm diameter	3	129.00	No.	387.00
	700mm diameter	1	1320.00	No.	1320.00
	800mm diameter	1	1728.00	No.	1728.00
	1100mm diameter	1	2099.00	No.	2099.00
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. (CG PHE SOR 2013 It.No. 8.53)				
	150 mm	4	4318.00	No.	17272.00
	200 mm	3	6066.00	No.	18198.00

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

S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
	300 mm	15	10723.00	No.	160845.00
	350 mm	3	16141.00	No.	48423.00
	400 mm	2	19586.00	No.	39172.00
	450 mm	1	23492.00	No.	23492.00
	500 mm	1	27708.00	No.	27708.00
	600 mm	4	39891.00	No.	159564.00
	700 mm	1	59322.00	No.	59322.00
	800 mm	1	75669.00	No.	75669.00
	1100 mm	1	138282.00	No.	138282.00
		11			
16	Providing and Supplying of following M.S. pipes 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 (CG PHE SOR P.212 It.No. 17.12.17.vii)	357.00	17642.00	Mtr	6298194.00
	1000 mm MS PIPE 12 mm th				
17	ITEMS FOR ROAD CUTTING FOR CROSSINGS 800 mmdia 10 mm casing (Node 3,3,11) 550 mmdia 10 mm casing (Node 4) 500 mmdia 10 mm casing (Node 6,7,10,18,19,20) (CG PHE SOR P.212 It.No. 17.2.11 & 12)	75.00 25.00 150.00	11756.00 8138.00 7403.00	Mtr Mtr Mtr	881700.00 203450.00 1110450.00
18	Fabrication of M.S. pipes & specials 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 for direction of Engineer-in-Charge. (CGPHE SOR Item no.17.13.1+ Cost of pipe) 1000 mm dia MS pipe 12 mm th 18 *3.14*0.750*0.012*7850 = 8 to 12 mm thick	5 5	64308.00	Mton	321540.00
19	Carriage of Material by Mechanical transport including loading unloading & stacking etc. R.C.C., Pipes, Steel Pipes, ACP pipes, CI & DI Pipes (CG PHE SOR P. 330 It.No. 32.15.5.11) Distance 1 Km 1000 mm dia MS pipe 12 mm th 3.14*0.75* 357 *0.012*7850/1000	106	3,580.00	Mton	379480.00

TENDER DOCUMENT FOR BILASPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY SCHEME UNDER
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20	Labour Only for lowering & laying of M.S. Pipes on pedestals or chairs upon prepared formation including all site arrangements complete. 8 to 12 mm thick				
	1000 mm dia MS pipe 12 mm th	350.00	563.00	Rmt	197050.00
	ITEMS FOR ROAD CUTTING FOR CROSSINGS				
	800 mmdia 10 mm casing (Node 3,3,11)	75.00	563.00	Rmt	42225.00
	550 mmdia 10 mm casing (Node 4)	25.00	350.00	Rmt	8750.00
	500 mmdia 10 mm casing (Node 6,7,10,18,19,20)	150.00	228.00	Rmt	34200.00
	(CG PHE SOR P. 217 It.No. 17.8.2)				
21	Labour Only lowering & laying of M.S. M.S.specials such as distance pieces, straps etc. including all site arrangements complete. 8 to 12 mm thick				
	1000 mm dia MS pipe 12 mm	18.00	86.00	Rmt	1548.00
	th 0 mm dia MS pipe 12 mm	0.00	86.00	Rmt	0.00
22	Providing and applying of elastomeric (45% elongation) thermo plastic fire retardant, skin tensile strength 18 to 21 kg/csqcm anti fungal graft co polymer coating on external pipeline laid/ unlaid condition after proper cleaning Samicron Dye Film thickness of self bonding with metallised surface , 50 micron of diff top coat (Epoxy painting) From outside for above ground pipes Water pipe in laid condition (MJP CSR 2015-16 SEC-H I.No.25)	1126.09	663.00	sqm	746598.00
23	Hydraulic testing of MS Pipeline to specified pressure including cost of all material and labour and water for testing for the length upto 1.0 Km, using reciprocating type pumps pumps which should be able to provide specified test pressure, gauges and other necessary equipments, labour, operation charges,				
	Above 600 to 1000 mm dia (MJP CSR 2015-16 SEC-H I.No.17)	0.350	39,168.00	Km	13709.00

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

S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
24	Providing Fabricating & fixing expansion joints for pipelines as per the drawing. The rate to include machining the strakes and steel ring as shown in the drawing and welding on either automatic welding machine or manually. Rates include plates and flats required for expansion joint and all other materials such as synthetic rubber, rubber ring etc complete. including packing as per specification grease, bolts and nuts, etc complete. 1000 mm dia MS pipe (MJP CSR 2015-16 SEC-I I.No.1)	1	122085.00	No.	122085.00
25	Welding in all position with required no. of runs for M.S pipes including gauging, fixing appurtances and other accessories in connection with pipes laying work as per specification (CG PHE SOR 2013 It.No. 17.10.1) 12 mm Butt Joint 12 mm Lap Joint 10% of Butt joint (MJP CSR 2015-16 SEC-I It.No. 7.b)	522.03 52.20	325.00 364.00	Rmt Rmt	169658.00 19002.00
26	Gas cutting holes upto 50mm dia. (either square cut or v cut) pipe, plates etc of thickness 12 mm (MJP CSR 2015-16 SEC-I It.No. 12) Above 10 mm to 14 mm	300	114.00	Rmt	34200.00
27	Providing and applying pipe coating of fibres, coaltar and solvent based rubber modified bituminous primer of density 0.92 gms/cu cm and viscosity of 1000-2000 cps cps @ 150 gms/sqm followed by seven layers (4mm thick) of polythene polymerised bitumen and polyester of local 7 layers pipe coat 4mm should conform to requirement of IS-10221 and AWWA c-203 for per-fabricated tapes including covering cost on pipe coating. Rates shall including cost of material coating and wrapping over the pipes, handling charges, preparation of pipe surface, all labour, material, etc. complete. (MJP CSR 2015-16 SEC-H It.No. 19)	1125.376	430.00	Sqm	483912.00

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

S.N.	PARTICULARS	QUANTITY	RATE	PER	AMOUNT
28	<p>Providing and making inner cement mortar lining to M.S pipes with mechanical devices in cement mortar 1:1 proportion including cost of all materials labour special and reuired machinery power generation and taking necessary openings and manholes as directed by Engineer Incharge and rewelding the same after done with doubler plates including necessaty excavation , refilling concrete,breaking and repainting in 3 coats all dewatering including emptying refilling after done with water (to be supplied by depat free of cost within k5 km lead all all other arrangements to be done by agency)</p> <p>(MJP CSR 2015-16 SEC-H It.No. 19) 12 mm thick above 700 mm dia</p>	1099.7	362.00	sqm	398091.00
29	<p>Blast cleaning the surface of the old or new pipeline internally to remove all rust etc. complete, including providing sand, machinery, labour, cutting of pipes at required places and rewelding the same etc, complete as directed by Engineer-in-charge.(pipes pieces if required for rewelding of old pipeline shall be paid separately.)</p> <p>(MJP CSR 2015-16 SEC-I It.No. 2)</p>	1125.376	81.00	Sqm	91155.00
30	<p>ITEMS FOR ROAD CUTTING FOR CROSSINGS</p> <p>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.</p> <p>No. of crossings ISTTE SOR - 2013, Item 1.1.1.2.3</p>	10	53200.00	No.	532000.00

TENDER DOCUMENT FOR BILASPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
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31	<p>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</p> <p>SoR for Trenchless technology-2013 + 30% for Trial pits, surface dressing, sundries etc.</p> <p>(item 13.2.1.6)</p> <p>In Hard Soil, 450mm to 800mm</p>	250	22,259	Rmt	5564750.00
32	<p>Providing and laying in position machine batched, machine mixed and machine vibrated design mix cement concrete of specified grade for reinforced cement concrete work including concrete laying, cost of centring, shuttering, finishing and including Admixtures in recommended proportions as per IS9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer -in- charge. M- 30 grade design mix reinforced cement concrete by using 405kg .of cement per cum of concrete. All work upto plinth level excluding the cost of reinforcement. (For Valve Chambers, Thrust Blocks & Pipe Pedestals)</p> <p>In plinth and foundation, M-30 for thrust blocks</p>	369.83	5170.00	cum	1912001.39
33	<p>Providing and placing in position cold twisted or un-coated HYSD steel bar and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage. (CG PHE SOR 2013 It.No. 2.25.5)</p>	36982.62	55.00	Kg	2034044.03
34	<p>Chamfering ductile iron pipes of all types and classes to make suitable for tyton joints. (CG PHE SOR 2013 It.No. 32.8)</p> <p>300 mm dia.</p> <p>350 mm dia</p> <p>400 mm dia.</p>	45 22 35	461.00 535.00 535.00	Per End Per End Per End	20745.00 11770.00 18725.00

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	450 mm dia.	21	609.00	Per End	12789.00
	500 mm dia.	6	651.00	Per End	3906.00
	600 mm dia.	89	722.00	Per End	64258.00
	700 mm dia.	20	828.00	Per End	16560.00
	800 mm dia.	3	1006.00	Per End	3018.00
	1000 mm dia.	28	1166.00	Per End	32648.00
	1100 mm dia.	25	1273.00	Per End	31825.00
35	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 (CG PHE SOR 2013 It.No. 2.10.1) Total Refilling	29007.0549	59.00	cum	1711416.00
36	Filling with murum / river sand for pipe bedding or over the pipe including supply 32440 *0.15 * 1.22 (CG PHE SOR P No 20 It.No. 2.11)	5933.817	620.00	Cum	3678966.33
37	Providing and constructing RCC valve chamber with 15cm thick 1:3:6 proportion PCC bedding excluding excavation, cement concrete grade M-15 (Nominal mix) with stone aggregate 20 mm Nominal size for benching, precast RCC frame as directed by Engineer-in-Charge. (Note :- Wall thickness : 0.2 M for depth of 1.2M and 0.35 M for balance depth exceeding 1.2M. 12 mm plaster 1:3 inside chamber). Size 1.8m x1.8m, depth 2.2 M with cover As per rate analysis attached in Annx. I	11	117536.33	each	1292899.61
38	Excavation in Soil (by Manual Means.) 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 upto1000 meters as per relevant clauses of section 300. (CG PWD SOR 3.1) Width excavate same as pipe & depth 0.40 m	15163.18	140.00	cum	2122845.20

TENDER DOCUMENT FOR BILASPUR AUGMENTATION & REORGANISATION OF WATER SUPPLY
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39	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 For Sub-base cum drainage layer or upper sub-base with Grading-VI Material				
	(CG PWD SOR 4.1.b.ii) The quantity excavated is filled with this item 50%	7581.59	1363.00	cum	10333707.17
40	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density as per clause 406.) (CG PWD SOR 4.10) The quantity excavated is filled with this item 50%	7581.59	1434.00	cum	10872000.06
41	Prime coat (Providing and applying primer coat with oil based bitumen emulsion (SS-1, grade confirming to IS:8887) on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means on WBM/WMM surface @0.85 Kg/sqm (CG PWD SOR 5.1)	34175.15	64.00	sqm	2187209.60

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42	<p>Bituminous Macadam (Providing and laying bituminous macadam as per clause 504 with mixed prepared in minimum 40-60 TPH capacity hot mix plant using crushed aggregates of specified grading premixed with bituminous binder, transported to site, laid over a previously prepared surface with paver finisher to the required grade, level and alignment and rolled to achieve the desired compaction)</p> <p>With mechanical paver finisher (ii) for Grading-II(19 mm nominal maximum size, bitumen content 3.40%) (CG PWD SOR 5.3.B.2)</p>	1708.758	6255.00	cum	10688278.16
43	<p>Semi-Dense Bituminous Concrete (Providing and laying semidense bituminous concrete with minimum 40-60 TPH capacity using crushed aggregates of specified grading, premixed with bituminous binder @ 4.50 to 5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORT&H specification clause No. 508 complete in all With mechanical paver finisher for Grading II (10 mm nominal size) with bitumen 5.0 %</p>	854.3788	8468.00	cum	7234879.26
44	<p>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</p> <p>B) 80mm thick Plain precast interlock concrete block (CG PWD SOR 4.15)</p>	6357.125	590.00	sqm	3750703.75
Total					419140891.56

Say Rs 4191.41
Lakhs

ANNEXURE –F 5 D

PERCENTAGE Break-up of payment of 1.042 % of LUMP SUM

**ESTIMATE FOR RAILWAY CROSSING in NODE 21-22, 3-4 & 4-5 FOR RAILWAY, NH 130 &
NH 130A IN GRAVITY MAIN
ABSTRACT**

SER .	Discription of Item	Quantity.	Rate	Unit	Amount
1	Excavation in all types of soils including all lifts and leads. For Railway Crossing For NH Crossing (CG PHE SOR P.19 It.No. 2.1)	144 432	144 144	Cum. Cum.	20736 62208
2	Providing and laying PCC in situ Concrete of grade M-150 for bed concreting. For Railway Crossing (CG PHE SOR P.20 It.No. 2.20.1.4)	7.2 21.6	3823 3823	Cum. Cum.	27526 82577
3	Proving and supplying of MS Pipe as per relevent IS of following Diameters. (CSR I.No.2 P,no. 162) For Railway Crossing c) 500 mm Dia. / 10 mm Tk.(Casing) b) 300 mm Dia/10 mm Tk For NH Crossing a) 1700 mm Dia. / 12 mm Tk. b) 800 mm Dia / 12mm Tk.(casing) a) 600 mm Dia. / 10 mm Tk. d) 650 mm Dia / 12mm Tk.(Casing) e) 450 mm Dia / 10mm Tk. d) 1500 mm Dia / 10mm Tk. e) 400 mm Dia / 10mm Tk. (CG PHE SOR It.No 17.1.2.1 to 25)	90 90 60 90 90 60 60 0	8244.00 5007.00 33211.00 15742.00 9867.00 12840.00 7438.00 24435.00 0.00	Rmt. Rmt. Rmt. Rmt. Rmt. Rmt. Rmt. Rmt.	741960 450630 1992660 1416780 888030 770400 446280 1466100 0
4	Providing and applying of anti Epoxy painting to outer and inner surface of the casing and carrier pipe of approved make				

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	in two coats. For Railway Crossing For NH Crossing (CSR I.No.6 P,no. 255)	175.22 2731.28	581.9 581.9	Sqm. Sqm.	1589331 1589331
5	Jacking of MS casing pipe with all necessacery men and machinery with all the arrangements such as jacks etc. complete.				
	For pipe upto 1000 mm dia For Railway Crossing For NH Crossing (CSR)	90 210	28435 28435	Rmt. Rmt.	2559150 5971350
6	Steel work is welded in built-up section tee & frame i/c cutting hoisting/fixing and painting with red lead paint. (i) In R.S. Joint in flat iron/angle / channel / bar. For Railway Crossing For NH Crossing (CG PHE SOR P.23 It.No. 2.25.4)	135 315	71 71	Kgs . Kgs	9585 22365
7	Lowering and laying of MS pipe inside casing pipe of various Dia. Including pulling/pushing of carrier pipe. For Railway Crossing Carrier Pipe 300 mm Dia. For NH Crossing Carrier Pipe 1500 mm Dia. Carrier Pipe 600 mm Dia. Carrier Pipe 450 mm Dia. Carrier Pipe 250 mm Dia. Carrier Pipe 200 mm Dia. (CG PHE SOR P.217 It.No. 17.9.2)	90 60 90 60 0 0	86 86 86 86 86 86	Rmt. Rmt. Rmt. Rmt. Rmt. Rmt.	7740 5160 7740 5160 0 0
8	Refilling the surplus excavatedstuff to the place as directed by the Engineer-Incharge. For Railway Crossing For NH Crossing (CG PHE SOR P.23 It.No. 2.25.4)	0 144 432	59 59 59	Cum. Cum. Cum.	0 8496 25488
	TOTAL FOR RAILWAY				3927843
	TOTAL FOR NH				11287708
			TOTAL	Total	18679471.73

ANNEXURE –F 5 E

PERCENTAGE Break-up of payment of 0.896 % of LUMP SUM

BULK FLOW METERS

Diameter	Description	Quantity	Rate	Amount
	<p>Electromagnetic Bulk Flow Meters</p> <p>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:</p> <p>Hard Rubber, Fully welded sensor housing complying to IP 68 standard, Electrodes SS Sensor housing SS 304, Cable gland 1/2" Sensor housing fully welded SS 304 housing protective Polyurethane paint, Flow Transmitter/ Converter : Microprocessor based, modular design display 2 line back lit LCD for indication of flow rate, forward, reverse, sumtotalizer, Perfection category : IP 65 Output : One current output (4-20 mA) one scalable pulse output with remote reading facility. (CG PHE SOR P.309 It.No. 30.5)</p>			
300 mm	300 mm 18 & 350 mm 6 Nos.	23	222597.00	5119731
400 mm		2	377936.00	755872
500 mm		2	522646.00	1045292
600 mm		6	850139.00	5100834
700 mm		2	1114567.00	2229134
1000 mm		1	1823892.00	1823892
		36		

Total 16074755
Say **160.75**
Lacs

**ANNEXURE –F -6 (RAW WATER AND CLEAR WATER PUMPING MACHINERY)
PERCENTAGE Break-up of payment of 0.789 % & 2.298 % of LUMP
SUM**

BREAK UP SCHEDULE OF PAYMENT

STAGE WISE PAYMENT OF WORK :

BREAK UP :

- A. On supply of equipment at site - 85%
B. On erection of equipment at site - 10%
C. On testing and commissioning - 5%

Total:- 100%

The percentage cost of work for intermediate payment at different stages of work shall be as follows :-

PART- A

SCHEDULE OF ITEMS FOR RAW WATER VT PUMP SET.

S. No.	Particulars.	Qty.	% Payment of work
	DESIGN, SUPPLY, FIXING, COMMISSIONING, TRIAL RUN OF FOLLOWING AS PER DETAILED SPECIFICATIONS GIVEN ON ANNEXURE “E”		
1.	V.T pump for 335.44 LPS at 21 Mtr. total head as per detail specification along with column pipe of size 400 (pipe)x 43 (shaft) mm column assembly of 15 MTR length I/c bowl assembly, Foundation bolts for above pump set along with suitable HP VHS Electric Motor 3 phase, 415 volts, as per detail specification. Pump efficiency minimum 80% at duty point.	4 Nos.	15%
2.	Vertical Hollow Shaft motor, SPDP, 1450 RPM suitable to operate on 415V + 10%, 3Ph, 50Hz, AC supply having ‘F’ class insulation temp. rise limited to ‘B’ class with continuous duty, conforming to IS-325	4 Nos.	10%
3.	Butterfly valve electrically operated of PN 1.0 size 400mm for delivery side of pump as per detail specification.	4 Nos.	0.4%
4.	Sluice valve of PN 1.0 size 400mm for delivery pipe as per detail specification.	4 Nos.	0.4%
5.	Non-Return valve of PN 1.0 size 400mm for delivery side of pump as per detail specification.	4 Nos.	0.4%
6.	Sluice valve of PN 1.0 size 700mm for manifold pipe line as per detail specification.	1 Nos.	0.5%
7.	Non-Return valve of PN 1.0 size 700mm for common manifold as per detail specification.	1 No.	0.5%
8.	D/f Flow meter of electromagnetic type for installation on manifold pipe as per detail specification.	1 No.	1.5%
9.	Pressure gauge of dial size 150mm dia 0-4 kg/cm2 on delivery side of pump as per detail specification	4 Nos.	0.2%
10.	M.S./ CI Dismantling Joint of 400 mm for delivery side of pump as per detail specification.	4 Nos.	0.4%
11.	M.S./ CI Dismantling Joint of 700 mm for common manifold pipe as per specification.	1 No.	0.2%
12.	M.S. D/F Pipe for delivery of 400mm size of 8 mm thickness along with flanges hardware like Nut, Bolts, Washers & Rubber Sheet, complete for	400Kg	0.5%

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	joining pipes, valves, etc.		
13.	M.S. C.I. D/F 400 x 500 as per delivery size of pump enlarge for delivery side.	4 Nos.	0.2%
14.	M.S. S/F 400 mm Bend of 90/45 deg for jointing to common main fold and pump outlet.	4 Nos.	0.2%
15.	M.S. D/F Pipe for common manifold of 700mm size of 8 mm thickness and of lengths as required along with flanges & hardware like Nut, Bolts, Washers & Rubber Sheet complete for joining pipes, valves, etc.	2500 Kg	1.4%
16.	3½ core x 400sq.mm Aluminum Armored cable from MCCB to pump house MCCB including accessories like lugs, gland. For connection of Transformer MCCB Panel to Motor Panel.	300 Mtr.	0.6%
17.	3½ core x 150sq.mm Aluminum Armored cable from Panel to motor including accessories like lugs, gland. For connection of Panel to Motor.	200 Mtr.	0.4%
18.	HOT Crane 3 Ton capacity with 6 mtr. span & 6 mtr. lift of chain & 40 x 40 mm sq. bar etc. complete as per specification.	1 Set	2.5%
19.	MOTOR CONTROL PANEL: Motor control panel shall be as per detail specification alongwith soft starters 4 Nos. As per specification.	1 Set	4.0%
20.	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Strip 25 x 5 mm, Complete hardware of earthing like coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete	4 Nos.	0.3%
21.	Tools accessories as per list enclosed.	1 Set	0.2%
22.	Installation and commissioning of all above items including painting, trial run of 3 months and testing	1 Job	1.0%
		TOTAL	40.80%

PART - B

SCHEDULE OF ITEMS FOR CLEAR WATER PUMPSET. (AT WTP)

S.No	Particulars.	Qty.	% Payment of work
	DESIGN, SUPPLY, FIXING, COMMISSIONING, TRIAL RUN OF FOLLOWING AS PER DETAILED SPECIFICATIONS GIVEN IN ANNEXURE "E"		
1.	Centrifugal pump for 167.03 LPS at 76 M total head with positive suction as per detail specification along with Coupling, Coupling guard, Base Plate & Foundation bolts for above pump along with suitable HP Electric Motor 1450 RPM as per detail specification. Pump efficiency minimum 80% at duty point.	4 Nos.	15%
2.	Electric motor 3 phase, 415V, foot mounted type TEFC, 1450 RPM as per detail specification.	4 Nos.	10%
3.	Sluice valve of PN 1.0 size 350mm for suction side of pump as per detail specification.	4 Nos.	0.4%
4.	Sluice valve of PN 1.0 size 300mm for delivery side as per detail specification.	4 No.	0.4%
5.	Non-Return valve of PN 1.0 size 300mm for delivery side of pump as per detail specification.	4 Nos.	0.4%
6.	Sluice valve of PN 1.0 size 500mm for manifold pipe line as per detail specification.	1 No.	0.3%
7.	Non-Return valve of PN 1.0 size 500mm for common manifold pipe line as per detail specification.	4 Nos.	0.3%
8.	Pressure gauge of dial size 150mm, 0-10 kg/cm ²	4 Nos.	0.2%
9.	D/F Flow meter of electromagnetic type size 500mm for installation on manifold pipe as per detail specification.	1 No.	1.5%
10.	M.S. D/F Pipe for suction as per site requirement of 350mm size along with flanges hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	800 Kg	0.8%
11.	M.S. D/F 450mm Bend of 90/45Deg for suction side.	200 Kg	0.2%
12.	M.S. D/F Pipe for delivery of 350mm size along with hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	600 Kg	0.6%
13.	M.S. D/F Pipe for delivery of 300 size along with hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	600 Kg	0.6%
14.	M.S. D/F 450mm Bend of 90° for jointing to common main fold and pump outlet.	4 Nos.	0.2%
15.	M.S. D/F Pipe for common manifold of 800 mm size, 8mm thick and of following lengths along with hardware like Nut, Bolts , Washers & Rubber Sheet complete for joining pipes, valves, etc.	4000 Kg	2.4%
16.	3½ core x 400sq.mm Aluminum Armored cable including accessories like lugs, glands. For connection of Transformer MCCB panel to Motor Panel.	300 Mtr.	0.6%
	3 core x 185 sq.mm Aluminum Armored cable from starter to motor including accessories like lugs, gland. for panel to Motor.	200 Mtr.	0.4%
19.	HOT Crane 3 Ton capacity with mtr. span & reqd. lift of chain & 40 x 40 mm sq. bar etc. complete as per specification.	1 Set	2.5%
20.	MOTOR CONTROL PANEL: Motor control panel shall be as per detail specification alongwith soft starters 4 Nos. As per specification.	1 Set	4.0%
21.	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. strip 25 x 3mm, 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.	4 Nos.	0.3%
22.	Tools accessories as per list enclosed.	1 Set	0.2%

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23.	Installation and commissioning of all above items including painting, trial run of 3 months and testing	1 Job	1.0%
		TOTAL	42.3%

PART – C

SCHEDULE OF ITEMS FOR CLEAR WATER PUMPING STATION SUB STATION.

S.No	Particulars.	Qty.	% Payment of work
	DESIGN, SUPPLY, FIXING, COMMISSIONING, TRIAL RUN OF FOLLOWING AS PER DETAILED SPECIFICATIONS GIVEN IN ANNEXURE “E”		
1	33/0.415 kV 1500 KVA Transformer having as per detail specification.	2 No.	10.0%
2	33 kV Lightning Arrestor.	6 Set.	0.25%
3	33 kV DO Fuse Unit.	4 Set.	0.10%
4	33 kV A.B. Switch Complete with Rod/ Handle.	2 Set	0.25%
5	ACRS Conductor.	200 MTR.	0.36%
6	33 kV Pin Insulator.	18 Nos.	0.30%
7	33 kV DISC Insulator.	54 Set.	0.30%
8	Hardware kit, compete for laying of ACSR Conductor & inter connection from A/B Set, L/A Set, D/O Set, Pin & Disc Insulator upto transformer.	2 Set.	0.36%
9	3½ core x 400 sq.mm Aluminum Armored cable from Transformer to MCCB panel including accessories like lugs, glands.	150 Mtr.	0.42%
10	Main panel having 400 Amp MCCB for fixing near transformer.	2 Set	0.25%
11	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Strip 25 x 5 mm, Complete hardware of earthing like coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete	14 Nos.	0.18%
12	I Section 200 x 100 - Length as required . Channel 100 x 50 , etc. – as required.	4700 Kg.	2.50%
13	Fencing work using 50 x 50 x 5mm size vertical post of 3 Mtr. length and 50 x 50 x 5mm size struts for even corner of 3 Mtr., Wire mesh of 3mm thick with netting size of 100 x 100mm of height 2 Mtr., M.S. Flats of size 25 x 3mm size for vertical & horizontal support. Hardware material, like Nut, Bolt, G.I. Wire, etc. for fencing., Gate of 3.5 Mtr. Wide & height of 1.5 Mtr. of Iron Steel.	51 Rmtr	0.50%
14	Metalling	1 Lot.	0.10%
15	Street lighting poles of height – 8.5 Mtr. Sodium Vapor Lamp of 250 Watts & fitting for Sodium Vapor lamp with hardware complete.	4 Nos.	0.28%
16	Cables of 2.5sq.mm x 2 core copper armored cable for street lighting load.	300 Mtr.	0.10%
17	Drawing preparation for sub – station and approval from safety electrical inspector.	1 Job	0.05%
18	Charging permission for sub – station and approval from safety electrical inspector.	1 Job	0.05%
19	All civil work relating to erection of poles, fencing work, construction of platform for transformer, earth pit chambers.	1 Job	0.20%

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S.No	Particulars.	Qty.	% Payment of work
20	Installation and commissioning of all above items including painting, trial and testing	1 job	0.25%
21	ACCESSORIES		0.10%
	Rubber Hand Gloves.	1 Set.	
	Ball Pin Hammer with Wooden Handle.	1 Set.	
	Screw Driver 8" & 12"	1 Set.	
	Shock Treatment Chart.	4 Nos.	
	Danger Notice Board.	1 Nos.	
	Fire Stand with Fire Bucket in sub-station.	1 Nos.	
	Insulated Player.	1 Set.	
	Fire extinguisher 4.5 Kg.	1 Set.	
	D.O. Operating rod 33 kV fiber H.D.	1 Set.	
	Discharge rod with accessories fiber.	1 Nos.	
	Helmet H.D.	1 Set.	
	Total percentage of Part C		16.90%

Annexure - "F-7 (PLC & SCADA)" : Price Schedule
PERCENTAGE Break-up of payment of 1.562 % of LUMP SUM

Sl. No	Description	Breakup of Payment
1	Design, Construction, installation of PLC SCADA system	
I	Designs preparation and submission of system drawing & its approval with list of procured hardwares	5%
ii	Installation of system components with complete hardware, electrical installation, cabling and system kick off	60%
iii	After three months of complete system operation with all the components running to their rated capacities	25%
Iv	After completion of 12 Months trial run	10%
	Total	100%

Annexure - "F-8 (RFORM WORKS)" : Price Schedule
PERCENTAGE Break-up of payment of 0.222 % of LUMP SUM

Sl. No	Description	Breakup of Payment
1	Supply of GIS Software, GIS Mapping and updating till completion of project, Consumer survey Etc complete	
I	Consumer Survey of all the houses and its compilation in 3 Sets	30%
Ii	Supply and installation of International standard GIS Software with training	5%
Iii	Digitisation of GIS Image with plotting of all base scenario, and design scenario attributes	10%
Iv	Final updation till completion of the project	55%
	Total	100%

Annexure - "F-9 (ALLIED CIVIL WORKS)" : Price Schedule
PERCENTAGE Break-up of payment of 1.969 % of LUMP SUM

Allied Civil Works

Estimated Cost Rs.

353.07 Lacs

S.R No	Particulars	Qty	Rate	Per	Amount (Rs. In lacs)
1	Provision for Compound wall along with Brick masonry at OHSR's, electric sub station. Canal Intake 4*15 = 60 m WTP 1136 m OHSR's 50 x 4 = 200m (As per Rate Analysis attached)	1396	4997.3	per Mtr.	69.76
	Supplying and erecting chain link mesh fencing for electric sub-station switch yard of 2.5 m approx. height from ground level using angle iron size 50 X 50 X 6 mm erected in C.C. foundation 15 X 15 X 40 cm deep at every 2 metre fitted with flat iron support of size 25 X 6 mm on top, bottom and mid way and chain link mesh 50 x 50 mm aparture and 4 mm dia G.I. hard wire securing and screwing with 2mm dia G.I. wire, G.I. staples, G.I.U-nails or steel pins to the angle iron at every distance of 30 cms, by iron studs complete duly painted with one coats of red oxide and two coats of approved colour paint CG PWD SOR 2015 24.10 420 x 2.50 =	1050	507	sqm	5.32
	Provision for Main Gates				

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2	<p>WTP 2 Nos of size 5 x 2.5m Head works 1 Nos of size 5 x 2.5m OHSR's 4 No of size 5.0 x 2.5m Quarters 2 Nos of size 2.5 x 5m Wicket Gates</p> <p>WTP 2 Nos of size 1.5 x 2.0m Head works 1 Nos of size 1.5 x 2.0m OHSR's 4 No of size 1.5 x 2.0m Quarters 2 Nos of size 1.5 x 1.5m Total 332.75 Sqm x 25 Kg per Sqm (CG PHE USOR P.No. 23 I.No. 2.25.4 Provision for Computers, peripherals &</p>	3262.5	71		2.32
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S.R No	Particulars	Qty	Rate	Per	Amount (Rs. In
3	Furniture and other Misc items like telephone connection, internet etc.				2.50
4	<p>Provision for plantation around OHSR and WTP including landscaping and beautification of construction site</p> <p>Providing and fixing M.S. flat iron tree guard 60cm dia. and 2m height above ground level formed of 4 nos. 25x6mm and 8 nos. 25x3mm vertical M.S. flats rivetted to 3 nos. 25x6mm M.S. flat iron rings in two halves, bolted together with 8mm dia. and 30mm long bolts including painting two coats with paint of approved brand and manufacture over a coat of priming, complete in all respects. CG Building SOR 2013 Chapter Chapter XXIII Pg. No. 194 It. No. 23.15</p>	5	5	Each	25.00
		200	1643	Each	3.29
5	Plants of Regular varieties of 5 Ft. Height including Transport	200	160	Each	0.32
6	Digging holes in ordinary soil and refilling the same with the excavated earth mixed with manure Holes 1.2 m dia and 1.2 m deep.	200	170	Each	0.34
7	Construction of I Type Staff Quarter at WTP Site including necessary excavation, RCC work, Brick Work, Plastering, Painting and all other allied works.				

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	I Type	4	14.96	Each	59.84
	H Type	4	10.692	Each	42.77
	G- Type	2	45.564	Each	91.13
8	CC Roads 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)				
	WTP site 800m x 4.0m	3200	1129.6	sqm	36.15

S.R No	Particulars	Qty	Rate	Per	Amount (Rs. In lacs)
9	Providing and placing in position cold twisted or un- coated HYSD steel barand hot rolled deformed steel reinforcement for R.C.C.work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage. (PHE SOR I. No. 2.25.1(2.25.1.1) of P. No. 23) Sub Structure 0.7% of CC Road Quantity	22400	55	kg	12.32
10	Diversion of National Highway at Canal Crossing near RATANPUR Making WBM Road for diversion of Nationa Highway for open excavation for laying Raw Water Gravity pipe line of 1500 mm dia MS pipe by excavation for earthwork with watering ramming making out road ways by making WBM road ways with Grade II 53 to 22.4 mm size aggregate vide CG PWD SOR I.No. 4.8.B(i) as directed by Engineer -in- charge along with putting Guard, making signboards for Diversion, barricading etc. (As per Analysis)	125	1616.0	Rmt	2.02

Total Rs. 353.07
Lacs

Annexure - "F-10
(O & M FOR FIVE YEARS)" : Price Schedule

PART B

S.No.	Name of Subwork			
	<p>Operation and Maintenance of existing 24 10 Mld WTPs and proposed 17 Mld WTP including PLC & SCADA monitoring & control system (covering all WTPs, all WPS, CWPS, valve actuators , OHSR's, FCV's & electromagnetic bulk flow meters) and all new RWP's & CWP's including replacement & warranty for 5 years.</p> <p>O & M per Year ----</p> <p>For First Year 18%</p> <p>For Second Year 19%</p> <p>For THird Year 20%</p> <p>For Fourth Year 21%</p> <p>For Fifth Year 22%</p>			

ENVIRONMENTAL MANAGEMENT PLAN

The Contractor shall comply with all applicable national, provincial, and local environmental laws and regulations.

The Contractor shall (a) establish an operational system for managing environmental impacts (b) carry out all of the monitoring and mitigation measures set forth in the [Initial Environmental Examination ("IEE")] or [Environmental Management Plan ("EMP")] and (c) allocate the budget required to ensure that such measures are carried out. The Contractor shall submit semi-annual reports on the carrying out of such measures to the Employer.

More particularly, the Contractor shall comply with (i) the measures and requirements set forth in the initial environmental examination and the environmental management plan attached hereto as Appendix [1 & 2]; and (ii) any corrective or preventative actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the initial environmental examination and the environmental management plan. The Contractor shall allocate a budget for compliance with these measures, requirements and actions.

POTENTIAL NEGATIVE IMPACTS	MITIGATION MEASURES
Pre- Construction Activities by Contractor	
Construction Camps – Location, Selection, Design and Layout	<p>The construction camps will be located at least 500m away from habitations at identified sites.</p> <p>Locate in barren / waste lands and not fertile agricultural land</p> <p>All fuel oil / lubricants loading and unloading areas shall be paved; and have separate storm water collection system fore separation of oil / lubricants prior to discharge.</p> <p>Provide adequate water supply, sanitation, septic tanks, soak pits of adequate capacity. Restore the site to its original state after Use.</p> <p>Proper training of labourers and management of waste, if any</p> <p>Prepare a waste management plan for the camps, including an appropriate sanitation and drainage system</p> <p>Approval should be taken from PWD- PHED for contractors location, selection design and layout of construction camps.</p>
Drinking water availability and water arrangement	<p>The contractor shall be responsible for arrangement of water in every workplace at suitable and easily accessible place for the whole construction period. Sufficient supply of cold potable water (as per IS: 10500) to be provided and maintained. If the drinking water is obtained from an intermittent public water supply then, storage tanks will be provided.</p>
Identification of disposal sites	Location of disposal sites shall be

	<p>finalized only after the Engineer shall certify that these are not located within designated environmentally sensitive zones and confirm that:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Disposal of the material does not impact natural drainage courses <input type="checkbox"/> No endangered / rare flora is impacted by such material <p>Not in the vicinity of settlements and sensitive landuses.</p>
Quarry Operations	<p>It has to be ensured that materials are obtained from licensed quarries having environmental clearance. Quality and legality to be examined by the Contractor and copies of environmental clearances for these needs to be submitted prior to sourcing of material.</p>
Construction	
<p>Excavation will produce large quantity of waste soil, which needs proper disposal. <i>Description.</i> Laying of pumping mains and distribution network is estimated to produce about 19,500 m³ of waste soil, which needs proper disposal. This soil shall be disposed off in the borrow- pits of the road section</p>	<p>Utilize surplus soil for following activities in order priority:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Utilise for filling deep borrow- pits along roads section. <p>Utilize for raising the ground- level of WTP Provide waste soil to local people for filling up low laying areas.</p>
<p>Water accumulation in trenches during rains and related impacts</p>	<p>Avoid scheduling of excavation work during the monsoon months</p> <ul style="list-style-type: none"> <input type="checkbox"/> Complete pipe laying work in excavated stretches and refill before onset of monsoon <input type="checkbox"/> In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil and ensure that drains are not blocked with excavated soil
<p>Sign Boards, Name boards showing project details at site</p>	<p>Put up visible signs showing duration of construction activities, contact details of focal persons from HSRDC and contractor, contact numbers in case of complaints/grievances</p>
<p>Dust nuisance due to construction <i>Description.</i> Earthwork</p>	<p>Cover or damp down by water spray on the excavated mounds of soil to control dust generation;</p>

<p>excavation, refilling, handling and transportation of construction materials (like sand and aggregate), and handling, transportation and disposal of waste soil will produce dust if it is not done properly.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process; <input type="checkbox"/> Bring the material (aggregate) as and when required; <input type="checkbox"/> Ensure speedy completion of work – trench excavation, laying of pipe and refilling, to remove surplus soil as soon as possible; <input type="checkbox"/> Use tarpaulins to cover loose material that is transported to and from the site by truck. <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 <input type="checkbox"/> Use tarpaulins to cover loose material/soil that is transported to and from the site by truck <input type="checkbox"/> Control dust generation while unloading the loose material (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 <input type="checkbox"/> Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition where loaders, support equipment and vehicles will operate <input type="checkbox"/> Don't allow access in the work area except workers to limit soil
<p>Generation of Pollution/noise and vibrations from excavation <i>Description.</i> High noise/vibration activities like rock blasting/pile construction are not anticipated. However, activities like breaking of CC/BT road surface using pneumatic drillers for laying pipelines may creates noise & vibration</p>	<p>Provide prior information to the local public about the work schedule</p> <ul style="list-style-type: none"> <input type="checkbox"/> Do not conduct noise generating activities in the night <input type="checkbox"/> Ensure that there are no old and sensitive buildings that may be in risk due to use pneumatic drills <input type="checkbox"/> Employ manual methods, whererequired <input type="checkbox"/> Clean up the affected area immediately at own cost of contractor andto the satisfaction of the PWD- PHED, andshall pay full compensation to any affected parties.
<p>Loss of fertile top soil</p>	<p>Remove the top soil for a depth of 0.3 m (1 feet) and stock separately</p> <ul style="list-style-type: none"> <input type="checkbox"/> This may be used within the site or on demand it may be provided to local farmers

<p>Cutting of trees. Pipelines will be laid avoiding trees; alignment will be altered slightly to save the trees, wherever possible</p>	<p>No trees shall be cut/pruned for laying pipeline <input type="checkbox"/> Plant and maintain</p>
<p>Impacts due to improper mining for construction materials <i>Description.</i> Large quantities of construction material like sand and aggregate will be required for WTP and reservoir constructions. As the excavated soil will be used for refilling trenches, pipeline construction will require minor quantities.</p>	<p>Ensure that construction materials (sand, aggregate and gravel) are obtained from quarries licensed by GoH (Directorate of Geology and Mining).</p>
<p>Shops and other business may loose income if costumer's access is impeded,sites of social/cultural importance and residential areas</p>	<p>Consult local people: inform them of work in advance <input type="checkbox"/> Leave spaces for access between mounds of soil <input type="checkbox"/> Provide walkways and metal sheets to maintain access across trenches for people and vehicles where required <input type="checkbox"/> Increase workforce in these areas to finish work quickly <input type="checkbox"/> Informing all residents and businesses about the nature and duration of any work well in advance so that they can make preparations if necessary <input type="checkbox"/> Storage facilities and other temporary structures on- site shall be located such that they have as little visual impact as possible <input type="checkbox"/> Special attention shall be given to the screening of highly reflective materials on site <input type="checkbox"/> In areas where the visual environment is particularly important or privacy concerns for surroundings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction. <input type="checkbox"/> The signs and barriers shall be adequately illuminated at night and kept clean and legible at all times <input type="checkbox"/> For the duration of the works the contractor shall at all times provide convenient access to paths, steps, bridges, crossings or drives for all entrances to property abutting the site and maintain them</p>

	<p>clear, tidy and free from mud and objectionable matter and</p> <ul style="list-style-type: none"> <input type="checkbox"/> Before setting out for the work the contractor shall inform the inhabitants of the area through appropriate means (bill board display, leaflet distribution, announcement on radio and TV, publishing in the widely circulated daily newspapers) atleast 7 days (or as directed by the PWDPHED) before commencement of any work.
<p>Water scarcity for the residents during replacement of pipe line <i>Description:</i> During replacement of existing pipe lines, residents will be intimated about the work and supply necessary water for 2 days storage capacity</p>	<p>During replacement of pipe work the disconnected consumers have to be provided with alternative water source sufficient to meet their daily requirement.</p> <ul style="list-style-type: none"> <input type="checkbox"/> The consumers have to be well informed about the arrangement.
<p>Excavation could damage existing infrastructure <i>Description.</i> Water supply lines will be laid along/within the road avoiding telephone/electricity infrastructure. As in most of the areas, water supply lines already exist, and therefore there is no major interference with the other infrastructure. But it cannot be altogether avoided.</p>	<p>Identify the services to be affected in each zone</p> <ul style="list-style-type: none"> <input type="checkbox"/> Coordinate with respective agencies (telephone & electricity department) in shifting those infrastructure <input type="checkbox"/> Provide prior public information about the likely disruption of services <input type="checkbox"/> Provide alternate arrangements for services like water supply in the event of disruption beyond reasonable time, for instance, through tankers
<p>Traffic, people and activities could be disturbed due to laying of water supply lines <i>Description.</i> No alignment of the pipes is passing through the town area. It is to be laid along road network leading to various villages, which does not have much of Commercial activity. Yet, construction work will affect the people, activities and business for a small period.</p>	<p>Provide information to the public through media – daily news papers and local cable television (TV) services, about the work (nature & schedule) likely disturbances, and need and schedule of road closure if any, and alternative routes This shall provide locality/village - wise information (where & when the work will be taken up and when it will be completed)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Ensure that the work is completed as scheduled; ensure that well experienced contractors are engaged and discourage delays by suitable penalties built into the Contracts <input type="checkbox"/> Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time <input type="checkbox"/> Avoid complete closure of road; ensure that work is conducted onto edge of the road; allow traffic to move on one line <input type="checkbox"/> Do not deploy heavy/large equipment, which will occupy & disturb traffic/people

	<p>movement; if necessary use only during light traffic hours (6 AM – 10 AM)</p> <ul style="list-style-type: none"> <input type="checkbox"/> In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions <input type="checkbox"/> At all works sites public information/caution boards shall be provided (name of the project, cost, schedule, contractor name, implementing & executing agency, schedule of work at that locality, details of traffic diversion, responsible officer for implementation and receiving complaints)
Increase in traffic due to trucks carrying construction material & waste	<p>Plan routes to avoid narrow streets, congested roads, and places of religious importance</p> <ul style="list-style-type: none"> <input type="checkbox"/> Plan work to avoid peak traffic hours
Site of social/cultural importance (schools, hospitals and religious places) may be distributed by noise, dust, and impeded access during laying of pipelines.	<p>avoid work at sensitive times, such as religious and cultural festivals</p> <ul style="list-style-type: none"> <input type="checkbox"/> Remove waste quickly, cover/spray stockpiles, cover soil/sand on trucks <input type="checkbox"/> Increase workforce to finish work quickly <input type="checkbox"/> Use wooded planks and metal sheets to allow access (people/vehicles) <input type="checkbox"/> Use modern vehicles/machinery & maintain as specified to reduce noise and exhaust emissions
Workers and public at risk from accidents on site <i>Description.</i> Excavations for distribution lines will be mostly limited to 1.1 m except few which may 1.4 m deep. Rising main – 1.3 m to 2 m. Excavations for foundations (WTP) may go to a depth of 5- 10 m. Public will be at risk as trenches for pipelines will be located along the roads.	<p>Follow standard and safe procedures for all activities – such as provision of shoring in trenches of 2 m or more</p> <ul style="list-style-type: none"> <input type="checkbox"/> Consulting the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills for cutting roads; <input type="checkbox"/> Excluding the public from the site – enclose the construction area, provide warning/sign boards <input type="checkbox"/> Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks etc); <input type="checkbox"/> Report accident and maintain records
Economic benefits for people employed in workforce	<p>Ensure that most of the workforce is from local communities</p>

Environmental Monitoring Plan

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Mitigation measures	Location	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring
Pre- Construction				
Air Quality		SPM and RSPM, NO _x , 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 WTP and where	SPM and RSPM, NO _x , CO The monitoring results shall be compared with baseline values (prior	Thrice annually	AMC-PHE

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	networks to be developed	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; this will be threshold	Thrice annually	AMC-PHE

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		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 lowlaying 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 earthen bunds, if	All construction sites	Observations on- site/offsite;	Weekly	AMC-PHE

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

<p>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 particularly (aggregate) at the</p>			
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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 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.

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- "G-I"

GUARANTEE BOND

(To be used by approved scheduled banks)

1. In consideration of Municipal Corporation Bilaspur (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. Bilaspur (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 Bilaspur 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, Bilaspur (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, Bilaspur 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 dose 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 BILASPUR 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 BILASPUR 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 star work, the contractor shall submit in the prescribed Performa a detailed construction programme month wise mentioning start and completion or each item/event involved in the due performance of the contract for contract more than 10 Crores Contractor shall also submit detailed proramme 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 BILASPUR 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 Bilaspur

Name of Contractor

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

Date of work order Due date of completion

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 Achievemtnt actual	Slipage if any (Period)	Reason for slippage (Use add sheet if needed)
		As per Original	1St Revision	Last No. Revision			
1	2	3 (a)	3 (b)	3 C	4	5	6

Comments of Executive Engineer if any

Cash Flow for performing the contract (applicable fro 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)						

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

(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
Bilaspur

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 ad 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 BILASPUR MUNICIPAL CORPORATION acting through Shri.....(Designation of the officer , Department) BILASPUR 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 BILASPUR 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 BILASPUR 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 BILASPUR 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 BILASPUR 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 BILASPUR 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 a period of five years or 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 BILASPUR 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 BILASPUR MUNICIPAL CORPORATION servant or not, but not include a spouse separated from the BILASPUR 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 BILASPUR MUNICIPAL CORPORATION servant but does not include a child or step child who is no longer in any way dependent upon the BILASPUR MUNICIPAL CORPORATION servant, or of whose custody the BILASPUR MUNICIPAL CORPORATION servant has been deprived of by or under any law, any other person related, whether by blood or marriage, to the BILASPUR MUNICIPAL CORPORATION servant or to the BILASPUR

MUNICIPAL CORPORATION's servant's wife or husband and wholly dependent upon BILASPUR MUNICIPAL CORPORATION's 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 BILASPUR 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 BILASPUR 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

1.1	<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>				
1.2	<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

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

Work Performed on all classes of Civil Engineering Construction Works over the last ten years

Sno	Project Name	Name of Employer	Description of Work	Value of Contract	Contract 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		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 Wor k	Cont ract No & Year	Name& Adders Of the Employ er	Value of Contra ct (Rs. Lakhs.)	Date of Issue of Wor k Orde r	Stipula ted Date of Compl etion	Stipulate d period of Completi on in Months	Antici pate A date of Comp letion	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. 30Crores to Rs.50 Crores	Fron 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.

List of Technical person to be deployed on Contract work

SI.	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. 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.

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

Affidavit

I..... S/o.....
A.ged..... 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. 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