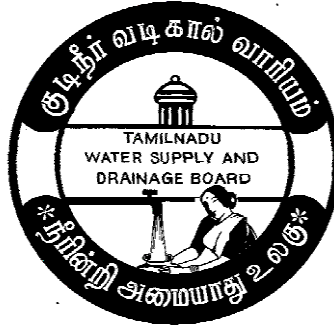


**TAMILNADU WATER SUPPLY AND DRAINAGE BOARD
BID DOCUMENT**



NAME OF WORK : Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion 12 months)

Last date of submission: Up to 03.00 P.M. on 04.06.2020

Sixth Call

CONTRACTOR

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NAME OF THE SCHEME: Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion 12 months)

CHECK LIST TO BE ENCLOSED BY BIDDER (along with Bid Documents)

The check list is only indicative to assist the bidder in satisfactorily enclosing all required major documents for Technical Qualification. The list is not exhaustive and the bidder should read all clauses of the bid document so as to enclose all documents as required.

A. BID SECURITY:

- I) Bid security for a value of **Rs. 16.50 Lakh** to be furnished
 II) Furnish the details of Bid Security as under

Sl. No	Name of the Bidder	Amount and type of security	Issued by

ELIGIBILITY / QUALIFICATION CRITERIA

Sl. No	Description	Requirement as per Bid document			Particulars as furnished by the bidder	Page No. with ref. no. if any where the particulars are furnished by bidder.
	Financial Turnover & Cash flow.	Lead Partner	Joint Venture	Total		
		Rs. in Crores				
1.	Annual Turnover in any one of the last three financial years Rs. in crores (2016-17, 2017-18 & 2018-2019) – 75% of BOQ value			16.50		
2	Minimum Annual Turnover in last three financial year Rs. in crores (2016-17, 2017-18 & 2018-2019) – 33% of BOQ value			7.26		

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3	Minimum cash flow required in Rs. in crores = $\frac{3 \text{ months} \times \text{BOQ Value}}{\text{Period of completion}}$			5.50		
4	The bidder should have satisfactorily completed Water supply scheme of value not less than Rs. ----- Crores during the last five years					
	i) If single agreement 40 % of BOQ value			8.80		
	(OR)					
	ii) If Two agreements 60 % of BOQ value			13.20		
5	Physical (Work Experience) Minimum aggregate during last five years					
5 a	Minimum aggregate number of construction of off take well / Collection well/ Infiltration well/ Jack well/ Intake well should have completed (50% of total requirement of 1 No.)	1 No		1 No		
5 b	Minimum aggregate experience of Full Scale Water Treatment Plant (25 % of total requirement of 4.83 mld)		1.21 MLD	1.21 MLD		

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5.c	<p>Minimum aggregate experience of pipeline in km</p> <p>i. DI/CI pipe should have supplied , laid, jointed , tested and satisfactorily completed (30% of total requirement of 10.115 KM)</p> <p>ii. PVC /HDPE pipe should have supplied , laid, jointed , tested and satisfactorily completed (30% of total requirement of 63.312 KM)</p>	3.04 KM		3.04 KM		
5.d	<p>Minimum aggregate experience of RCC water retaining structure (LL) completed and tested for water tightness in last five years (40% of total requirement of 5.80 LL)</p>	2.32 LL		2.32 LL		
5.e	<p>Minimum Aggregate capacity of pumping machinery installed (KW), erected, tested and satisfactorily completed in last five years (50% of total requirement of 125 KW)</p>	62.50 KW		62.50 KW		
6.	<p>Bid capacity Assessed Available Bid capacity = (A*N*1.5 - B)</p>			Should be more than Rs.22.00 Crore		

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- 7 Whether performance eligibility for 5 (a) , 5 (b), 5 (c), 5 (d) and 5 (e) above are based on certificate issued by the officer not less than the rank of Executive Engineer of that user departments and in the case of Private organization from the General Manager of that Organization (Yes / No)
- 8 Whether Annexure - I to XII are all filled up fully and enclosed (Yes / No)

9. If Yes, give details as under (Notarized as per requirement)

Sl. No	Description	Page Nos. in the Bidders Document
1.	Performance of the bidder showing total monetary value of Civil Engineering work for the past three years (Annexure- I)	
2.	Average Annual Construction Turn over (Annexure – II)	
3.	Experience in works of similar nature of Magnitude within a period of 5 years (Annexure – III)	
4.	Commitment of works on hand (Annexure – IV)	
5.	Works for which Bids are already submitted (Annexure-V)	
6.	List of equipments available with bidder (Annexure – VI)	
7.	Qualification / Experience of key personnel proposed for technical and administrative functions under this Contract (Annexure – VII)	
8.	Sample Format for evidence of access to or availability of credit facilities (Annexure – VIII)	
9.	Details of Litigation if any (Annexure – IX)	
10.	Declaration by the bidder pertaining to blacklisting / debarment etc., (Annexure – X)	
11.	Details of components proposed to be sublet and sub contractor involved (Annexure – XI)	
12.	Technical staff to be employed (Annexure – XII)	

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10. List of Certificates to be enclosed by the Bidder.

Sl. No	Description	Page Nos. in the Bidders Document
1.	Signature of the proprietor or proprietress attested by the Notary public.	
2.	Signature of all the partners / power of attorney attested by the Notary public	
3.	Registration of the firm, Signature of all the authorized person attested by the Notary public	
4.	A copy of the listed Power of Attorney authorizing the signatory of the bidder.	
5.	Proof of Registration of firm / company	
6.	Audited Balance sheets	
7.	Credit line certificate from Financial institutions	
8.	Income Tax clearance certificate.	
9.	GST Registration certificate.	
10.	Certificate of performance issued by not less than the rank of Executive Engineer / Responsible person of the organization.	

Signature of Tenderer

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- 7) Qualification/Experience of key personnel proposed for technical and administrative functions under this contract (Annexure-VII)
- 8) Sample Format for evidence of access to or availability of credit facilities (Annexure-VIII)
- 9) Details of Litigation if any (Annexure-IX)
- 10) Declaration by the bidder pertaining to blacklisting/debarment etc.,(Annexure-X)
- 11) Details of components proposed to be sublet and Sub contractor involved (Annexure-XI)
- 12) Technical staff to be employed (Annexure-XII)

Certificates:

- 1) Signature of the Proprietor or Proprietress attested by the Notary Public
- 2) Signature of all the Partners/Power of attorney attested by the Notary Public.
- 3) Registration of the firm, signature of the authorized person attested by the Notary public.
- 4) A copy of the listed Power of Attorney authorizing the signatory of the bidder
- 5) Proof of Registration of firm/company.
- 6) Audited Balance sheets.
- 7) Credit line certificate from Financial Institutions.
- 8) Income Tax clearance certificate.
- 9) GST registration certificate
Certificate of Performance issued by not less than the rank of Executive Engineer/Responsible person of the Organization.

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TWAD BOARD – INVITATION OF BIDS – TWO COVER – ITEMWAR TENDER SYSTEM (SIXTH CALL)			
IFB No.	F.Kuzhithurai WSIS /SDO II/ CW /2020 /Dt.19.05.2020		
Fund	IUDM 2018-19		
Eligibility	Registered Class I Bidders (Civil)		
Tender Invitee	The Chief Engineer, TWAD Board, No.1/1,Sambakulam, Mattuthavani, Madurai. 625007		
Sale of Bid& Place of Sale	20.05.2020 to 02.06.2020 up to 17.45 hours at O/o the Executive Engineer, TWAD Board, Project Division, Nagercoil, TamilNadu by cash or by Demand Draft Rs.1000+ GST in favour of Executive Engineer, TWAD Board, Project Division, Nagercoil payable at Nagercoil.		
Down loading website	(Free of cost) at www.tenders.tn.gov.in and www.twadboard.tn.gov.in .		
Pre Bid meeting	26.05.2020 at 11.00 hours at the office of the Tender Invitee		
Bid Submission	04.06.2020 before 15.00 hours at the office of the Tender Invitee in person or through post. This office will not be held responsible for postal delay, if any.		
Bid opening	04.06.2020 at 15.30 hours at the office of the Tender Invitee		
Sl. No.	Name of work	Approximate value of work (Rs.in Crore including GST)	Bid security (Rs.in lakh)
1	Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion – 12 months)	22.00	16.50
Chief Engineer, TWAD Board, Madurai			

Sd/-P.Ramachandran(19.05.2020)
Chief Engineer(a/c),
TWAD Board, Madurai

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Sd/-CHIEF ENGINEER, TWAD, MDU

II. LETTER OF APPLICATION

(Letter head paper of the Applicant, including full postal address, telephone no., fax no., cable address, and E.mail)

Dated

To

**The Chief Engineer, TWAD Board,
No.1/1, Sambakulam,
Opp. to Mattu thavani Bus stand,
Madurai –625 007.**

Sir,

Being duly authorized to represent and set on behalf of

(Hereinafter "the Applicant"),

and having reviewed and fully understood all the information provided, the undersigned hereby apply for consideration as a bidder for the following

Invitation For Bid NO. F.Kuzhithurai WSIS /SDO II/ CW /2020 /Dt.19.05.2020

(Sixth Call)

Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion 12 months)

Attached to this letter please find copies of original documents defining

- the Applicant's legal status
- the principal place of business and
- the place of incorporation (for applicants who are corporation) or the place of registration and the nationality of the owners (for applicants who are partnerships or individually owned firms)

Your Agency and its authorized representatives are hereby authorized to conduct any inquiries or investigations to verify the statements, documents and information submitted in connection with this application, and to seek clarification from the bankers and clients regarding any financial and technical aspects. This 'Letter of Application' will also serve as authorization to any individual or authorized representative of any institution referred to in the supporting information, to provide such information deemed necessary and requested by yourselves to verify the statements and information provided in this application, or with regard to the resources, experience and competence of the Applicant. This application is made in the full understanding that bids by the applicants will be subject to verification of all information submitted for consideration, at the time of bidding.

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Your Agency reserves the right to

- amend the scope and value of any contract bid under this project
- and reject or accept any application, to cancel the entire bidding Process and reject all the applications and
- your Agency shall not be liable for any such action and shall be under no obligation to inform the Applicants of the grounds for them

It is hereby certified that the unit rates and price for all the items covered in the Bill of Quantities set out in the Price Schedule have been furnished clearly in figures and words and it is hereby agreed to execute the works at the rates and prices mentioned therein and to receive the payments on measured quantities as per the Conditions of the Contract.

It is hereby distinctly and expressly declared and acknowledged that before the submission of the bid, the instructions therein have been carefully followed and the conditions of the Contract and other terms and conditions have been read. It is also declared and acknowledged that careful examination of the bid documents has been carried out with reference to the specifications, quantities, location where the said work is to be done, investigation of the works to be done, materials required for this contract and their source and other requirements, covenants, stipulations and restrictions. It is distinctly agreed that no claim or demand will be made on the TWAD Board by the applicant, arising out of any misunderstanding or misconception or mistake of the said requirements, covenants, stipulations, restrictions, conditions etc on the part of the Applicant .

The Income Tax Clearance Certificate and GST Registration Certificate in currency are enclosed

The Bid Security of **Rs.16,50,000.00**(Rupees Sixteen lakh and fifty thousand only) is enclosed in the shape of _____
(enter the form and other details of the bid security) drawn in favour of the **Executive Engineer, TWAD Board, Project Division, Nagercoil**. It is hereby agreed that in case the bid is accepted, the Performance Security to the value and in the manner/form prescribed by the Employer will be submitted and agreement entered into within the time frame stipulated for the due fulfillment of the contract. It is agreed that in the event of non remittance of the required Performance Security and execution of the Agreement within the stipulated time frame, the Bid Security deposited with the bid will be forfeited. In the event of non acceptance of the bid offered by the Applicant, the Employer shall intimate the applicant of the rejection of his bid, upon which the applicant can get his Bid Security refunded on an application for the same. Any notice required to be served on the applicant shall be deemed to have been sufficient if delivered personally or left at the address given herein or sent by post either by registered mail or ordinary. Such notice shall, if sent by post shall be deemed to have been served on the applicant at the time when in due course of post it would be delivered at the address to which it is sent. For all purposes, the address given herein will serve as permanent address and any change therein will be promptly intimated then and there.

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It is fully understood and agreed that on receipt of communication of acceptance of the bid from the accepting authority, there emerges a valid contract between the Applicant and TWAD Board represented by the officer accepting the bid and is expressly agreed that the bid documents with the schedules, conditions of the contract, negotiation communications and other correspondence connected to this contract will all constitute the contract for this purpose and be the foundation of rights on both the parties.

It is agreed that time shall be considered as the essence of this contract and the work will be commenced immediately on getting information of the acceptance of the bid and any slow progress will be subjected to the relevant penal clauses contained in the Conditions of the Contract

It is hereby agreed that the professionally qualified personnel to execute and supervise the works shall be deployed as required in clause 10 of General Conditions of Contract.

The Applicant hereby agrees to undertake full responsibility for the stability and soundness of the works executed.

The Applicant hereby agrees that the bid will not be withdrawn during the period of validity as indicated in the bid documents and also during such extended periods agreed to by the applicant. The Applicant agrees that in the event of withdrawal of the bid during the validity period or extended period, the Bid Security is liable to be forfeited by Employer.

It is explicitly understood that the Employer is not bound to accept the lowest or any bid the Board may receive. It is hereby agreed that the Employer reserves the rights to reject any or all the bids without assigning any reasons therefor.

Dated this day of
Month of

Signature of the Applicant
(To be signed by the authorized
signatory with seal)

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III . INSTRUCTIONS TO BIDDERS GENERAL

1. Scope of the Bid

This is a "Procurement, Construction Contract" and the contractor is responsible for the execution of the water supply works including the supply and installation of all materials, machineries, equipment etc in accordance with the specifications stipulated in the Bid Document and in conformity with the Quality Parameters laid down in the relevant BIS, TNBP, Bid Documents etc and completing the entire works in all respects satisfactorily and commissioning within the stipulated period and maintaining the scheme for the specified period

1.1 The Chief Engineer, TWAD Board, Madurai (hereinafter referred as "Employer" in these documents) invites bids for the construction of works (as defined in these documents and referred as "the works") as detailed in the Bill of Quantities. The bidder shall offer their/his price for all the items of works detailed in the Bill of Quantities.

Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion 12 months)

SALIENT DETAILS

1	Source	Surface water from River Kuzhithuraiyar downstream of Nesamony Bridge near Gnaravilai 6.0m dia In take well - 1 No
2	Pump set	Centrifugal non clog Pumpset – 20 HP –3080 LPM X 20m – 2 Nos (100% stand bye)
3	Raw water main	250 mm CI – 75m
4	Treatment works	Capacity :4.83 MLD
a	Aerator	4 Trays (1.6 m ,2.4 m , 3.2 m 4.00 m)
b	Stilling chamber	3m x 2 m x1.70m
c	Raw Measuring channel	10 m x 1.00 m x 0.6 m
d	Flash mixer	1 No. - 1.85 m Dia , 2.6 m Depth
e	Clariflocculator	1 Nos. – 15.00 m Dia.
f	Clarified water channel	15 m x 0.4 m x 0.6 m ,
g	Rapid Sand Filter bed unit.	2 Nos. + 1 No. standby unit- (Single Bed Type 4.0 m x 3.0 m each bed-((Existing) proposed to be upgraded using dual filter media)
h	Clear water Sump	Capacity of sump : 2.00 LL.(Existing)
i	MV Panel Room	9m x 5 m.(Existing)
j	Wash Water Tank	Capacity:1.00 LL.(Existing)

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5	Clear water Pump sets:-			
a	Clear water sump to Kazuvanthittai SR(P) – Submersible pump set		Duty 1437 lpm x 63 M - 2 Nos. -30HP	
b	Clear water sump to Panniyani SR(P) – Submersible pump set		Duty 473 lpm x 56 M - 2 Nos - 10HP	
c	Clear water sump to Pammam SR & Market SR Submersible pump set		Duty 1024 lpm x 85 M - 2 Nos - 25HP	
6	Clear water Main from Water Treatment Plant to Service Reservoirs :			
a	Pumping main I &Branch Mains		200mm DIK9, 150mm DI K9, 100 mm DI K9 - 5825 m	
b	Pumping main II & Branch mains		150mm DI K9, 100mm DI K9 - 1400 m	
c	Pumping main III & Branch mains		200 mm DI K9, 150 mm DI K9, 100 MM DI K9 -2815 m	
7	SERVICE RESERVOIRS			
	zone	LOCATION	CAPACITY IN LAKH LITRES	REMARKS
a	I	Pammam	1.00	Existing
b	II	Panniayani	1.00	Existing
c	III	Marthandam Market-OHT	2.00	Existing
d	IV	Kazhuvanthattai Old	0.90	Existing
e	V	Kazhuvanthattai New	2.50	Existing
f	VI	Kattuvilla	0.90	Existing
g	VII	Tiruthuvapuram-	1.00	Existing
h	VIII	Marthandam Market-GLSR	1.00	Existing
i	IX	Pammam	1.70	Proposed
j	X	Panniyani	1.60	Proposed
k	XI	Kazuvanthattai-	2.50	Proposed

8. DISTRIBUTION SYSTEM :- :

Sl no	Pipe details	Existing	Proposed	Total
1.	200 mm HDPE PN6	-	1685 M	1685 M
2..	160 mm HDPE PN6	-	2396 M	2396 M
3.	140 mm HDPE PN6	-	3813 M	3813 M
4.	110 mm HDPE PN6	-	55418 M	55418 M
	TOTAL	-	63312 M	63312 M

9. HOUSE SERVICE CONNECTIONS :- Proposed - 6755 Nos.**10. PUBLIC FOUNTAINS :-**

Existing - 75 Nos.
Proposed - 20 Nos

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- 1.3 The successful bidder will be expected to complete the works within the period stipulated for completion in the program schedule.
- 1.4 In these bidding documents, the terms bid and tender and their derivatives (bidder/ tenderer, bid/tender, bidding/tendering etc) are synonymous
- 1.5 **Down loading the documents from web site.**
The documents can be down loaded free of cost from the web site www.tenders.tn.gov.in and www.twadboard.tn.gov.in by the tenderer. Tender should, thereafter be submitted duly filled and signed along with all required documents to the tender inviting authority as notified in the IFB subject to the following:
- a) The bidder shall furnish a certificate to the effect that **no correction/ alteration on the bid document as found in the web site** was made by him and he shall abide by all the terms, conditions and specifications contained in the bid document.
 - b) **No cost towards bid document shall be required to be paid by the bidders who are using the forms downloaded from the designated website.**

The bidder shall submit the tender to the tender inviting authority as prescribed in the IFB.

- 1.6 The Bid Document can be purchased from the **Executive Engineer, TWAD Board, Project Division, Nagercoil** by remitting the required cost of Bid Document as stipulated in Invitation for Bid.

2. Method of Bidding

- 2.1 If the bid is made by an individual, the bid documents shall be signed by the individual with his full name and current address.
- 2.2 If the bid is made by a proprietary concern, the bid documents shall be signed by the proprietor with his full names as well as the name of the firm and full address. In the case of an authorized person holding power of attorney signing the bid documents, a certified copy of the registered power of attorney should accompany the bid documents. The signature of the proprietor shall be attested by a notary public and enclosed as a documentary evidence.
- 2.3 If the bid is made by a partnership firm, the bid documents shall be signed by all the partners of the firm along with their full names and current address with specific mention on the registered address of the firm. In the case of a partner holding power of attorney signing the bid documents, a certified copy of the registered power of attorney should accompany the bid. It is also mandatory to furnish a certified copy of the registered partnership deed, current address of the partners, registered address of the firm along with the bid. The signature of all the partners/ power of attorney

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shall be attested by a notary public and enclosed as a documentary evidence.

- 2.4 If the bid is made by a limited company or a limited corporation, it shall be signed by a duly authorized person holding power of attorney for signing the bid documents in which case a certified copy of the registered power of attorney shall accompany the bid. Such limited company or corporation may be required to enclose satisfactory evidence of its existence along with the bid.
- 2.5 The bids from the contractors / firms shall be accompanied by an attested copy of the Income Tax Clearance Certificate relating to the previous financial year and GST Registration Certificate

3. One Bid per Bidder

- 3.1 Each bidder shall submit only one bid for the whole scheme and in the case of packages, only one bid for a package. A bidder who submits or participates in more than one bid (other than sub contractors) will be disqualified.

4. Cost of Bidding

- 4.1 The bidder shall bear all the costs associated with the preparation and submission of his bid. The Employer will in no case be responsible for those costs, regardless of the conduct or the outcome of the bidding process.

5. Site Visit.

- 5.1 The bidder, at the Bidder's own responsibility and risk is advised to visit and examine the site of works and its surroundings and obtain on his own all information that may be necessary for preparing the bid and entering into contract for the construction of the works. The costs of visiting the site and its surroundings shall be at the bidder's expense. Site levels, Soil data made available are only for the information of bidder and the employer is not responsible for their correctness.
- 5.2 The bidder and any of his personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the bidder, his personnel or agents, will release and indemnify the Employer and his personnel or agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs and expenses incurred as a result of the inspection.
- 5.3 Deleted.
- 5.3 The employer will arrange a site visit for the bidders **on 22.05.2020 at 11.00 A.M.** to enable the bidders to have an understanding of the site conditions and to clarify any issues relating to the site conditions in the pre bid meeting.

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B. Eligibility / Qualification Criteria

6. Eligible Bidders

6.1 The Invitation to Bid is open to any bidder meeting the following requirements:

6.2 A bidder shall not be associated nor has been associated in the past, directly or; indirectly, with the Consultant or any other entity that has prepared the design, specifications and other documents for the project.

6.3 A bidder shall not be associated directly or indirectly with the firm engaged by the Board for providing consultancy services for the preparation and supervision of the works and any of its affiliates.

6.4 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer as the Employer shall reasonably request.

6.5 Joint Venture will be accepted.

1) For the works costing more than Rs.1.00 crore and up to Rs.20.00 crore, the lead partner with One Joint Venture (1 + 1) as partner may be permitted.

2)For the works costing more than Rs.20.00 crore, the lead partner with not more than Two Joint Venture (1 + 2) as partners may be permitted.

3)Joint Venture shall be allowed whenever any special nature of works like Sewerage Treatment Plant, Water Treatment Plant etc., which need specialised agencies form a substantial portion of the main work.

4) Joint Venture may be permitted for value not less than 25% of value of work put to tender and for a value less than 25% sub contracting may be permitted.

5) The Joint Venture partner should separately satisfy the physical and financial qualification criteria for their participation in the proposed Joint Venture.

6.5.1 The bid shall include all the information listed in the Bid Document clause 7 Qualification of the Bidder, 7.1 ,General 7.1.2 to 7.1.14.

6.5.2 The bid and, in case of a successful bid, the agreement, shall be signed so as to be legally binding on all the partners.

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- 6.5.3 One of the partners shall be nominated as the lead partner, and his authorization shall be evidenced by submitting a power of attorney signed by the legally authorized signatories of all the partners.
- 6.5.4 A copy of the Joint Venture Agreement shall be submitted along with the bid. The Joint Venture Agreement entered in to between the Joint Venture Partners should be registered and submitted within 28 days from the date of Letter of Acceptance (LoA) or before concluding agreement whichever is earlier.
- 6.5.5 **Physical Qualification criteria**
Joint Venture Partner's experience for a particular work to be given to a Partner / Partners shall be taken in to account for arriving at the eligibility of the contractor / firm.
- 6.5.6 **Financial Qualification criteria**
In respect of Annual Turnover as per clause 7.2.1,7.2.2, the lead partner should meet not less than 50% of the qualifying criteria and other partner/partners should meet individually not less than 25% of the qualifying criteria and all the partners should collectively meet 100% of the qualifying criteria.
- 6.5.7 In respect of qualification criteria under clause 7.2.4, the bidder on his own or any one of the partner/partners of the Joint Venture should have completed successfully the works specified, as stipulated in the bid document for which necessary documentary evidence should be produced to the satisfaction of the TWAD Board.
- 6.5.8 The lead Partner shall be authorized to incur liabilities and receive instructions for and on behalf of any and all Partner/Partners of the joint venture and the entire execution of the contract, including payment, shall be done exclusively with the lead Partner. The Employer will have correspondences only with the lead partner.
- 6.5.9 All the partners of the joint venture shall be liable jointly and severally for the execution of the contract in accordance with the contract terms, and statement to this effect shall be included in the authorization mentioned under 6.5.8 above, and registered authentication in the Agreement (in case of a successful bid).

7. Qualification of the Bidder

7.1 General

- 7.1.1 Bidders shall provide the following as part of their bid in the prescribed formats.
- 7.1.2 A registered Power of Attorney authorizing the signatory of the bid to commit on behalf of the bidder should be enclosed.

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- 7.1.3 Proof of Registration of the firm/company under Companies Act should be enclosed.
- 7.1.4 Total monetary value of civil engineering works performed during each of the last three financial years should be furnished in Annexure-I.
- 7.1.5 Annual turnover for the past three financial years (Audited balance sheet for the last three financial years) should be enclosed. Annual turnover for the past three financial years should be certified by a registered Chartered Accountant. The certificate should be affixed with the seal of the office of the Chartered Accountant with the registration number legibly in Annexure-II.
- 7.1.6 Experience in works of similar nature and magnitude during each of the previous FIVE financial years, the details of works on hand and works for which bids are already submitted should be furnished in the Annexures-III, IV and V respectively.
- 7.1.7 List of equipments available with the bidder for deployment in the project should be furnished in Annexure-VI.
- 7.1.8 Technical, administrative and managerial personnel proposed to be employed for key site management in this work with their qualification details should be furnished in Annexure VII.
- 7.1.9 Evidence of access to lines of credit and availability of other financial resources, credit line certificates from financial institutions should be enclosed in the prescribed Annexure-VIII.
- 7.1.10 Litigation details of the bidder with the details of the parties concerned and the amount involved should be furnished in Annexure-IX.
- 7.1.11 The bidder should declare clearly whether the bidder has been black listed, banned or debarred in Central Government Department/Under-taking/Organization or any State/Union Territory/Department Undertaking/ Organization in Annexure-X.
- 7.1.12 Proposals to Sub-contract components of the works with experience details of the Sub-contractor in similar nature of works proposed to be sublet should be furnished in Annexure-XI.

The Sub-contractors shall have experience of successfully completing and commissioning of at least two works of similar nature and magnitude to the work to be sublet during the last 5 years.

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The Sub-contractors shall not further Sub-contract any portion of their work, Sub-contracted to them by the Contractor.

The value of sub contracted work under any such sub contract shall not exceed 15% of the contract value and total sub contracted work shall not exceed 60% of the contract value. The contractor shall notify the Executive Engineer concerned in writing for objections, if any, about the sub-contractor that he proposes to appoint if the value of a sub contract work exceeds 10% of the contract value. If nothing is heard from the Executive Engineer within 15 days of the receipt of the Contractor's notice, then the contractor may proceed with the appointment of the sub-contractor concerned. If any objections are received about the appointment of the sub contractor from the Exe. Engineer concerned, the contractor shall give due weightage to such objections and either change the sub contractor, or refer the matter to the Chief Engineer concerned for his decision, which shall be final.

7.1.13 Income Tax Clearance Certificate in currency as proof of having remitted the income tax for the previous financial year (with reference to the year in which the bid is opened)

7.1.14 GST Registration Certificate, a valid certificate issued by the competent authority to this effect.

Conditions to be satisfied:

7.2 Performance Eligibility:

a) Financial & Physical capacity:

Sl. No	Description	Requirement as per Bid document		
		Lead Partner	Joint Venture	Total
	Financial Turnover & Cash flow.	Rs. in Crore		
1.	Annual Turnover in any one of the last three financial years Rs. in crores (2016-17, 2017-18 & 2018-2019) – 75% of BOQ value			16.50
2	Minimum Annual Turnover in last three financial year Rs. in crores (2016-17, 2017-18 & 2018-2019) – 33% of BOQ value			7.26
3	Minimum cash flow required in Rs. in crores = $\frac{3 \text{ months} \times \text{BOQ Value}}{\text{Period of completion}}$			5.50

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4	The bidder should have satisfactorily completed Water supply scheme of value not less than Rs. ----- Crores during the last five years			
	i) If single agreement 40 % of BOQ value			8.80
	(OR)			
	ii) If Two agreements 60 % of BOQ value			13.20
5	Physical (Work Experience) Minimum aggregate during last five years			
5 a	Minimum aggregate number of construction of off take well / Collection well/ Infiltration well/ Jack well/ Intake well should have completed (50% of total requirement of 1 No)	1 No.		1 No
5 b	Minimum aggregate experience of Full Scale Water Treatment Plant (25 % of total requirement of 4.83 mld)		1.21 MLD	1.21 MLD
5 c	Minimum aggregate experience of pipeline in km i. DI/CI pipe should have supplied , laid, jointed , tested and satisfactorily completed (30% of total requirement of 10.115 KM) ii. PVC /HDPE pipe should have supplied , laid, jointed , tested and satisfactorily completed (30% of total requirement of 63.312 KM)	3.04 KM 19.00 KM		3.04 KM 19.00 KM
5.d	Minimum aggregate experience of RCC water retaining structure (LL) completed and tested for water tightness 40% of total requirement of 5.80 LL)	2.32 LL		2.32 LL
5.e	Minimum Aggregate capacity of pumping machinery installed (KW), erected, tested and satisfactorily completed in last five years (50% of total requirement of 125 KW)	62.50 KW		62.50 KW

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6	Bid Capacity Assessed Available Bid capacity = $(A*N*1.5 - B)$			Should be more than Rs.22.00 Crore
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Note : in Addition to the above requirements the following criteria also to be satisfied.

b) Bid capacity:

- Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under:

$$\text{Assessed Available Bid Capacity} = [A*N*1.5-B]$$

Where A = Maximum value of civil engineering works executed in any one year during the last three financial years [updated to 2019-20 price level @ 6% per annum] taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited i.e. 1 year.

B = Value of existing commitments and on-going works to be completed during the next 1 years. [Updated to 2019-20 price level]

7.3 In order to prove that the Goods offered are of acceptable quality and standard, the bidders shall furnish documentary evidence that the Goods offered have been in production and similar capacity have been sold, as indicated in the table below. **Further documentary evidence to establishment the manufacturers credential including the certificate from the manufacturing company's Auditor is requested to be submitted along with the bid.**

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Table:

Item	Goods	Manufacturer's Experience Criteria	
		Minimum No. of years preceding the due date of tender the goods offered are in production	Minimum average units sold <u>per year</u>
1	Pumps, Electrical & Mechanical equipments		
1.1	Pumps		
	Submersible pump	5	50 Units *
2	Valves Above 200 mm size	5	200 Units **
3 3.1	Pipes PVC pipes		200 % of total length required (.....KM)

* Pumpset: Pumpset with ISI Specifications of reputed brands, such as Jyothi, Kirloskar, Best & Crompton, Mather and Platt, Worthington, KSB, Calama, Waterman, Atlanda, Flow more, Fair more Fair banks, Morese or equivalent.

** Valves: Valves with ISI Specifications of reputed brands, such as Kirloskar, Venus, Upadyaya, CALSONS, Endress and Hauser / Siemens / ABB / Krohne - Marshall or equivalent

Unless otherwise stated in the Contract, the Accepted Contract Amount covers the entire Contractor's works under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper design, installation, test, commission and trial operation at Section I of the Works and operation and maintenance at Section II of the Works. The Accepted Contract Amount shall cover the completion of both Sections of the Works and the re-modifying of any defects.

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Note:

- i. The performance eligibility shall pertain to the similar works executed by the tenderer in any of the Central/State Government Departments/Quasi Government Organizations and Government Undertakings, a Private Organization. The performance experience for Central/State Government Department/Undertaking/ Quasi Government Organization should be supported by performance certificates issued by the concerned organization by an officer not less than the rank of Executive Engineer. **The experience certificates issued by an officer below the rank of Executive Engineer or on behalf of Executive Engineer will not be considered.**

In case of experience certificate of a Private Organization, the following criteria should be satisfied:

- a) The Photographs of the works undertaken for the Private Organization should be enclosed as a proof.
 - b) The certificate of the work done for the Organization be enclosed by a Senior Official who should be at least of the rank of the General Manager or Equivalent.
 - c) The above certificate should be countersigned by a Government Department Engineer at least of the rank of Assistant Executive Engineer and should also be Notarized.
- ii. For the experience certificates furnished by the bidders which are obtained from the Departments outside the State, clarification will be obtained by the Employer from the concerned Department whenever felt necessary as to whether the details furnished in the certificates are genuine, before finalization of evaluation.
 - iii. The bills / claims should be prepared by the contractor as per Agreement and in accordance with the agreement executed and submitted to the Department
 - iv. Sub contractors' experience for the particular works to be sublet **shall not be taken into account for arriving at the eligibility of the contractor/firm.**
 - v. The tenderer should enter into proper agreement with sub contractor proposed to be sub let and furnish the documentary evidence along with bid.

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Special Condition:

In case if a contractor/firm worked as sub contractor previously, then their experience in those particular components of work will be considered **only if** their sub contract/sublet work **was properly approved by the User Department**. A certified copy to that effect from Engineer in charge (not below the rank of Executive Engineer) must be produced for arriving at the performance eligibility for the particular work to be sublet.

7.4. Disqualification:

Even though the bidders meet the above qualifying criteria, they are subject to be disqualified at any point of time if they have

- i) made misleading or false representation in the form statements and attachments submitted and/or
- ii) Record of poor performance during the last **5** years as on the date of application such as abandoning the work rescinding of contract for which the reasons are attributable to the non performance of the Contractor inordinate delays in completion, consistent history of litigation awarded against the applicant or any of its constituents or financial failure due to bankruptcy etc.
- iii) been debarred/blacklisted as on the date of application by any Central/State Government Department/Undertaking/Organization and their bid will not be taken up for evaluation.

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iv) **SPECIAL ATTENTION TO BIDDERS.**

I. Copies of experience certificates obtained from the Officer not below the Rank of **Executive Engineer** of respective user departments must be attested by Notary Public and produced.

II. These Certificates should contain the following details

- 1) Name of Scheme (Name of the :
State also to be specified)
- 2) Contract No. and date :
- 3) Value of Contract : Rs.
- 4) Name of Contractor with :
full address
- 5) Period of completion as :
specified in the Contract
- 6) Date of commencement of work:
- 7) Actual date of completion/
commissioning :
- 8) Reason for the delay if any :
- 9) Full details of components :
executed under this contract

10) **Performance of the work should contain the following details:-**

<u>Component</u>	<u>Performance</u>
i) In case of I.W / Collection well / : Sump/ collection well Foot bridge/ Off take well	Whether completed and commissioned satisfactorily?
ii) In case of Water treatment plant : (Capacity of WTP must be given)	Whether completed and commissioned satisfactorily?
iii) In case of pipeline work (Type of : each pipe with dia., length, pressure must be given)	Whether completed and commissioned satisfactorily?
iv) In case service reservoirs / Sumps : with capacity of S.Rs/Sump	Whether constructed and commissioned satisfactorily?
iv) In case of pumping machinery : installed (KW)	Whether completed and commissioned satisfactorily?

Signature of Officer with Seal

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C. BID DOCUMENTS

8. Contents of Bid Documents

- 8.1 The Bid Documents will comprise the following documents & addenda issued in accordance with clause 10 below:

Invitation for Bids

Instruction to Bidders

Eligibility/Qualification Criteria

Forms of Bid

Program Scheme and Financial Milestone

Payment Schedule

General Conditions of the Contract

Special Conditions

Technical Specifications

Bill of Quantities

Drawings

Forms of Agreement

Indemnity Bond

9. Clarification of Bid Documents.

- 9.1 A prospective bidder requiring clarification may raise the same at the time of Pre-bid meeting in writing or by cable (hereinafter the term cable is deemed to include telex and facsimile) at the employer's address indicated in the invitation for bid. The employer will respond to any clarification sought for

10. Amendment to Bid Documents

- 10.1 At any time prior to 48 hours to the deadline for submission of bids, the Employer may amend the bid documents by issuing Addenda.
- 10.2 Any Addendum thus issued shall be part of the bid documents and shall be communicated in writing or by cable to all purchasers of the bid documents. Prospective bidders shall promptly acknowledge the receipt of each addendum by cable to the Employer.
- 10.3 To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer shall extend as necessary the deadline for submission of bids, in accordance with Clause 21.2 of "Submission of Bids".

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D. PREPARATION OF BIDS

11. Language of the Bid

- 11.1 The bid, and all correspondences and documents related to the bid exchanged by the bidder and the Employer shall be written in English. Supporting documents and printed literature furnished by the bidder may be in other language provided they are accompanied by an accurate translation of the relevant passages in either English or Tamil language, in which case, for purpose of interpretation of the bid, the translation shall prevail.

12. Documents comprising the Bid

- 12.1 The bid submitted by the bidder shall comprise the following:

Cover – 1 (Technical Bid)

- i. The Bid Documents duly filled and signed
- ii. List of Annexures
- a) Performance of the Bidder showing value of Civil Engineering work for the past three years – (7.1.4) – Annexure-I**
- b) Average Annual Construction Turnover of last three years – (7.1.5) – Annexure-II**
- c) Experience in works of similar nature and Magnitude within a period of 5 years – (7.1.6) – Annexure-III**
- d) Commitment of works on hand – (7.1.6) – Annexure-IV**
- e) Works for which Bids are already submitted – (7.1.6) – Annexure-V**
- f) List of Equipments available with Bidder – (7.1.7) – Annexure-VI**
- g) Qualification/Experience of key personnel proposed for technical and administrative functions under this contract – (7.1.8) – Annexure-VII**
- h) Sample Format for evidence of access to or availability of credit facilities – (7.1.9) – Annexure-VIII**
- i) Details of Litigation – (7.1.10) – Annexure-IX**
- j) Declaration by the bidder – (7.1.11) – Annexure-X**
- k) Details of components proposed to be sublet and sub contractors involved – (7.1.12) – Annexure-XI**

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- l) Technical staff to be employed (Para 10 of General Conditions)
– **Annexure-XII**

iii. List of Certificates.

- a) Signature of the Proprietor or Proprietress attested by the Notary Public (2.2)
 - b) Signature of all the Partners/Power of Attorney attested by the Notary Public – (2.3)
 - c) Registration of the firm, signature of the authorized person attested by the Notary Public – (2.4)
 - d) A copy of the listed Power of Attorney authorizing the signatory of the bidder – (7.1.2)
 - e) Proof of Registration of firm/Company (7.1.3)
 - f) Audited Balance Sheets – (7.1.5)
 - g) Credit line Certificate from Financial institutions – (7.1.9) (Format-VIII)
 - h) Income Tax Clearance Certificate – (7.1.13)
 - i) GST Registration Certificate – (7.1.14)
 - j) Certificate of performance issued by not less than the rank of Executive Engineer of the organization concerned/responsible person of the private organization – (7.3)
- iv. Bid Security
- v. Any other material required to be completed and submitted by the bidders in accordance with these instructions.

Cover – II (Price Bid)

12.2 Priced Bill of Quantity duly signed.

12.3 The Bid should be submitted only in the original documents as issued by the Employer or as downloaded from the website. No alteration or correction should be made under any circumstances in the Bid Documents issued by the Employer.

12.4 Conditional tenders are liable for rejection

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13. Bid Prices

- 13.1 The contract shall be for the whole works as described in sub clause (1.1), based on the priced bill quantities submitted by the bidder.
- 13.2 The bidder shall fill in rates and prices and line item total (both in figures and words) for all items of works described in the Bill of quantities along with total bid price(both in figures and words). Items for which no rate or price is entered by the bidder will not be paid for by the employer when executed and shall be deemed covered by the other rates and prices in the bill of quantities. Corrections, if any, shall be made by crossing out, initialing.
- 13.1 From every payment made to the firm/ contractor, deduction at source towards GST shall be made for civil works contract subject to issue of amendments from time to time.
- 13.2 The rates and prices quoted by the bidder are subject to adjustment during the performance of the contract in accordance with the provisions of Clause 49.

14. Currencies of Bid and Payment

- 14.1 The unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees.

15. Bid Validity

- 15.1 Bids shall remain valid for a period not less than **one hundred and twenty days** from the date of opening of Technical Bid. A bid valid for a shorter period shall be rejected by the Employer as non responsive.
- 15.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request the bidders to extend the period of validity for a specific additional period. The request and the bidders' response shall be made in writing or by cable. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend his bid security for; the period of extension.

16. Bid Security

The bidder shall furnish, as part of his bid, as bid security of **Rs.16.50 Lakh (Rupees sixteen lakh and fifty thousand only)** in the following forms.

- 16.1 The bid security duly pledged in favour of **the Executive Engineer, TWAD Board, Project Division, Nagercoil** in any one of the following forms Demand draft / Deposit call receipt / Fixed deposit receipt/ Bank Guarantee (Prescribed format of the Bank Guarantee (Unconditional) for the bid security issued by a Nationalized Bank/Scheduled Bank located in India/National savings certificate/Post office Savings Bank deposits.

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- Unconditional Bank Guarantee in the prescribed format for the bid security issued by a Nationalized Bank/Scheduled Bank located in India & valid for 45 days after the end of the validity period of the bid

FDR and deposits at call receipts should contain lien certificate issued by the Bank for encashment by department. The FDR furnished by the firm should also bear the signature of the authorized signatory on a revenue stamp at the back of the FDR.

EMD remitted in any form along with tender document should be drawn by the bidder's name only. In case, if EMD drawn in other's name, the tender will not be accepted.

- 16.2 Any bid not accompanied by bid security in stipulated form shall be rejected by the Employer as non responsive
- 16.3 The bid security of the unsuccessful bidders will be returned as promptly as possible, but not later than 30 days either after the expiration of the period of bid validity or after finalizations of the bid whichever is later.
- 16.4 The bid security of the successful bidder will be returned after the bidder has furnished the required performance security and signed the agreement. No interest is payable on Bid security by the Employer.
- 16.5 The bid security shall be forfeited.
 - In the case of bidder withdrawing or modifying his bid during the period of bid validity
 - If the bidder does not accept the corrections of the bid price, pursuant to clause 28 of "Bid Opening and Evaluation"
 - In the case of a successful bidder failing to furnish the performance security in the specified form within the stipulated time.
 - In the case of successful bidder failing to enter into agreement within the stipulated time.
 - In the case of the bidder severing the conditions after intimation of the acceptance of the bid.

17. Compliance to Technical Design and Specifications.

- 17.1 Bidders shall submit their offers that comply with the requirements of the bidding documents including the basic technical design as indicated in the drawing and specifications.

18. Format and Signing of Bid

- 18.1 The bid document submitted to the Employer shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the bidder in accordance with "Instructions to Bidders". All pages of the bid and where entries or corrections have been made shall be initialed by the person signing the bid.

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- 18.2 The bid shall contain no alteration or additions, except those to comply with the instructions issued by the Employer and wherever necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person signing the bid.
- 18.3 The technical and price bids (BOQ) as issued by the Employer should be submitted duly signed at the bottom of each page, failing which the bids will be summarily rejected.

19. Pre Bid Meeting:

- 19.1 The bidder or his authorized representative, who are desirous, may attend the pre bid meeting which will take place at **Office of the Chief Engineer, TWAD Board, 1/1, Sambakulam, Madurai –625 007 on 26.05.2020 at 11.00 A.M.**
- 19.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter than may be raised at that stage.
- 19.3 The bidder is requested, as far as possible, to submit the questions in writing or by cable, to reach the Employer not later than one week before the meeting. It may not be practicable at the meeting to answer questions received late.
- 19.4 Minutes of the meeting, including the text of the questions (without Identifying the source of enquiry) and the responses given together with any responses prepared after the meeting, will be transmitted without delay to all purchasers of the bidding documents. Any modification of the bidding documents listed in clause 23.1 of "Submission of Bids", which may become necessary as a result of the pre bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to clause 10 of the "Bid Document" and not through the minutes of the pre bid meeting. Then will be hosted on www.tenders.tn.gov.in and www.twadboard.tn.gov.in
- 19.5 Attendance at the pre bid meeting is not mandatory and non attendance will not be a cause for disqualification of the bidder.

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E. SUBMISSION OF BIDS

20. Sealing and Marking of Bids

- 20.1 Two cover system shall be adopted for submission of bids.
- 20.2 The first cover shall contain the technical bid documents, supporting material relating to the eligibility criteria, Bid Security in the proper form and other connected Certificates.
- 20.3 No indication direct or indirect, implicit or explicit regarding the rates and prices should be made in the technical bid or any other documents submitted in the first cover.
- 20.4 The second cover shall contain the Price Bid alone.
- 20.5 The bids should be submitted in the original bid documents as issued by the Employer.
- 20.6 The bid documents, under no circumstances, are transferable.
- 20.7 The first cover containing the Technical Bid and Bid Security and the second cover containing the Price Bid, should be pasted properly, sealed and superscribed indicating clearly the name of work and marking specifically as under:

Cover I - Technical Bid

Cover II - Price Bid

Both the covers containing the Technical bid and Price Bid should be placed in a common envelope, pasted, sealed and super scribed properly.

20.8 Format and signing of Tender

- 20.8.1 The Tenderer shall submit one original and one copy (hard) and one draft copy of technical bids comprising of Tender as described in the Instruction to Tenderers, bound in a format as stipulated.
- 20.8.2 All bidders will be provided with an electronic copy of the schedule of prices. Cells that contain permanent information and are not to be changed by the Bidder will be protected.
- 20.8.3 Cells into which the bidder can enter rates and Amount (where these may vary), will be left unprotected. However, the Employer will not enter any formulae in the spread sheets.

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- 20.8.4 The Bidder is entirely responsible to ensure that the calculations presented in the Schedule of Prices are correct, and that the Bidder's offer is complete in all respects. The Price Bid completed in computerized printout, adopting the format of the Bid document in total and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder.
- 20.8.5 **The Tenderer shall submit the Price bid in duplicate one in hard copy and another in soft copy. The BOQ in the excel format is uploaded.** The Bidder will need to submit the completed Schedule of Prices together with the bound copy of the Price Proposal which has been issued by the Employer along with the separate Priced Schedule of Prices, and to affix his signature on all pages of his submittal. The Bidder shall give an undertaking that the content of the CD and the content of hard copies are identical. In the case of discrepancy between the soft copy and hard copy (print out) furnished by the bidder, the hard copy (print out) will prevail. If there is discrepancy between the hard/soft copy furnished by the bidder and the hard copy issued by the Employer, the hard copy issued by the Employer will prevail.
- 20.8.6 The Tender shall contain no alternations, omissions or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Tenderer, in which case such corrections shall be initialed by the person or persons signing the Tender.
- 20.9 All the envelopes shall be addressed to the Employer **"THE CHIEF ENGINEER, TWAD BOARD, MADURAI"** and bear the following identification

Bid for **"Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion 12 months)"**

**INVITATION FOR Bid.NO. F.Kuzhithurai WSIS /SDO II/ CW /2020 /Dt.19.05.2020
(Sixth Call)**

Do Not Open Before	04.06.2020 at 03.30 PM	(Time and date of bid opening as per Clause 24 of "Bid Opening and Evaluation") and should be submitted to the following Address:
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**THE CHIEF ENGINEER, TWAD BOARD, 1/1, Sambakulam,
Madurai –625 007.**

- 20.10 In addition to the Identification required in sub clause above, the envelope shall indicate the name and address of the bidder to enable the bid to be returned in case it is declared late, pursuant to Clause 22 of "Submission of Bids".

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- 20.11 If the envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

21. Deadline for Submission of the Bids

- 21.1 Bids must be received by the Employer at the address specified in clause 20.9 above not later than **3.00 P. M** on **04.06.2020**. In the event of the specified date for the submission of bids declared a holiday for the Employer, the bids will be received upto the appointed time on the next working day.
- 21.2 The Employer may extend the deadline for the submission of bids by issuing amendment in accordance with clause 10 of "Bid Documents" in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

22. Late Bids

- 22.1 All bids received by the Employer after the deadline prescribed in clause 21 of "Submission of Bid" will be returned unopened to the bidder.

23. Modification, Substitution and Withdrawal of Bids

- 23.1 The bidder may modify or substitute his bid after submission, provided that written notice of the modification and substitution is received by the Employer prior to the deadline for submission of bid.
- 23.2 The bidder's modification or substitution notice shall be prepared, sealed, marked and delivered in accordance with provisions of clause 20 and 21 of "Submission of Bid", with the envelope additionally marked '**MODIFICATION**' or '**SUBSTITUTION**' as appropriate.

The modification / substitution for price bid cover should be super scribed as **PRICE 'MODIFICATION' / SUBSTITUTION COVER.**

Where more than one tender is submitted by the same bidder the lowest eligible financial tender shall be consider for evaluation

- 23.3 No tenderer shall be allowed to withdraw the tenders after submission of tender

No bid shall be modified or substituted after the deadline for submission of bids.

- 23.4 Modification or substitution of a bid between the deadline for submission of bids and the expiration of the original period of validity specified in clause 15.1 of "Preparation of Bids" or as amended pursuant to clause 15.2 of "Preparation of Bids" may result in the forfeiture of the Bid Security pursuant to Clause 16 of "Preparation of Bids".

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F. BID OPENING AND EVALUATION

24. Bid Opening

- 24.1 The Employer will open all the bids received (except those received late) including modifications made pursuant to clause 23 of "Submission of Bids", in the presence of the bidders or their representatives who choose to attend on the date at the time in the address specified in clause 20 of "Submission of Bids".(In the event of specified date of bid opening being declared a holiday for the Employer, the bids will be opened at the appointed time and location on the next working day).
- 24.2 Envelopes marked "substitution" and "modification" shall be opened and read out first. Envelopes superscribed as **'MODIFICATION' / SUBSTITUTION to price bid will be opened at the time of opening of the price bid.**
- 24.3 The Bidders' names, the Bid prices, the total amount of each Bid, any discounts, bid modification and (substitution) the presence or absence of Bid Security and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. Bids (and modifications) sent pursuant to clause 22 of "Submission of Bids" that are not opened and read out at the bid opening will not be considered for further evaluation regardless of the circumstances.

25. Process to be Confidential

- 25.1 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 person not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by a bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his bid.

26. Clarification of Bids.

- 26.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at his discretion, ask any Bidder for clarification of his bid, including breakdown of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 28 of "Bid Opening and Evaluation".

27. Examination of Bids and Determination of Responsiveness

- 27.1 Prior to detailed evaluation of Bids, the Employer will determine whether each Bid
- (a) meets the eligibility criteria set out in clause (7) ;
 - (b) has been properly signed,
 - (c) is accompanied by the required securities and
 - (d) is substantially responsive to the requirements of the Bid Documents,
- 27.2 A substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Bid 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 Bid Documents, the Employer's rights to the Bidder's obligations under the contract, or (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive Bids.
- 27.3 If a Bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non conforming deviation or reservation. The decision of the Employer on the issue whether the Bid is responsive or not" will be final and binding on the bidders. The Employer is not bound to disclose the reason in case a bid is determined by him as non responsive.

28. Correction of Errors

- 28.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic error. Errors will be corrected by the Employer as follows:
- If any variation in the rates in words and figures , the lesser of the two will only be taken into consideration.
 - Where there is a discrepancy between the unit rate and line item total resulting from multiplying the unit rate by the quantity , the unit rate as quoted will govern.
 - Where there is an arithmetical discrepancy in the page total as well as grand total, the corrected total by the Employer will govern
- 28.2 The amount stated in the Bid will be adjusted by the Employer 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 of the Bid, his bid will be rejected and his bid security may be forfeited in accordance with Clause 16.5 of "Preparation of Bids".

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29. Evaluation and Comparison of Bids

- 29.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause 27 of "Bid Opening and Evaluation".
- 29.2 In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid price as follows:
- making any correction for errors pursuant to Clause 28 of "Bid Opening and Evaluation". or
 - making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Clause 23 of "Submission of Bids"
- 29.3 The Employer reserves the right to accept or reject any variation/deviation.
- 29.4 If the Bid of a successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract, the Employer 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 analysis, the Employer may require that the amount of the Performance Security set forth in Clause 34 of; "Award of Contract" be increased at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

G. AWARD OF CONTRACT

30. Award Criteria.

- 30.1 Subject to Clause 29 of "Bid Opening and Evaluation", the Employer will award the contract to the Bidder, whose Bid has been determined to be substantially responsive to the Bid Documents and who has offered the lowest evaluated Bid Price, provided that such Bidder has been determined to be (a) eligible in accordance with the provision of clause 6 of "Eligibility/Qualification Criteria" and (b) qualified in accordance with the provisions of Clause 7 of "Eligibility / Qualification Criteria".

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

- 31.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected bidder or bidders of the grounds for the Employer's action.

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32. Notification of Award

- 32.1 The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance"), will state the sum that the Employer will pay to the contractor in consideration of the execution, completion and maintenance of the works by the Contractor as prescribed by the Contract (hereinafter and in the conditions of Contract called the "Contract Price").
- 32.2 The notification of award will constitute the formation of the Contract.

33. Registration in TWAD

- 33.1 The successful contractor/firm, if not a registered contractor in Tamil Nadu Water Supply and Drainage Board, he / they shall get himself / themselves registered in TWAD Board.

34. Performance Security

- 34.1 A) Within 28 days from the date of the Letter of Acceptance, the successful bidder shall deliver to the Employer a Performance Security

- i in the form of National Savings Certificate/Post Office Savings Deposit account purchased within the State of Tamil Nadu and pledged in favour of the Executive Engineer, TWAD Board, **Project Division, Nagercoil.**

(OR)

- II. Unconditional and irrevocable bank guarantee issued by any one of the branches of Nationalized Bank or scheduled Bank within the State of Tamilnadu, provided they are in prescribed format (enclosed in this Document) in favour of the Executive Engineer, TWAD Board, **Project Division, Nagercoil** for an amount

- For tenders with any plus Percentage and up to minus 5 percentage of department value – 2 % of contract value
- For tenders with minus 5 Percentage and up to minus 15 percentage of department value – 4 % of contract value
- For tenders with more than minus 15 Percentage of department value – 5 % of contract value.

- 34.2 The bidder along with the performance security, shall deliver a non judicial stamp paper for Rs.100/- (Rupees One Hundred only) at his cost for executing the agreement.

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35. Signing of Agreement

- 35.1 The Employer on receipt of the performance security and non judicial stamp paper, will furnish to the bidder the Agreement in the form prescribed, incorporating all terms and conditions between the Employer and the successful bidder.
- 35.2 The Bidder should remit the performance security prescribed by the Employer in the form as in Clause 34 above and sign the agreement in the presence of the Employer within 28 days from the date of Letter of Acceptance notifying the award of contract.
- 35.3 Upon furnishing the performance security by the successful bidder, the Employer will promptly notify the other bidders that their bids have been unsuccessful.
- 35.4 Failure of the successful bidder to comply with the requirements of Clause 34 & 35 and 35.2 of "Award of Contract" shall constitute a breach of contract, cause for annulment of the award, forfeiture of the bid security and any such other remedy the Employer may take under the contract

Amendment to Agreement:

- 35.5 Any amendment shall be issued by mutual consent between the Employer and the contractor only with out any contrary to the bid conditions.

36. Forfeiture of Performance Security

- 36.1 The performance security is liable to be forfeited in cases where the firm/contractor fails to carry out the work in accordance with the specifications, terms and conditions of the contract leading to termination of the contract.

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IV. PROGRAM SCHEDULE

37. Project completion and Financial Milestone

- 37.1 The twenty eighth day from the date of issue of work order shall be reckoned as the start date of the contract period.
- 37.2 Entire project must be completed in all respects within **Twelve** months for construction work and **six** months for trial run, successful commissioning & proof of guarantee performance.

The mile stone for each component would be as under.

Sl. No.	Description	% of achievement	Cumulative % of achievement
1.	Up to 3 Months	10	10
2.	Up to 6 Months	25	35
3.	Up to 9 Months	30	65
4.	Up to 12 Months	35	100

38. Program Schedule / Rate of Progress / Milestone

- 38.1 The Contractor, within seven days from the date of signing of the agreement shall submit to the Engineer for approval **an Activity Chart showing the general methods, arrangements, order, and timing for all the activities in the Works .**
- 38.2 An update of the Activity Chart shall be a Program showing the actual progress achieved on each activity and the progress to be achieved on the remaining work including any changes to the sequence of activities. The Contractor shall submit to the Engineer in charge, for approval, an updated Activity Chart. The Employer reserves the right to approve or reject the updated Activity Chart without prejudice to levying of liquidated damages for slow progress.

39. Penalty for Defective Construction

If any defect is noticed by the Employer in the construction of any portion of work/component, the Employer shall levy penalty upto 10% of the total value of the defective work as assessed by the Engineer in charge, in addition to rectification of defective works at his cost.

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40. Liquidated damages

- 40.1 Provided the firm/contractor fails to maintain the required rate of progress/mile stones liquidated damages will be invoked at the rate of 0.05% per week for the unfinished work. The firm/ contractor achieve the next mile stone within the stipulated period cumulatively (i.e., including the first mile stone) the levied Liquidated Damages will be revoked. The amount recoverable towards liquidated damages shall not be more than 10% of the total value of contract value. The imposition of the liquidated damages clause will be without prejudice to the rights of the Employer to terminate the contract as time barred.
- 40.2 For imposing liquidated damages, detailed show cause notice shall be served on the defaulting firm/contractor either by RPAD or through personal service. The first notice shall be served allowing 15 days time to the firm/contractor for furnishing the reply by them. In case of non receipt of reply on expiry of 15 days time from the date of first notice, the second notice shall be served allowing 7 days of time to the firm/contractor for furnishing the reply by them. Again in case of non receipt of reply on expiry of 7 days time from the date of second notice, the third notice shall be served allowing 3 days of time to the firm/contractor for furnishing the reply by them. On receipt of the reply, it shall be verified by the Engineer in charge and liquidated damages clause shall be invoked by issuing an explicit speaking order to the firm/ contractor, Similarly, the non receipt of any reply from the firm/ contractor shall attract imposing the liquidated damages clause automatically and in this case also, the liquidated damages shall be imposed by issuing an explicit speaking order to the firm/contractor.

41. Foreclosure of Works

The Employer shall have the right to issue notice to the firm/contractor, for any reason whatsoever does not require the whole or part of the works to be carried out after the award of the contract. The contractor shall not have any claim towards compensation or whatsoever, on account of any profit or advantage, which he might have derived from the execution of such works. For the works executed which could not be utilized in view of the foreclosure, the firm/contractor shall be paid a eligible amount as certified by the Engineer in charge.

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V. PAYMENTS AND RECOVERIES

42. Payment Schedule

Payment shall be made in stages for each component as envisaged under:
CIVIL WORKS:

Payment may be released up to
 95% of the measured and check measured quantity
 2.5% on commissioning of the scheme and
 2.5% on commissioning of the entire scheme against unconditional
 irrevocable Bank Guarantee for a period of 2 years

1. PUMPING MAIN, BOOSTER MAIN FEEDER MAIN, GRAVITY MAIN AND D'SYSTEM

For Pipes & allied works

After supply at site	-	75 %
After laying, jointing and testing of pipe	-	85 %
After satisfactory completion of trial run and commissioning of the entire length of main	-	95 %
After commissioning of the entire scheme against unconditional irrevocable Bank Guarantee for a period of 2 years for the 5 % of the amount	-	100 %

2. Mechanical items in Pumping plant & treatment Plant

After receipt of materials at site	-	75 %
After erection	-	90 %
After commissioning	-	95 %
After commissioning of the entire scheme against unconditional irrevocable Bank Guarantee for a period of 2 years for the 5 % of the amount	-	100 %

3. For Higher capacity pumpsets (above 25 HP)

After receipt of materials at site	-	75 %
After erection, commissioning & Post installation, inspection by third Party agency	-	95 %
After commissioning of the entire scheme against unconditional irrevocable Bank Guarantee for a period of 2 years for the 5 % of the amount	-	100 %

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Note:

- The percentage of payment mentioned above is with reference to the total value of each component as per the agreement entered into by the firm/contractor except pumping main and distribution system.
- The payment shall be made for each component as per the actual measurement up to the percentages mentioned above for the stage of progress of each component. In the case of actual value of works carried out becoming lesser than the percentage limits prescribed for the stages, the payments shall be restricted to the actuals.
The bill will be prepared at the end of every month and payment will be made accordingly.
- 5% of the value of every running bill shall be retained by the Employer as additional performance security.
- Payments shall become eligible only for finished items of works in all respects

42.1 Preparation of bills:

The Contractors will submit their bills every month in the M.Book format for the Quantity only of the relevant running bill duly signed. This will be treated as claim of the Contractor to consider payment every month.

The Contractor shall submit their bills to the Executive Engineer or any of his subordinate officer under his control as directed by the Executive Engineer. The Executive Engineer shall be responsible to scrutinize and make payment to the Contractor within 6 weeks from the date of submission of bills by the Contractor concerned.

43. Release of Performance Security & Retention Amount

- 43.1 In addition to the withheld amount, 40% of the amount of each bill of the contract shall be deducted and will be retained till the date of receipt of certificate of water tightness from the Executive Engineer, TWAD Board. The whole of the above sum of together with any recovery from the payments already made to the contractor as may be assessed by the Executive Engineer shall be forfeited to the TWAD Board if the RCC reservoir develops structural defects or leaks. The above recovery shall be exclusive of the amount deposited towards security deposit. The fact of carrying out water tightness test should be recorded in the M. Book. The last part bill should be passed only after above certificate is issued. However, the contractor shall be permitted to execute an indemnity bond in lieu of the recovery of 40% in each bill in prescribed form in non judicial stamp paper for a value of Rs.100.00 towards water tightness and structural stability of the reservoir/water retaining structure. The period of guarantee required by

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the contract shall be two years from the date of completion and commissioning (with filling of water up to maximum water level in the case of service reservoir/overhead tanks/water retaining structure). If defects are noticed within the stipulated period of 24 months of satisfactory performance, the defects should be rectified by the contractor at his own cost and the performance period again shall be reckoned from the date of completion of the rectification of defects by the contractor. In the case of service reservoir/overhead tanks and other water retaining structures during this period, structure under full working head of water should show no sign of leakage. The test for water tightness should be arranged to be carried out and completed within 30 days from the date of intimation by the Engineer in charge. The testing of the service reservoir/over head tank and other water retaining structures should be done by the contractor at his own cost inclusive of all necessary equipment, water etc., complete. The test for water tightness of the structure as well as materials of construction used shall be conducted in conformity with the standard specifications as per I.S. 3370 (Part-I) – 1965 as amended from time to time and the other specifications as mentioned in the Bid Document.

- 43.2 The security deposit less any amount due to the Board and 2 ½ % out of the total 5% of the retention amount made in every running bill shall be released in final bill which shall be prepared after the works are completed in all respects and completion of the maintenance period.
- 43.3 In respect of building works, RCC reservoir and other works where water tightness and soundness are to be watched for more than 6 months notwithstanding above clause, the balance 2 ½ % out of the total 5% retention amount from final bill in respect of contract for original construction or original building works, construction of RCC reservoir work etc., will be retained by Engineer in charge and paid to then contractor after a period of 24 months of satisfactory performance of entire civil works including maintenance period and on production of irrevocable Bank Guarantee in a prescribed form for the above amount for a further period of 3 years beyond the above said 2 years to ensure structural stability.
- 43.4 The whole of the above, it is the duty of the contractor to check the verticality of water retaining / storage structures with the use of survey instruments by the contractor at his cost as a forming part of the works.

44. Recovery of money payable to the TWAD Board

- 44.1 All losses, costs, damages and expenses and other money payable to the Board by the contractor under any stipulation in the contract, may be retained out of any money due or which may subsequently become due from the Board to the contractor under any contract or otherwise whatsoever and in case such money then due or to become due to the contractor by the Board shall be insufficient to pay such losses, costs,

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damages, and other money payable to the TWAD Board by the contractor, it shall be lawful for the Engineer in charge without any further consent on the part of the contractor to sell or dispose of any securities deposited in the Board by the contractor as aforesaid and with and out of the proceeds of such sale, after payment of all expenses connected therewith or reimburse and pay to the Board all such losses, cost, damages and expenses and other money payable to the contractor. And in case such proceeds of sale of the said securities shall be insufficient for such purpose then and in that case it shall be lawful for the Board to recover the residue thereof, if necessary by legal proceedings and or by resorting to revenue recovery act against the contractor.

45. Income Tax

- 45.1 During the course of the contract period, deduction of income tax shall be made at the prevailing rates from every payment as may be specified by the Income Tax Department.

46. GST

GST is applicable as per GO. 296, Finance(salaries) Dept. Dt. 09.10.2017, GOI, Ministry of finance – central tax (Rate) New Delhi, notification No. 12/2017/ Dt. 28.06.2017 and 20.10.2017 and as amended from time to time.

From every payment made to the firm/ contractor, deduction at source towards GST shall be made for civil works contract as per Government of India, Ministry of Finance/ Department of Revenue, New Delhi Notification No. 20 / 2017 – Central Tax (Rate) / Dt.22.08.2017 subject to issue of amendments from time to time

47. EXCISE DUTY

Deleted

48. FUND CONTRIBUTION FOR MANUAL WORKERS

Towards contribution of fund for the benefit of manual workers employed in the construction works an amount equivalent to one percent of total estimated cost of the construction work proposed will be paid by the Employer direct to the respective welfare Board, as per G.O. Ms. No. 295/ Labour and Employment (I2) Department/ Dated: 17.12.2013, subject to issue of amendments from time to time by the respective department of Government of Tamil Nadu.

(Lump sum provision for this contribution may be appropriately made in the Estimates sanctioned for the schemes and the amount would be remitted at the end of the financial year to the labour welfare Board, as per G.O Ms. No.283, MAWS Dept., Dated:11.11.2010)

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49 Price Adjustment

49.1 The conditions for price adjustment shall be in accordance with G.O Ms. No. 101/ Public works (G2) department/ dated: 10.06.2009, G.O Ms. No. 227/ MA&WS (MA3) Department/ Dated: 23.11.2009 & B.P. Ms. No. 93/ COM wing/ Dated: 12.08.2009. The amounts payable to the Contractor shall be adjusted for rises or falls in the cost of specified materials and all labour, by the addition or deduction of the amounts determined by the formulae prescribed in this Clause. To the extent that full compensation for any rise or fall in costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

- i. Full price adjustment on all components including cement, steel, bitumen and petroleum, oil and lubricants (POL) shall be applicable to the works with contract period of more than 12 months.
- ii. In respect of contracts of 12 months and below, price adjustment shall be applicable in respect of cement, steel, bitumen and petroleum, oil & lubricants (POL) only.
- iii. Price adjustment clause will be applicable for all works, where value of work put to tender costing Rs.100 lakhs and above. However No price adjustment will be applicable for maintenance and Repair works.
- iv. Price adjustment will apply only when the rates exceed or decrease by 3% or more as compared to the estimated rates (RBI Index Price)
- v. The Price adjustment shall be calculated only on the departmental estimated cost of the work. (For minus tender, the value of work done will be adopted)
- vi. All the works for which price escalation/ variation is contemplated must have milestones fixed in physical terms and have a prefixed time line for use of inputs-clearly indicating the nature and quantum of eligible inputs to be used for the work for the relevant period between two mile stones. Price variation/ escalation will be applicable for those quantities 'actually' used by the contractor including additional quantities, if any, used or achieved ahead of the time line. However, if the contractor does a certain quantity of the work in the third quarter which ought to have been done in earlier quarter, price variation/ escalation will still be applicable on the quantity at the rates applicable in the relevant quarter as per time line or period of actual use, whichever is less.
- vii. Liquidated damages will be imposed on the contractor for the lapses/ shortfall in achieving the rate of progress as per existing schedule.

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- viii. The price adjustment mechanism will cease to operate for value of work executed beyond the agreement period. But agreement period shall include the 'actual period', for which the work was 'suspended officially' and extension of time permitted for any valid reasons such as war, natural calamities, like-flood, earth quake and other risks arising out of acts of God during the agreement period; work delayed due to the land acquisition process; change in design, change in scope of work, etc., which is given in writing by the Tender Calling Officer of the respective work.
- ix. Price adjustments will be calculated once in a quarter as per the specified formula from the last date of submission of bid up to the end of agreement period provided, if the agreement is signed within the minimum specified time, failing which, the price variation will be applicable from the date of agreement only, based on the whole sale price indexes of RBI. The quarter would be reckoned with reference to the quarter of the calendar year in which the last date on bid submission is fixed. In case of delayed agreement, the quarter in which the Agreement is signed will be reckoned for the purpose of calculation of Price Adjustments.

49.2 Formulae for price adjustment

The price adjustment shall be calculated based on the departmental estimated cost of the work (For minus tender, the value of work done will be adopted), which is abbreviated as - "R" in the formula(The Provision of the G.O Ms.No.227/ MA&WS (MA3) Department/ Dated: 23.11.2009 will be followed.

(i) Adjustment for cement

Price adjustment for increase or decrease in the cost of cement procured by the Contractor shall be paid in accordance with the following formula.

$$V_c = 0.85 \times P_c / 100 \times R (C_1 - C_0) / C_0$$

V_c = Increase or decrease in the cost of work during the period under consideration due to changes in the rates for cement.

C_0 = The All India Average whole sale price index for cement (grey cement) for the quarter of the calendar year in which the last date of submission of bids / signing of the agreement (as the case may be) as published by RBI/ Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

C_1 = The All India Average whole sale price index for cement (grey cement) for the quarter under consideration to which a particular Interim Payment Certificate is related as published by RBI/Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi.

P_c = Percentage of Cement component of the item, stipulated in the Table 49.2.

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(ii) Adjustment for steel reinforcement/structural steel

Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula.

$$Vs = 0.85 \times Psr / 100 \times R (S_1 - S_0) / S_0$$

V_s = Increase or decrease in the cost of work during the period under consideration due to changes in the rates for steel.

S_0 = The All India Average whole sale price index for MS bars and rounds for steel reinforcement (Rebars) as applicable for the items for the quarter of the calendar year in which the last date of submission of bids / signing of the agreement (as the case may be) as published by RBI / Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

S_1 = The All India Average whole sale price indices for MS bars and rounds for steel reinforcement (Rebars) for the quarter under consideration to which a particular Interim Payment Certificate is related as published by RBI/Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi.

P_{sr} = Percentage of component of steel reinforcement or structural steel in the item, stipulated in the Table 49.2 .

The following percentages will govern the price adjustment for the entire contract

Table 49.2 : Percentages of various components in the work.

Sl. No.,	Component	Percentage
i.	Cement - P_c	6.56 %
ii.	Steel - P_{sr}	2.64 %

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50. Mobilization Advance :

Mobilization advance up to 10% of the agreed construction contract value with interest at the rate notified by the Govt. against irrevocable bank guarantee for Mobilization Advance. The Contractor shall ensure that the Bank Guarantee is valid and enforceable until the Mobilization advance payment has been repaid, but its amount may be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. The Mobilization Advance payment shall be repaid through percentage deductions in Payment Certificates:

- (a) deductions shall commence in the next Payment Certificate in which the total of all certified interim payments (excluding the advance payment and the payment of retention money) exceeds thirty percent (30%) of the Contract value (Construction Period at Section I of the Works) less Provisional Sums; and
- (b) deductions shall be made at the amortization rate of 20% of the amount of each Payment Certificate (excluding advance payment and the payment of retention money) in the currencies and proportions of the advance payment, until the Contractor received 80% of their Contract amount or completion of Agreement period whichever is earlier and by then the advance payment should be due and have been repaid.

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VI. LIST OF ANNEXURES

Sl. No.	Description	Para No.
I.	Performance of the bidder showing value of Civil Engineering work for the past three years	7.1.4
II.	Average Annual Construction Turnover	7.1.5
III.	Experience in works of similar nature and Magnitude within a period of 5 years	7.1.6
IV.	Commitment of works on hand	7.1.6
V.	Works for which Bid already submitted	7.1.6
VI.	List of Equipments available with Bidder	7.1.7
VII.	Qualification/Experience of key personnel proposed for technical and administrative functions under this contract	7.1.8
VIII.	Sample Format for evidence of access to or availability of credit facilities	7.1.9
IX.	Details of Litigation	7.1.10
X.	Declaration by the bidder	7.1.11
XI.	Details of components proposed to be sublet and sub contractors involved	7.1.12
XII.	Technical staff to be employed	Para 10 of General Conditions

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VI. LIST OF CERTIFICATES

Sl. No.	Description of Certificate	Para No.
1	Signature of the proprietor or proprietress attested by the Notary Public	2.2
2	Signature of all the partners/power of attorney attested by the Notary Public	2.3
3	Registration of the firm, signature of the authorized person attested by the Notary Public	2.4
4	A copy of the listed power of attorney authorizing the signatory of the bidder	7.1.2
5	Proof of registration of firm/Company	7.1.3
6	Audited Balance Sheets	7.1.5
7	Credit line Certificate from Financial institutions	7.1.9 Format-III
8	Income Tax Clearance Certificate	7.1.13
9	GST Registration Certificate	7.1.14
10	Certificate of performance issued by not less than the rank of Executive Engineer/Responsible person of the private organization.	

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ANNEXURE I**Performance of the Bidder showing Total Monetary Value of Civil Engineering works in the last Three Financial Years**

Year	Monetary Value of Civil Engineering work (Rs. In lakhs)
2016-2017	
2017-2018	
2018-2019	

Seal of the Firm**Signature of the bidder with date**

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ANNEXURE II**Annual Construction Turnover**

Each Bidder must fill in this form

Annual Turnover Data (Civil Engineering Work) in the Last Three Financial years		
Sl. No.	Year	Amount Currency
1	2016-2017	
2	2017-2018	
3	2018-2019	
Average Annual Construction Turnover		

The information supplied should be the Annual Turnover of the Bidder in terms of the amounts billed to clients for each year for work in progress or completed.

Seal

.....

(Signature of the Bidder)

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ANNEXURE III**Experience in works of similar Nature and Magnitude within a period of 5 years**

Sl. No	Contract No. and Name of the Project	Description of the work	Name of the employer with full address	Value of the Contract (Rs. In lakhs)	Date of Issue of Work Order and stipulated period of completion	Actual date of completion	Reason for the delay, if any in completing the Project

Seal of the firm**Signature of the bidder with date**

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ANNEXURE IV**Commitments of works on hand**

Sl. No	Contract No and Name of the Project	Description of the work	Name of the employer with full address	Value of the contract (Rs. In lakhs)	Date of Issue of work order and stipulated period of completion	Value of works remaining to be completed (Rs. In lakhs)	Anticipated date of completion

Seal of the firm**Signature of the bidder with date**

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Works for which Bids are Already Submitted

[illegible]

Signature of the bidder with date

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Annexure VI

List of Equipment Available with Bidder

Sl. No	Equipment Name	Requirement for the project		Availability Status			Remarks
		Nos	Capacity	Owned/ leased/ To be procured	Nos and capacity	Age/ condition	

Seal of the firm

Signature of the bidder with date

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ANNEXURE VII**Qualification/Experience of key personnel proposed for technical and administrative functions under this contract**

Sl. No	Name of the person	Position for which proposed	Qualification	Total Years of experience	Years of experience in the proposed position	Remarks

Seal of the firm**Signature of the bidder with date**

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ANNEXURE VIII**SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF
CREDIT FACILITIES – CLAUSE 7.1.9****BANK CERTIFICATE**

This is to certify that M/s..... is a
reputed company with a good financial standing.

If the contract for the work, namely..... is awarded
to the above firm, we shall be able to provide overdraft/ credit facilities to the
extent of Rs..... to meet their working capital requirements for executing
the above contract.

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ANNEXURE IX**Details of Litigation, if any.**

Sl. No	Name of the Govt. Dept./Private Organization (Other party)	Cause of the litigation	Amount involved (Rs. In lakhs)	Award for (or) against bidder	Remarks / present stage

Note: Should be attested by the Notary Public**Seal of the firm****Signature of the bidder with date**

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ANNEXURE X**Declaration by the Bidder:**

It is to certify that our firm
.....has not been black listed, banned, debarred in any Central
Government Department or Undertaking/Organization or any State or Union
Territory, Department or Undertaking/Organization.

Seal

.....
.....

(Signature of the Bidder)

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ANNEXURE XI**Details of Components proposed to be sublet and sub-contractors involved**

Sl. No	Name of component proposed to be sublet	Name of the Sub Contractor	Details of experience in similar work	Annual turnover of Sub-Contractor for the last 3 years (Rs. In lakhs)

Seal of the firm**Signature of the bidder with date**

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ANNEXURE XII**Technical Staff to be employed**

I/We shall/Will employ the following technical staff as per the prescribed rules

Sl. No	Name of the technical staff to be employed	Designation	Qualification

Seal of the firm

Signature of the bidder with date

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VII. GENERAL CONDITIONS OF CONTRACT

1. DEFINITIONS

In the Contract (as hereinafter defined) the following words and expressions shall have its meanings hereby assigned to them, except where the context otherwise requires.

“Board” means the Tamil Nadu Water Supply and Drainage Board, a statutory body constituted under the Tamil Nadu Water Supply and Drainage Board Act, 1971 having its office at No.31,Kamarajar Salai, Chepauk, Chennai – 600 005 and any officer authorized to act on its behalf

“Employer” means the Tamil Nadu Water Supply and Drainage Board and shall include the officers duly authorized to act on its behalf

“Contractor” means the person or persons, firm or company whose tender has been accepted by the Employer and includes the authorized representatives, successors, heirs, executors, administrators

“Subcontractor” means any person or persons, firm or company named in the Contract as a Subcontractor for a part of the Works or any person or persons, firm or company to whom a part of the Works has been subcontracted with the consent of the Engineer and includes the authorized representatives, successors, heirs, executors, administrators of such Subcontractors

“Engineer” means the Executive Engineer or any other Engineer appointed from time to time by the Employer to act as Engineer for the purposes of the works brought under this contract

“Engineer in charges” means the Executive Engineer or any other Engineer authorized by him.

“Engineer’s representative” means any Resident Engineer or assistant of the Engineer or any clerk of works appointed from time to time by the Employer or/the Engineer to perform the duties set forth in respect of this Contract.

“Contract” means the Invitation for Bids and amendment made thereof, Letter of Acceptance, the formal Agreement executed between the Employer and the Contractor together with the documents referred to therein, General Conditions of the Contract, Special Conditions, Specifications, Minutes of the pre Bid conference, Design, Drawings, Schedule of Rates and Prices, Bill of quantities, Rate of Progress etc., All these documents taken together shall be deemed to form one contract and shall be complementary to one another.

The quality parameters laid down in relevant BIS, TNBP, Bid Documents etc., are to be followed and it is stipulated to complete the entire works in all respects satisfactorily and commission within the stipulated period and maintain the scheme for the specified period.

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“Contract Price” means the sum stated in the Letter of Acceptance as payable to the contractor for the execution, completion and maintenance of the works, subject to such additions thereto or deductions therefrom as may be provided under this Contract and the remedying of any defects therein in accordance with the provisions of the contract.

“Constructional Plant” means all appliances or things of what so ever nature required in or about the execution, completion or maintenance of the works but does not include materials or other things included to form or forming part of the permanent works.

“Works” shall include both permanent works and temporary works. “Permanent works” means the works of permanent nature to be executed, completed and maintained (including Plant) in accordance with the contract. “Temporary works” means all temporary works of every kind required in or about the execution, completion or maintenance of the works and remedying of the defects therein

“Specification” means the schedules, detailed designs, technical data, performance Characteristics and all such particulars referred to in the bid/contract and any modification thereof or addition thereto as may from time to time be furnished or approved by the Employer.

“Drawings” means the drawings, calculations and technical information referred to in specification and any modification of such drawings approved in writing by the Engineer and such other drawings, calculations and technical information as may from time to time be furnished or approved in writing by the Engineer.

“Site” means the land and other places on, under, in or through which the Permanent works and/or Temporary Works are to be executed and any other lands and places provided by the Employer for working space or any other purpose as may be specifically designated in the Contract as forming part of the site.

Approved means approval in writing including subsequent written confirmation of previous verbal approval

“Test” means such test or tests as are prescribed in the specifications or considered necessary by the Engineer

“ISS” means Indian Standard Specifications

“BIS” means Bureau of Indian Standards

“TNBP” means Tamil Nadu Building Practice

“Day” means a Calendar day from midnight to midnight)

“Week” means seven consecutive days.

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“Month” means from the beginning date of a given date of a calendar month to the end the preceding date of the next calendar month

“Quarter” means a period of three months reckoning from the 1st date of January, April, July and October and counted to the last date of March, June, September and December respectively.

Rupees means Rupees in Indian Currency

“Bill of Quantities” means the priced and completed bill of quantities forming part of the tender

“Tender” means the Contractor’s priced offer to the Employer for the execution, completion and maintenance of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of acceptance

“Letter of Acceptance” means the formal acceptance by the Employer of the Tender

“Contractor Agreement” means the contract agreement referred to in clause(..)

Appendix to Tender” means the appendix comprised in the form of Tender annexed in these conditions.

“Commencement Date” means the date of signing the agreement or the date of handing over the site to the successful firm/contractor, however twenty-eight day from the date of issue of work order shall be reckoned as the start date of the project.

“Time of Completion” means the time for completing the execution of and passing the Tests on Completion of the Works of any section or part thereof as stated in the Contract (or as extended under Clause...) calculated from the Commencement Date

“Maintenance” means the successful maintenance of the completed and commissioned project as a whole or in parts as the case may be for the stipulated period

“Joint Venture” means two or more firms/contractors aspiring to take up the contract jointly with the lead partner and other partner/partners possessing the required qualifications.

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2. INTERPRETATION

In interpretation of these Conditions of Contract, headings shall not be deemed part thereof or be taken into consideration. Words importing persons or parties shall include firms and corporations and any organization having legal capacity. Words importing the singular only also include plural and vice versa where the context requires.

The Employer will provide instructions clarifying the queries about the contract.

3. Authority of Engineer in Charge

It shall be accepted that the authority of the Engineer in charge shall be an integral part of the contract in all matters regarding the quality of materials, workmanship, removal of improper work, interpretation of the contract drawings and specifications, mode and procedure of carrying out the works where the decision of the Engineer in charge shall be final and binding on the contractor. The Engineer in charge shall have absolute authority on all technical matters and payment considerations.

4. Sufficiency of Bid

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the bid and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

5. Priority of Contract Documents

The several, documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract. The priority of the documents forming the Contract shall be as follows:

- The Contract Agreement
- The Letter of Acceptance
- The Tender
- Conditions of the Contract
- Technical specifications
- Any other document forming part of the Contract

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6. Secrecy of the contract document

The Contractor shall treat all documents, correspondence, direction and orders concerning the contract as confidential and restricted in nature by the contractor and shall not divulge or allow access to these matters to any unauthorized person.

7. Instruction in Writing

Instructions given by the Engineer or Engineer's Representative shall be in writing, provided that if for any reason, the Engineer or the Engineer's Representative considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer or Engineer's Representative, whether before or after the carrying out of the instructions given by the Engineer or Engineer's Representative, shall be deemed to be an instruction.

8. Commencement of Works

The Contractor shall commence preliminary works after the receipt by him of the LOA to this effect from the Engineer in charge. Thereafter, the contractor shall proceed with the Works with due expedition and without delay and in accordance with the program schedule set out in the Contract.

9. Reference Marks

The basic center lines, reference points and bench marks shall be fixed by the Engineer in charge of the works.

The contractor shall establish additional reference points and bench marks as may be necessary at his cost. The contractor shall remain responsible for the accuracy and sufficiency of the reference and bench marks. The contractor shall take proper precautionary steps to ensure that the reference lines and bench marks established for the works are not disturbed and shall make good any damages caused.

10. Supervision

The Contractor shall provide all necessary superintendence during the execution of the works and thereafter as may be necessary for the proper fulfillment of the obligations under this contract. The contractor shall arrange for the deployment of proper qualified personnel at the site of work constantly, such supervising staff, apart from those separately set out as the requirements of the contract, shall be skilled and experienced technical assistants, foremen and others competent enough to produce proper supervision.

The Contractor shall employ the technical staff as per the prescribed rules. The details of value, scale and minimum qualification prescribed for the employment of technical staff, the rate of penalty for the failure on the part of the contractor to employ the technical staff for the work etc are as follows

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Sl. No.	Scale and minimum qualification prescribed for the employment of technical staff	Number of persons required	Rate of Penalty
	Up to Rs. 50.00 Crore		
1)	Project Manager - B.E. (Civil) or equivalent with 15 years experience	1	Rs. 25,000/- per month/ person
2)	Deputy Project Manager - B.E.(Civil) or equivalent with 10 years experience	1	Rs. 15,000/- per month/ person
3)	Resident Engineer - B.E. (Civil)/ Mechanical/Electrical or equivalent with 5 years experience	2	Rs. 10,000/- per month/ person

If the contractor fails to employ the technical staff to the departmental requirements, the contractor is liable to pay the penalty as indicated above during the period of such non employment of technical staff.

In the event of any staff of the contractor being non co-operative, negligent, incompetent or misconduct, the Engineer in charge shall have the liberty to object to the placement of such staff at the site or other place of works and will promptly issue notice in writing to the contractor for the removal of such staff members. It will be obligatory on the part of the contractor to remove/change such persons in the larger interests of the works.

11. Subletting of Contract

Assignment of the contract is not permissible

Transfer of the contract is not permissible on any grounds

The contractor shall sublet any portion of the contract only with the written consent of the Engineer in charge. It should be clearly understood that any subletting shall in no way absolve the contractor of his responsibilities and obligations under this contract

12. Specifications and Checks

Stated dimensions in the drawings are to be taken for consideration and no measurements based on scaling of the drawings shall be considered. In case of discrepancy between the description of items in the schedule of quantities and the specifications, the later shall prevail. In case of the description, any work having not fully described or doubts prevail, the contractor shall forthwith write to the

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Engineer in charge and clarify himself before executing that portion of the work. However, this cannot be a cause for any delay in the progress and the contractor should take advance action in this regard ensuring timely completion of the works. Before commencement of the work, it will be obligatory on the part of the contractor to furnish a detailed plan of action along with layouts showing the position of the construction plants and other facilities required and proposed to be provided for this contract.

The contractor shall execute the works true to alignment, grade and levels as set out in the drawings and as directed by the Engineer in charge from time to time. The Engineer in charge or his representative is at liberty to check the correctness of the works, the suitability of the materials used, design mix etc., The contractor will raise no objections for such checks and shall provide necessary labour and instruments to carry out such check to the Engineer in charge as well as his representative and co-operate in the checks. However, such checks will not absolve the contractor of his responsibility of maintaining the accuracy of the work.

13. Custody and Supply of Drawings and documents

The drawings shall remain in the sole custody of the Engineer in charge, but two copies thereof shall be provided to the contractor free of charge. The contractor shall make at his own cost any further copies required by him. Unless it is strictly necessary for the purposes of the contract, the drawings specifications and other documents provided by the Employer or the Engineer in charge shall not, without the consent of the Engineer in charge, be used or communicated to a third party by the contractor. One copy of the Drawings, provided to or supplied to the Contractor as aforesaid, shall be kept by the Contractor at the site and the same shall be made available for inspection and use by the Engineer and by any other person authorized by the Engineer.

14. Bill of Quantities

The Bill of quantities shall contain items for the construction, installation, testing, commissioning and maintenance of the Works to be carried out by the Contractor. The Bill of Quantities will be used to calculate the Contract Price. The contractor shall be paid for the quantum of work done at the rate mentioned for each item in the Bill of quantities.

15. Change in the Quantities

If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item/items, the rates as in the agreement for the relevant items shall be paid as per the actual quantity.

16. Additional items

If additional items that are not contemplated in the contract are to be executed, the Engineer in charge will execute the works either through the main contractor/firm or through any other agency. Payment for such works shall be made based on the rates derived by the Engineer in charge as per rules in force.

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17. Order Book

An order book will be kept by the Officer in charge of the site (Junior Engineer/Assistant Engineer) of the particular component of the works. Orders entered in this book by the Engineer in charge or any higher authority shall be held to have been formally communicated to the contractor/firm. The Officer in charge of the site will sign each order as it is entered and will hand over the duplicate to the contractor/firm or his agent, who shall sign the original in acknowledgement of having received the order.

18. Independent Inspection

The Engineer shall delegate inspection and testing of materials or Plant to an independent inspector/Agency. Any such delegation shall be considered as prerogative of the Engineer. In addition to third party inspection, wherever felt necessary, the engineer shall be empowered to test the PVC Pipes for its quality such as specific gravity, diameter, thickness etc in the TWAD Board laboratory. **The cost of the third party quality check pipes, valves and pump sets shall be borne by the employer.**

19. Covering and Opening of Works.

No work shall be covered or put out of view without the approval of the engineer in charge. The contractor shall give due notice to the Engineer in charge whenever such works are ready for examination and the Engineer in charge within a reasonable period, arrange for the inspection and measuring of the work as may be necessary. No portions of the work shall be covered up without the consent of the Engineer in charge. The cost of opening any portion of the works that was covered without the consent of the Engineer in charge and the cost of covering thereafter shall be borne by the contractor. The contractor shall open the covered portion of the works for inspection by the Engineer in charge on a request and the inspection or examination shall be carried out promptly by the Engineer in charge. In the case of defects notified by the Engineer in charge, the contractor shall rectify the same as may be instructed by the Engineer in charge. All costs of opening, covering and rectification shall be on to the account of the contractor. Should the contractor refuse to open such portions of works the Engineer in charge shall open such portions with other persons and inspect the part of the works as he may feel necessary. On inspection, the works being not in accordance with the requirements of the contract documents, the Engineer in charge shall carry out necessary rectification and the entire cost of opening, rectification and closing shall be on to the contractor's account.

20. Temporary Diversion of Roads and Commencement of Work.

During execution of the works, the contractor/firm shall make at his cost all necessary provision for the temporary diversion of roads, car tracks, footpaths, drains, water courses, channels etc. , Should the contractor/firm fail to do these arrangements, the same shall be done by the Engineer in charge and the cost thereof shall be recovered from the contractor/firm.

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21. Notice to Telephone, Railway and Electric Supply Undertaking.

The Contractor/firm shall give all notices required by any law or custom or as directed by the Engineer in charge and irrespective of whether notice be so required so directed or not, shall in all cases give due and sufficient notices to all persons and authorities having charge of the telegraph, water and other pipes, sewers, culverts drains, water courses, railway, telephone, highways, roads, streets, foot and carriage highways, payment and other works, prior to commencements and at the completion of any work under this contract in order to enable the proper bodies or persons in respect of the matters aforesaid to attend and see the works within their jurisdiction and all matters and things incidental and pertaining thereto are secured, re-laid or reinstated in a proper and satisfactory manner. The notices by the contractor/firm shall also serve the purpose of enabling such bodies and persons to attend and secure, shore up, alter the position or remove, relay and reinstate the works and things belonging to them notwithstanding the notices given as aforesaid the Contractor/firm shall be chargeable and responsible for the proper protection and restoration of all matters and things herein referred to.

22. Watching and Lighting

The Contractor/firm shall at his expense shall provide at the site of works sufficient fencing, barricading, watching and lighting during day and night. The contractor/firm shall in every respect conform to the police regulations in these matters and shall free and relieve the Board on all such matters. Should the contractor/firm fail/neglect to do these arrangements, the same shall be carried out by the Engineer in charge and the costs thereof shall be recovered from the contractor/firm.

23. Measurement of Work

The work will be measured by the site engineer (Junior Engineer/Assistant Engineer) and recorded in the measurement book. The contractor/firm will be at liberty to accompany the site engineer in order that they may agree on the measurements but should they neglect to do so, the measurements as recorded by the site engineer shall be taken as final and conclusive. The measurements of works will be recorded as prescribed in the TNBP and as amended from time to time.

24. Tools and Plants

All tools, plants and equipments required for this contract will be arranged by the Contractor at his own expense. The Contractor shall erect necessary construction plant as may be necessary and shall use such methods and appliances for the proper performance of all the operations connected with the work brought under the contract ensuring satisfactory quality of work and maintenance of the program schedule. The non availability of any tool, plant or equipment shall not be relied upon as a reason for non functioning or slow progress.

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25. Information and Data

The information and data made available to the contractor in respect of the works and site conditions are only general and the contractor is advised to get himself fully acquainted with the nature of the location of the works and the surroundings, quarries, local conditions and such other aspects that are relevant to the works.

26. Co-existence with other Contractors.

Where two or more contractors are engaged on work in the same vicinity, they shall work together harmoniously with the spirit of cooperation and accommodation. The contractor shall not disrupt or disturb the works or labour arrangements of the neighboring contractors. In case of disputes and difficulties arising between the contractors in the execution of the respective works, the Engineer in charge shall interfere and give directions for the smooth functioning of the entire works and it shall be the bounden duty of the contractors to abide by these instructions.

27. General Responsibilities and Obligations of the Contractor

The contractor shall, subject to the provisions of the contract, execute and maintain the works with proper care and diligence and provide all labour including the supervision thereof, materials, constructional plant and all other things, whether of a temporary or permanent nature required for such execution and maintenance.

The contractor shall take full responsibility for the adequacy, stability and safety of all site operation and methods of construction.

The contractor shall promptly inform the Employer and the Engineer in charge if any error omission, fault and other defects in the specification or design of the works which are identified at the time of reviewing the contract documents or during the execution for proper rectification thereof.

All notices, certificates connected with the work served by the employer relating to the contract shall be sent by post or by hand to the contractor's principal place of business as mentioned in the document or at other places as may be nominated by the contractor in writing for this purpose. Any change in the address of the contractor should be promptly intimated to the Employer in writing then and there.

The contractor shall visit the spots of work and ascertain the site conditions. The contractor shall satisfy himself of the conditions prevailing in the spots where the work is actually to be executed and its environs and the precise offered by him shall be treated as those which were worked out taking fully into consideration the prevailing site conditions, hydrological conditions, extent and nature of work to be executed, the material availability, etc., Any claim on this ground at a later date shall be summarily rejected.

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However during the execution of the works, if the contractor has to encounter artificial obstructions, which in his opinion could not have been reasonably foreseen, then the contractor shall write forthwith to the Engineer in charge of such obstruction and remedial measures needed. The Engineer in charge, if opined that the conditions cannot be possibly foreseen by an experienced contractor, he shall extend possible assistance to the contractor to overcome such obstructions. The opinion of the Engineer in charge shall be final and binding and the contractor is not entitled to advance these as reasons for any delay that may be caused to the completion of the project.

The contractor shall execute and maintain all works in accordance with the specification and to the satisfaction of the Employer. The contractor shall strictly adhere to the instructions and directions of the engineer in charge, whether included in the contract agreement or not but concerning the safe and proper execution of the works.

28. Labour

The contractor shall not employ any person who has not completed fifteen years of age in connection with the works under this contract.

The contractor shall furnish the information on various categories of labour employed by him to the Engineer in charge in the form prescribed for this purpose

The contractor shall in respect of labour employed by him comply with or cause to be complied with the provisions of various labour laws, rules and regulations as applicable to them in regard to all matters provided therein and shall indemnify the Employer in respect of all claims that may be made against the Employer for non compliance thereof by the contractor.

Now withstanding anything contained herein, the Employer reserves the right to take such action as may be deemed fit and proper for the compliance of various labour laws and recover the costs thereof from the contractor.

29. Restriction of Working Hours

Subject to any provisions contained in the Contract, none of the works shall, save as hereinafter provided, be carried on during the night or on locally recognized days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer, Provided that the provisions of this clause shall not be applicable in the case of any work which is customary to carry out by multiple shifts

30. Right of Way and Facilities

The Contractor shall bear all costs and charges for special or temporary rights of way required by him in connection with access to site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works

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31. Removal of Improper Work, Material and Plant

The contractor shall make his own arrangements for the procurement, supply and use of the construction materials and shall ensure that the materials either procured within the country or abroad conform to the relevant specifications set out in the bid documents. In case of alternatives being used, they should be of equal or higher quality than those specified subject to the review and written approval of the Engineer in charge. Differences between the standards specified and the proposed alternatives must be described in writing to the Engineer in charge at least 30 days in advance from the date on which the approval of the Engineer in charge is needed. The disapproval of the proposal by the Engineer in charge shall result in the contractor confining to the standards set forth in the contract documents. The contractor shall arrange for the inspection of the material at the manufacturing place or other places by the department personnel

All materials and workmanship shall be in accordance with the specifications set out in the contract document and as directed by the Engineer in charge and shall be subjected to tests by the Engineer in charge or his representative at the place of manufacture or at the site of work or places wherever felt necessary. The contractor shall provide all the assistance necessary including instruments, machines and materials that are normally required for carrying out the testing/measuring the quality/quantity of the materials and workmanship. Any material rejected after testing by the Engineer in charge or his representative will not be used on the works. The contractor shall without claiming any extra cost, shall arrange for the testing of materials and supervision of the works. The Engineer in charge or his authorized representative will have access at all times to the places of manufacture, storage to ascertain as to whether the manufacturing process wherever mentioned is in accordance with the drawings and specifications

The Engineer in charge shall have the right to order the removal of such materials which in his opinion are substandard stipulating a time limit for the removal of the same and replacement with quality material

Notwithstanding the previous tests of the materials by the Engineer in charge or his representative, if any portion of the work, in the opinion of the Engineer in charge is not in order, the contractor shall redo such work to the satisfaction of the Employer at no extra cost. In case of default on the part of the contractor in carrying out such orders, then the Employer shall have the right to carry out such works through some other persons and the expenses thereon or incidental thereto shall be recoverable from the contractor.

32. Default of Contractor in Compliance

In case of default on the part of the Contractor in carrying out such instruction within the time specified therein, if none, within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and all costs consequent thereon or incidental thereto shall after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and shall be deducted by the

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Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer

33. Default by Contractor

If the contractor shall become bankrupt or have a receiving order made against him or shall present his petition in bankruptcy or shall make an arrangement with or assignment in favour of his creditors or shall agree to carry out the contract under a committee of inspection of his creditors, or being a corporation shall go into liquidation (other than a voluntary liquidation for the purpose of amalgamation or reconstruction), or if the contractor shall assign the contract, without the consent in writing of the employer first obtained, or shall have an execution levied on his goods, or if the engineer in charge shall certify in writing to the employer that in his opinion, the contractor.

- a) Has abandoned the contractor or
- b) Without reasonable excuse has failed to commence the works or has suspended the progress of works for twenty eight days after receiving a written notice from the Engineer in charge to proceed or
- c) Has failed to remove materials from the site or to pull down and replace work for twenty eight days after receiving the written notice from the engineer in charge stating that the said materials or work stands condemned and rejected under these conditions, or
- d) Despite previous warnings in writing by the Engineer in charge, not executing the works and achieving the progress as stipulated in the programmed schedule drawn for the contractor is persistently or flagrantly neglecting to carryout the obligations under this contractor
- e) Has, to the detriment of good workmanship, or in defiance of the instructions of the Engineer in charge or in contract sublet any part of the contract, then the Employer, may at his option, after giving two weeks notice in writing to the contractor, enter upon the site and the works and expel the contractor therefrom without thereby voiding.
- f) The contract, or releasing the contractor from any of his obligation or liabilities under this contract, and may himself complete the works or may employ any other contractor to complete the work. The employer or such other contractor may use the construction plant, temporary works

and materials which have been deemed to be reserved exclusively for the execution of the works under the provisions of the contract as may be thought fit and proper for the completion of the work. The employer may, at anytime, sell any of the said constructional plant, temporary works and materials which have been deemed to be reserved exclusively for the execution of the works under the provisions of the contract as

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may be thought fit and proper for the completion of the work. The employer may, at any time, sell any of the said constructional plant, temporary works and unused materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the contractor under this contract.

- g) has carried out the work in a defective manner.
- h) has not made payment of labour dues.
- i) has become eligible for maximum compensation under the "Liquidated damages clause" leading to Termination of the contract.

The Engineer in charge shall as soon as may be practicable after any such entry or expulsion by the employer, fix and determine expert or by after reference to the parties, or after such investigation or enquiries as maybe thought fit to make or institute, and shall clarify what amount, if any had at the time of such entry and expulsion been reasonably occurred to the contractor in respect of work then actually done by him under this contract and the value of any of the said unused or partially used materials, any constructional plant and any temporary woks.

If the employer shall enter and expel the contractor under this clause, the employer shall not be liable to pay to the contractor any money on account of the contract until the expiration of the period of maintenance and thereafter until the costs of execution and maintenance, damages for delay in completion, if any and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the engineer. The contractor shall then be entitled to receive only such sum or sums, if any as the engineer in charge may certify would have payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the contractor on due completion by him, then the contractor shall, upon demand, pay to the employer the amount of such excess and it shall be deemed a debt due by the contractor to the Employer and shall be recoverable accordingly.

If, by reason of any accident, or failure, or other event occurring to or in connection with the work, or any part thereof, either during the execution of the works, or during the period of maintenance, any remedial or other work or repair shall in the opinion of the Engineer in charge or his authorized representative, be urgently necessary for the safety of the works and the contractor is unable or unwilling at once to do such work or repair as the Engineer in charge or his representative may consider necessary, such works shall be carried out by the Engineer in charge. If the work or repair so done, which in the opinion of the Engineer in charge, liable to have been done by the contractor at his expense

under this contract, all expenses incurred by the Employer in carrying out such works shall be recoverable from the contractor or shall be deducted by the Employer from the money due to the contractor provided always that the Engineer in charge or his representative, as the case may be, shall as soon after the occurrence of any such emergency as may be reasonably practicable, notify the contractor thereof in writing.

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34. Power to vary work

The description of the works required to be executed by the contractor/firm are set out in the specifications, schedules and drawings, but the Engineer in charge reserves the power to vary, extend or diminish the quantities of work, to alter the line, level or position of any work, to increase, change or decrease the size, quality, description, character or kind of any work, to order the contractor/firm to execute the works or any part thereof, by day or night work, or to add or take from the work included in the contract as he may deem fit and proper without violating the contract and the contractor/firm shall not have any claim upon the Employer for any such variation, extension, diminution, alteration, increase, change or decrease other than for the work actually done, calculated according to the prices tendered and accepted in this contract.

35. Extra for Varied Works

Any unforeseen additional work that may become necessary and is accordingly carried out under this contract based on proper written orders shall be measured and valued by the Engineer in charge at the rates contained in the contractor's/firm's original bill of quantities. If these rates do not apply to the additional works ordered to be carried out, then prior to execution of the additional work, a rate for such work shall ordinarily be agreed upon and entered in a supplemental schedule and signed by both the Engineer in charge and the contractor/firm.

36. Omissions

In the event of anything reasonably necessary or proper to the due and complete performance of the work (Engineer in charge will be the sole judge on these things) being omitted to be shown or described in the drawings, specifications and schedules, the contractor/firm shall notwithstanding execute and provide at the rates noted in the bill of quantities all such omitted works and things as if they have been severally shown and described and the execution should be according to the directions of the Engineer in charge and to his satisfaction.

37. Notices Regarding Shoring etc.,

Wherever shoring or other works for the protection or security of the buildings/structures are necessary, the contractor/firm shall within a reasonable period before the execution of such works, shall serve notices upon the occupiers of the buildings/structures to be shored up or otherwise secured and upon all other parties entitled to notice, apprising them respectively that such works are necessary, that the contractor/ firm about to execute the same and will, at a time to be specified in such notice, enter upon the premises for the purpose of executing such works.

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38. Cost of Repairs

Loss or damage to the Works or materials to be incorporated in the works between the Start Date and the end of the Defects correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions. **Contractor shall attend to the defect in the work noticed during defects correction period within 3 days from the date of issue of notice to attend to the defects, failing which the defect will be remedied by engaging other Contractors at any cost and that cost will be recovered from the Contractor's money available with the Employer and balance alone will be paid when it is due.**

39. Suspension of Work

The Contractor shall, on the instructions of the engineer, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as is necessary in the opinion of the Engineer in charge.

40. Suspension of Progress

The contractor/firm shall, without recompense, claim or demand, delay or suspend the progress of works as a whole or any part thereof, if and when or so often as directed by the Engineer in charge and for such time or times, as may be in the judgement of the Engineer in charge be necessary for the purposes or advantages of the undertaking. Upon all such occasions, whether directed or not, the contractor/firm at his/their expense, properly cover down and secure so much of the work as may be liable to sustain damage from whether or any other cause and shall at all times and forthwith when required properly make good all the damage or injury which such works or any part thereof may have sustained and these should be done to the entire satisfaction of the Engineer in charge.

41. Termination

The Employer may terminate the Contract for any reason that is regarded as breach of the Contract.

If the contract is terminated, the contractor shall stop work immediately, make the site safe and secure and leave the site as soon as reasonably possible on termination of the contract, the Engineer shall issue a certificate for the value of work done less payments received upto the date of the issue of certificates, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be treated as debt payable to the Employer and can be recovered from any amount due or may become due to the contractor.

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In the case of termination, works that are pending for the proper completion of the project, shall be carried out by the Employer either by themselves or through any other agency. Any additional expenditure over the value finalised in the contract for any component or for the whole project, incurred by the Employer by the Employer due to such termination, shall become recoverable from the contractor/firm whose contract stands terminated, from the money due or may become due to him/them. All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of Contractor's default

42. Plant etc., not to be removed

The plant, tools and materials provided by the contractor/firm shall, from the time they are brought to the site of the works, during the construction and until the satisfactory completion of the contract, shall become and continue to be the property intended for the proper fulfillment of the contract and the contractor/firm shall not remove the same or part thereof without the consent of the Engineer in charge in writing.

43. Contractor not to occupy Land etc

In no case shall the contractor/firm continue to use or occupy or allow to be used or occupied any land or property either for the deposit of materials or plant or for any purpose whatever, after written notice from the Engineer in charge served on the contractor/ firm to the effect requiring the contractor/firm to remove or cause to be removed all such materials from any such land or property as aforesaid and to give vacant possession of such land or property to the Engineer in charge. All such notices shall be served through post office or other modes of delivery to the contractor/firm at his/their usual or last known place of business, It is enough for the Engineer in charge to send the notice through any mode of delivery as he may prefer and implement this clause irrespective of the receipt of the notice by the contractor/firm. Should any materials or plant remain upon any such property or land or should any such land or property continue to be occupied or be used after such notice for any purpose whatsoever as aforesaid, then and in every such case and as often as the same shall happen, the contractor/firm shall forfeit and on demand pay to the Employer the charges fixed by the Engineer in charge as and for liquidated and ascertained damages for each and every day during which the said lands or property are so used and occupied as aforesaid from the time of such notice shall have been served.

44. Power Supply

The power supply connection from the TNEB has to be obtained by the contractor himself and the charges thereon shall be borne by the contractor. However, necessary vouchers in original for the payment made to the TNEB shall be produced to the Employer by the contractor which will be reimbursed by the Employer.

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45.Completion and Delivery of the Works

The completion and delivery of the works shall be deemed to be full, complete and sufficient only when the Engineer in charge accepts the same and issues a certificate in writing viz. " Certificate of Completion" under the hand of the Engineer in charge to the effect that all the works contracted for and directed to be executed have been completed and are in a sound, water tight, workmanlike and complete and usable condition and the contractor has in the opinion of the Engineer in charge reasonably fulfilled and completed his contract and undertaking except so far as it relates to the maintenance of the works as hereinafter provided. Provided always and notwithstanding anything contained in the contract, it shall be lawful for the Employer to undertaker and execute either departmentally or through other parties at any period during the continuance of this contract, any kind of work, matter or thing whatsoever, which they may consider necessary or proper to be performed and executed for the purpose of any in connection with any or all of the works under this contract and that without in any way relieving the contractor/firm from any of his/their liabilities and responsibilities under this contract or in any way violating or voiding this contract.

46.Final Certificate

When the works covered under this contract are completed in all respects, the contractor / firm shall submit a request to the Engineer in charge to make a final measurement of the works and take over the whole of the works on behalf of the Employer and issue a final certificate to enable him/them to submit a final bill for payment. The Engineer in charge shall thereupon, unless he records reasons in writing to the contrary, make a final measurement of the works and take them over on behalf of the Employer and sign a certificate purporting to be a last certificate. Nothing in this clause or in the agreement shall prohibit the Employer taking over and using any portion of the works which may be completed prior to the completion of the whole works of this contract.

47. Completion Certificate

The Contractor shall request the Engineer to issue a certificate of Completion of the Works and the Engineer shall issue certificate of completion after satisfactory completion of the works in all respects

48. Taking Over

The Employer shall takeover the Site with the works within thirty days after satisfactory completion of the maintenance of the entire project for the stipulated period as contemplated in this contract.

49. Performance Guarantee

The period of guarantee for the entire works shall be **24 months** from the date of completion and commissioning of the project to the satisfaction of the Engineer in charge of the work. This will include the maintenance of the entire project by the firm/contractor for a period of **12 months**. If defects are noticed during the guarantee period, the firm/contractor shall rectify/replace wherever necessary at

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its/his own cost within 30 days of such intimation. If the contractor/firm fails to carry out rectification within the stipulated time, the rectification works shall be carried out by the Employer at the risk and cost of the contractor/firm and contractor/firm will become ineligible for the payment of the retention amount for the said purpose.

50. Maintenance of the project

The contractor / firm shall successfully maintain the project for the stipulated period from the successful commissioning of the works in this project. **During the period of maintenance, all costs towards Labours, consumables, chemicals, repairs and renewals shall be paid as per BOQ. The electrical energy charges payable to the TNEB during the maintenance period shall be borne by the Employer.**

51. Operating and Maintenance Manual

"As built" drawings and operating and maintenance manuals shall be supplied by the contractor/firm at the time of handing over the completed works at his/their cost

52. Work on Private Property

The contractor/firm shall not commence any work in or upon, under, across of through any land, house building, shed, yard, area, roadway, ground, garden or any other place being private property until authorized in writing by the Engineer in charge to do so.

53. Protection

It will be the responsibility of the contractor to take adequate precautions and protect the adjoining sites against structural, decorative and other damages. The contractor shall be responsible for the safety of the public properties wherever the works are executed. Whenever damages are caused to the adjoining structures, roads, bridges etc due to the execution of this contract, it will be the responsibility of the contractor to restore them to their original level at his cost.

54. Accident or Injury to Workmen

The Employer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any Subcontractor. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto

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55. Risk Insurance

The firm/Contractor shall provide risk insurance at their/his cost against loss or damages to the construction to cover from the start date to the end of the Defects Liability Period, for the following events

- Loss of or damage to the Works, Plant and Materials
- Loss of or damage to Equipment
- Loss of or damage of property (except the Works, Plant, Materials and Equipment) in connection with the Contract and
- Personal injury or death

Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred. The contractor will not be eligible for any payment on this account.

If the Contractor does not provide any of the policies and certificates required, the Employer shall effect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due

Alterations to the terms of an insurance shall not be made without the approval of the Engineer.

56. Care and Risk

From the date of commencement to the date of completion of the work and during the period of maintenance, the contractor shall take full responsibility and care thereof for the safety of the installation connected with the works. Any damage or loss are to be made good at the risk and cost of the contractor and shall ensure conformity in every respect with the requirements of the contract. The contractor shall be liable for any damage to the works occasioned by him in the course of any operation carried out by him for the purpose of completing any outstanding work and the damage so occurred shall be rectified at the cost of the contractor.

57. Safety Provisions

The Contractor shall be responsible for the safety of all activities on the Site.

- 1) Suitable scaffolds shall be provided for workers for all that cannot safely be done from the ground or from solid construction, except such short period work, as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination no steeper than 1\4 to 1 (1\4 horizontal to 1 vertical). IS code for scaffolding and ladders I.S 3696 Part -I and Part II and its latest revisions is to be followed.

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- 2) Scaffolding or staging more than 3.25 meters above the ground or floor swung or suspended from an overhead support or erection with stationary support, shall have guard rail properly attached bolted, braced and otherwise secured at least 1 meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or the structure.
- 3) Working platform, gangways and stairways shall be so constructed that they do not sag unduly or unequally, and if height of a platform or gangways or stairway is more than 3.25 meters above ground level, it shall be closely boarded, having adequate width and be suitably fenced, as described in 2 above. Every opening in floor of a building or in a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing with a minimum height of 1 meter. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 7 meters in length. Width between side rails in a rung ladder shall in no case be less than 30 cm, for ladders, this width shall be increased by at least 6mm for each additional 30cm length. Uniform steps spacing shall not exceed 30cm.
- 4) Adequate precautions shall be taken to prevent danger from electrical equipment. No material on any of the sites shall be so stocked or placed as to cause danger or inconvenience to any person or to the public. The Contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defense of every suit, action or proceedings at law that may be brought by any person for injury sustaining, owing to neglect of the above precautions and to any such suit, action or proceedings to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.
- 5) All necessary personal safety equipment as considered adequate by the Engineer shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned
 - a) Workers employed on mixing asphalt materials, cement and lime mortars/ concrete shall be provided with protective footwear, hand gloves and goggles.
 - b) Those engaged in handling any materials, which is injurious to eyes, shall be provided with protective goggles.
 - c) Stonebreakers shall be provided with protective goggles and protective clothing.
 - d) When workers are employed in sewers and manholes, which are in use, the Contractor shall ensure that manhole covers are opened and manholes are ventilated at least for an hour before workers are allowed to get into them. Manholes so opened shall be cordoned-off with suitable railing and warning signals or boards provided to prevent accident to public.
 - e) The Contractor shall not employ men below the age of 15 and women on the work of painting with products containing lead in any form. Whenever men above the age of 18 are employed on the work of lead painting the following precautions shall be taken:

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- i. No paint containing lead or lead products shall be used except in the form of paste of ready-made paint.
 - ii. Suitable face masks shall be supplied for use by workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scraped.
 - iii. Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and on cessation of works.
- 6) When the work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps shall be taken for prompt rescue of any person in danger and adequate provisions shall be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.
- 7) Use of hoisting machines and tacks including their attachments, anchorage and supports shall conform to the following:
- a) i) These shall be of good mechanical construction, sound material and adequate strength and free from patent defects and shall be kept in good working order.
 - ii) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects
 - b) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in-charge of an hoisting machine, including any scaffold winch or giving signals to operator.
 - c) In case of every hoisting machine and of every chain ring hook, shackle, swivel and pulley block used in hoisting machine or lowering or as means of suspension, safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with safe working load. In case of hoisting machine having a variable safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.
 - d) In case of departmental machine, safe working load shall be notified by the Engineer. As regards Contractor's machine, the Contractor shall notify safe working load of each machine to the Engineer whenever he brings to the site of work and he shall get it verified by the Engineer.
- 8) Motors, gearing, transmission, electrical wiring and other dangerous parts or hoisting appliance shall be provided with such means so as to reduce to minimum risk and accidental descending of load; adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations, which are already energized, insulating mats, wearing apparel such as gloves, sleeves and boots, as may be necessary shall be provided. Workers shall not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.

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- 9) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold ladder or equipment shall be altered or removed, while it is in use. Adequate washing facilities shall be provided at or near place of work.
- 10) The safety provision shall be brought to the notice of all concerned by displaying on a notice board at a prominent place at the work spot, persons responsible for ensuring compliance with the safety provision shall be named therein by the Contractor.
- 11) To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the Contractor shall be open to inspection by the Engineer or his representative and the inspecting Officer.
- 12) The Contractor shall obtain prior permission of the competent authority such as Chief of Fire services for the site, manner and method of storing explosives near the site of work. All handling of explosives including storage, transport shall be carried out under the rules approved by the "Explosive Department of the Government".
- 13) The Contractor shall at his own cost provide and maintain at the sites of works, standard first aid box as directed and approved by the Engineer, for the use of his own as well as the Employer's staff on site.
- 14) Notwithstanding the above provision 1 to 15 Contractor is not exempted from the operation of any other Act or rules in force relating to safety provisions.

58. Provision of Health and Sanitary Arrangements

The contractor/firm, shall provide at his/their own expenses, first aid appliances and medicines including an adequate supply of sterilized dressing and sterilized cotton wool kept in good order under the charge of a responsible person who shall be readily available during working hours.

Water of good quality fit for drinking purposes shall be provided for the work people on a scale of not less than 15 litres per head per day. Each water supply storage shall be at a distance of not less than 15 meters from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or other sources of pollution, the well shall be properly chlorinated before water is drawn from it for drinking.

Adequate washing and bathing places shall be provided separately for men and women and such places shall be kept in clean and drained condition. Latrines and urinals shall be provided within the precincts of work place and the accommodation separately for each of them shall be at the rate of 2 seats upto 50 persons, 3 seats above 50 persons but not exceeding 100 persons, and 3 seats for every additional 100 persons. The contractor/firm shall employ adequate number of scavengers and conservancy staff to maintain the latrines and urinals in a clean condition.

Two sheds one for meals and the other for rest shall be provided separately for the use of men and women workers and properly maintained.

All the above amenities shall be provided at the contractor's/firm's own expenses besides providing sheds for his/their workmen.

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59. Patent Rights

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Contractor's Equipment, material or Plant used for or in connection with or for incorporation in the Works and from and against all damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto

60. Royalties

Except where otherwise stated, the Contractor shall pay all seignorage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

61. Old Curiosities

All old curiosities, relics, coins, minerals and any other item of archeological importance found at the site shall be the property of the Government and shall be handed over to the Engineer in charge for depositing to the Government exchequer. Should any structure be uncovered, the instruction of the Engineer in charge shall be provided before demolition or removal of the structure.

62. Contractor Dying, becoming Insolvent or Insane

In the event of death or insanity of the contractor, the contract may be terminated by notice in writing, pasted at the site and advertised in the issue of the local newspaper. All acceptable works shall thereafter, be paid at appropriate rates after recovering all the contractor's dues to Employer, to the persons entitled to receive and give a discharge for such payments.

In the contractor is imprisoned because insolvent compound with his creditors has a receiving order made against him or carriers on business under receiver for the benefit of the creditors of any of them or being a corporation goes into liquidation or commences to be wound up not being a voluntary winding up for the purpose only of amalgamation or reconstruction, the employer shall be at liberty.

- a) To give such liquidator, receiver or other persons in whom the contract may become vested the option of carrying out the contract or a portion thereof to be determined by the employer, subject to his providing an appropriate guarantee for the performance of such contractor.
- b) To terminate the contract forthwith by notice in writing to the contractor the liquidator, the receiver or person in whom the contract may become vested and take further actions as provided in the clause pertaining to default by contractor, treating as if this termination is ordered under the respective clause.

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63. Force Majeure

The works taken by the contractors under the contract shall be at the contractor's risk until the work is taken over by the Executive Engineer. The contractor shall arrange his own insurance against fire, flood, volcanic eruption, earth quake and other convulsions of nature and all other natural calamities, risks arising out of acts of God, Acts of Terrorism, Civil disturbances, Riots during such period and that the TWAD Board / Government shall not be liable for any loss or damages occasioned by or arising out of any acts of God.

Provided however that the contractor shall not be liable for all or any loss or damages occasioned by or arising out of acts of foreign enemies, invasion, hostilities or war like operations (before or after declaration of war) rebellion military or usurped power.

64. Payment out of Public Funds

The payments to the contractor/firm shall be made out of the funds under the control of the Employer in their public capacity and no member or officer of the Employer shall be personally responsible to the contractor/firm.

65. Bribery and Collusion

In the event of the contractor offering or giving any official of the employer, any gift or consideration of any kind as an inducement or regard for doing, or for bearing to do, any action in relation to obtaining or in the execution of the contract or any other contract with the employer, or for showing favour to any person in relation to the contract or any other contract with the employer, or if any of the such acts shall have been done by any person employed by the contractor or acting on his behalf, either with the knowledge of the contractor or not which are all grounds for the employer to terminate the contract awarded to the contractor. Similarly if the contractor colludes with another contractor or number of contractors whereby an agreed quotation or estimate shall be offered as a bid, that will also form the basis for the employer to terminate the contract.

66. Technical audit

It is a term of this contract that department shall have the right to carry out post payment audit and technical Audit by the Engineers of Technical audit cell (or by an approved consultant of repute). The Technical audit officer shall have the powers to inspect the work or supply running account bill, final bill and other vouchers, measurement books, test reports and other documents either during progress of work or after completion of the same and order recoveries from the contractor for recorded reasons even though the contractor might have been paid earlier. These recoveries are enforceable against the contractor from any amount due to him, from performance security or withheld amounts or any amounts due to the contractor or may become due to him from the department in any work or supply.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

67. Settlement of dispute**a. Dispute Redressal Committee**

In order to ensure a dispute Redressal mechanism, a Committee headed by the Managing Director / Joint Managing Director and consisting of Engineering Director, TWAD Board and Engineering Director, CMWSS Board as Member, will comprise the " Dispute Redressal Committee" for each package in order to resolve any disputes between the Employer / Engineer – in charge concerned and the contractor

b. Jurisdiction of Court

In the event of non settlement of any dispute by the Dispute Redressal Committee arising between the parties hereto in respect of any matter comprised in the contract, the same shall be settled by a competent court having jurisdiction over the place where the contract is awarded and agreement is concluded and by no other court.

68. Reservation of Right

The Employer reserves the right to accept or reject any or all the bids and to annul the entire process of bidding at any time. Under such circumstances, the Employer will neither be under any obligation to inform the bidders of the grounds for the action of the Employer nor will the Employer be responsible for any liability incurred by the bidder on this account.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

VIII. SPECIAL CONDITIONS OF CONTRACT

Section-1 – Construction period of the Contract.

Section-2 – Operation & Maintenance by the Contractor.

In Section I of the Works, the Contractor shall, except as stated below, be responsible for the provision of all electricity power, water, gas, consumables, chemicals and other services he may require. In Section II of the Works, the **Contractors shall be responsible for the provision of all water, gas, consumables, chemicals, other services and all spares and tools** not listed in Schedule of Technical Particulars VIII but actually be required for the Works. **The electricity power cost as related to the normal operation and maintenance at Section II of the Works shall be borne by the Employer. During the construction and trial run period EB power has to be borne by the bidder only.** However, the electricity power being used by the Contractor in Section II of the Works to carry out any outstanding pre-commissioning tests, final commissioning tests or to repeat these tests as a result of failure during the 'Test on Completion for Section I of the Works', shall be borne by the Contractor. The cost of water, gas, consumables, chemicals and other services shall be borne by the Contractor, as mentioned above, except when such items are explicitly entered in the Schedule of Prices of the Contract such that the Contractor shall be entitled to obtain reimbursement after they are provided by the Contractor.

Unless otherwise stated in the Conditions of Particular Applications, at each of the two Sections of the Works, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report of each of the two Sections shall cover the period up to the end of the first calendar month following the commencement date of that Section. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all works in each of the two Sections of the Works, which are known to be minor outstanding at the completion dates stated in each of the Taking-Over Certificate for each of the two Sections of the Works.

Each report in Section II of the Works shall include:

- a) Photographs showing status of each equipment, plant, civil structures at all sites of the Works;
- b) Deleted
- c) Logs to show the maintenance record to all equipments;
- d) Logs to show the replacements of damage and defective components of each equipment or the whole equipment of a Plant;

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

- e) Logs to show the attendance records of all the operation and Maintenance staff; and
- f) Comparisons between the recommendations from the Operation and Maintenance Manual with the actual maintenance, defective parts replacement records as described in (c) and (d) above.

Contractor's Operations on Site:

Upon the issue of the Taking-Over Certificate for Section I of the Works, the Contractor will be handed over the whole Works by the Employer such that the whole Work will be under possession by the Contractor. The Contractor shall be responsible for all works that are required for possession of the whole Works. Upon the issue of the Taking-Over Certificate for Section II of the Works, the Contractor may retain on Site, during the Defects Notification Period for Section II of the Works, as that are required for the Contractor to fulfill the works under the Contract.

General Design & Obligations :

The requirements to As-Built Documents to Section I and Section II of the Works are described in Part A – General Specification of the Contract. The requirements to Operation and Maintenance Manuals to Section I and Section II of the Works are described in Part A – General Specification of the Contract.

The Contractor shall allocate his operation and maintenance staff at the Works every day to conduct operation and maintenance work to the Works, in multiple shifts, with details as specified in the Employer's Requirement Facilities for Staff and Labour Save insofar as the Contractor may otherwise provide, the Contractor shall provide and maintain such accommodation and amenities as he may consider necessary for all his staff and labour, employed for the purposes of or in connection with the Contract, including all fencing, water supply (both for drinking and other purposes), electricity supply, sanitation, cookhouses, fire prevention and firefighting equipments, cookers, refrigerators, furniture and other equipments in connection with such accommodation or amenities. On completion of Section I of the Contract, unless otherwise agreed with the Employer, the temporary camps/housing provided by the Contractor shall be removed and the site reinstated to its original condition, all to the approval of the Engineer.

CONTRACTOR

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LETTER OF NEGOTIATION

In pursuance of negotiation with the Executive Engineer/Superintending Engineer/Chief Engineer of Division/Circle/Region on

I/We agree to reduce the rates for the items in the BOQ as follows.

Sl.No.	Item No. In the BoQ	Reduced rate/unit
--------	---------------------	-------------------

Signature of Contractor

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

TAMILNADU WATER SUPPLY AND DRAINAGE BOARD

Forwarding Slip to The Lump sum Agreement No.

1. Name of Work :
Estimate Amount :
- Sanctioned in Original Estimate No. :
- Revised Estimate No. :
2. Name of Contractor and Address :
3. Original or Supplemental :
4. If Supplemental, Original Agreement No. :
5. Approximate value of work :
to be done under this Agreement :
6. If this is Supplemental, approximate value
of works to be done under Original
Agreement :
7. If bids have been called for, is the lowest :
tender accepted?
If not reasons to be recorded
8. Has the contractor; signed the divisional :
copy of TNBP and Its addenda volume
brought upto date.
9. Is data furnished for all items of :
works noted in the Schedule

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

10. Are the rates in Agreement within the :
estimate rates or schedule of rates
whichever is less and the Lump sum
provision sufficient or likely to be
exceeded.

II. Additional Information

A. Original Agreement

1. Original Agreement amount of tender excess :
and percentage over the estimate rate.
2. If concessional rate of EMD & SD have :
been allowed ref. to sanction thereof

B. Supplemental Agreement

1. Whether the approval of the competent :
authority has been obtained for the rates as
required as per B.P.Ms.No.27/CMW/
dated 5.2.2002
2. If entrusted without tenders whether sanction :
is necessary with reference to total value of
work covered by the supplemental agreement
so far accepted.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

TAMILNADU WATER SUPPLY AND DRAINAGE BOARD

Form of Agreement (Lump sum)
 Articles of Agreement made this-----

Day of -----
 between Thiru-----

hereinafter referred to as the contractor which expression shall where the context so admits include his heirs, executors, administrators and legal representatives of the one part and the Chief Engineer, Tamil Nadu Water Supply and Drainage Board (hereinafter called the Employer) which expression shall where the context so admits include its successors in office and assigns) of the other part. Whereas the contractor delivered to the Employer the bid which was opened on -----
 ----- whereby the contractor offered and undertook to carryout the works specified under this contract and allied work, i.e. (name of work) -----

In the State of Tamil Nadu in India, and provide the works, materials matters and things described or mentioned in these presents at the prices set forth in the schedule annexed to such bid and the contractor also undertook to do all extra and varied works which might be ordered as part of the contract on the terms provided for in the conditions and specifications hereto annexed and the Employer accepted such tender in pursuance where of the parties hereto have entered into this contract.

And whereas the contractor in accordance with the terms of the said Bid has deposited in the Office of the -----
 Engineer, TWAD,-----as performance security for the due and faithful performance by the contractor of this contract, the sum of Rs.-----
 -----(Rupees-----
 -----)

And whereas the contractor fully understands that on receipt of communication of acceptance of bid from the accepting authority, there emerges a valid contract between the contractor and the Employer represented by the Officer accepting the agreement and the bid documents, i.e. invitation for bids, letter of application, bill of quantities and other schedules, general conditions of the contract, technical specifications of the bid, negotiation letter, communications of acceptance of bid, shall constitute the contract for this purpose and be the foundation off rights of both the parties, as defined in clause 8.1 of ""Bid Documents "Now hereby agreed that in consideration of payment of the said sum of Rs. (Rupees)

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

or such other sum as may be arrived at under the clause of the General conditions of the contract relating to payment by final measurement at unit prices, the contractor shall and well within the time specified in his bid thoroughly and efficiently and in a good workman like manner perform, provide, execute and do all the works, materials matters of things incidental to or necessary for the entire completion of the works specified under this contract and necessary works including all works shown in the drawings hereinafter referred to or described or set forth the said specifications and schedule hereto annexed and in accordance with such further drawings and instructions as the Engineer of the Board or other Engineer duly authorized in that behalf (therein after) and in the annexed documents referred to as the Engineer) shall at any time in accordance with the said schedule (Bill of Quantities) and specifications provide and give together, with any alterations in the works or additions thereto, in the time and manner in such schedule (Bill of Quantities) and specifications stipulated to the entire satisfaction of the Engineer, the Employer for themselves and their successors convenient and agree with the Contractor that during the progress of the works and on the completion of contract to the satisfaction of the Engineer, the Employer shall and will from time to time on receiving the certificates in writing of the Engineer pay to the contractor according to such certificates and the terms of this contract the price or sum mentioned in such certificates as due to the contractor under the terms of this contract subject nevertheless to deductions or additions thereto or therefrom which may be lawfully made under terms of his contract. It is hereby mutually agreed and declared as follows.

- a) All certificates or notice or orders for items or for extra varied or altered works which are to be the subject of an extra or varied or altered works charge shall be in writing whether so described in the contract or not and unless in writing shall not be valid or binding or be of any effect whatsoever.
- b) The term contract include these presents and the invitation for bid, bid documents, bill of quantities and other schedules, general conditions and specifications hereto annexed and the plans drawings herein and hereafter referred to.
- c) If the contractor claims that the decisions or the instructions of the Employer are unjustified and that accordingly, he is entitled to extra payments on account thereof he shall forthwith notify this to the Employer to record his decisions and reasons therefor in writing and shall within two weeks state his claims in writing to the Employer thereafter. The Employer shall thereafter within four weeks of the receipt of the claim, reply to the points raised in the claim. Unless resolved by negotiation or discussions immediate thereafter, within further four weeks the question of liability for such payment will be treated as a dispute.
- d) In the contract whenever, there is as discretion or exercise of will, by the Employer during the progress of the work, the mode or manner of the exercise of discretion shall not be a matter for dispute.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

e) The decision of the Employer shall be final conclusive and binding on all, Parties to the Contract upon all questions relating to the meaning of specifications, designs, drawings and instructions, and as to the quality of workmanship or material used on the work or any matter arising out of or relating to the specifications, designs and drawings and instructions concerning the works or the erection of or failure to execute the same arising during the course of works. The above shall not be the subject matter of dispute and in no case shall the work be stopped consequent on such a dispute arising and the work shall also be carried out by the contractor strictly in accordance with the instructions of the Employer.

f) In case any question, difference or dispute shall arise on matters other than clauses (d) and (e) above and except any of the "excluded matters" mentioned in bid documents touching the construction of any clause herein contained on the rights, duties and liabilities of the parties hereto or any other way touching or arising out of these presents, the same shall.

Settlement of dispute

Dispute Redressal Committee

In order to ensure a dispute Redressal mechanism, a Committee headed by the Managing Director, Joint Managing Director and consisting of Engineering Director, TWAD Board and Engineering Director, CMWSS Board as Member, will comprise the "Dispute Redressal Committee" for each package in order to resolve any disputes between the Employer / Engineer – in charge concerned and the contractor

i) In the event of any dispute arising between parties here to in respect of any of the matter comprised in this contract, the same shall be settled by a competent court having jurisdiction over the place where contract is awarded and agreement is concluded and by no other court.

ii) Provided always the contractor shall not except with the consent in writing of the Engineer in any way, delay carrying out works in any such matter, question or dispute being referred to court but shall proceed with the works with all the diligence and shall until the decision of the Employer and no award of Competent Civil Court shall relieve the contractor of his obligations to adhere strictly to the instructions of the Engineer with regard to the actual carrying out of the works.

g) Time shall be considered as essence of the contract and the contractor hereby agree to commence the work immediately after taking over of site or signing the agreement whichever happens earlier, complete the work within _____ months and to show progress at the stipulated milestone.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

In witness where of the contractor

and the

Employer on behalf

of the Board have caused their common seal to be affixed the day and year first
above written Signed, sealed and delivered by the said.

In the presence of

Signature of Contractor
Name and Seal.

Signature, Name and
Designation of Witness.

Signed by on behalf of
TWAD Board.

Signed, Name and
Designation of Witness

CHIEF ENGINEER
TWAD BOARD

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

INDEMNITY BOND

This deed of indemnity bond executed at _____ (place) on this _____

Day of _____ (month) _____ year by and between Thiru/Tmt. _____ (Name)

widow/Wife/Son/Daughter of Thiru / Tmt residing at _____

(Full Address) (hereinafter called

“Contractor” which expression unless excluded by or repugnant to the context include his/her heirs, executors administrators and legal representatives) to and in favour of the TWAD Board (hereinafter called” the Engineer, which expression shall unless excluded by or repugnant to the context include its successor and assigns) represented by the Superintending Engineer of Circle/Executive Engineer of division. Assistant Executive Engineer of sub division(Place)shown as follows.

2. Whereas the contractor has submitted the bid for (description of work) at (place of work or supply) and such bid has been accepted subject to the relevant conditions to contract appended to Tamil Nadu Building Practice and other conditions issued along with bid documents.

3. And where as in pursuance of the terms of contract, that a sum equal to 21/2% of the total value of work done have been retained with the Employer for a period of two years reckoned from the date of completion of the work in order to enable the departmental officers to watch the effect of all seasons on the work and the structural stability of the work executed by the contractor.

4. And whereas it was decided to refund the said sum equal to 21/2% of the total value of the work done retained with the Employer on the expiry of two years period reckoned from the date of completion of work provided that the contractor execute an indemnity bond for a period of three years indemnifying the Board against any loss or expenditure incurred to rectify any defect noticed due to the faulty workmanship by the contractor or substandard material used by the contractor during the period of three years.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

5. Now this deed of indemnity witness that in consideration of the contract entrusted to the contract or by the Employer, the contractor has agreed to the following terms and conditions and executed this indemnity bond in conformation of all and undertakes to comply with the terms referred to infra.

6. The contractor both hereby indemnify the Employer against any loss or damage that may be caused to the Employer in respect of rectification of any defect noticed due to the faulty workmanship by the contractor, or substandard material so used by other contractor in the execution of work entrusted to the contractor during the period of three years i.e. from up to (dates to be specified)

7. It is hereby confirmed that in all other respects, the agreement conditions will be binding between the parties.

In witness whereof Thiru / Tmt / Miss

Contractor has signed this deed on this day of month

year.

Witness:

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

INDEMNITY BOND

(In lieu of water tightness and structural stability)

To accompany the Lump sum agreement No.

This deed of Indemnity made this day of _____ between
 Thiru S/o _____ (hereinafter called contractor " which
 expression shall unless excluded by or repugnant to the context include his
 heir/executors, administrators and legal representatives) and in favour of the
 Tamil Nadu Water Supply and Drainage Board (hereinafter called the Employer
 which expression shall unless excluded by or repugnant to the context include its
 successors and assigns) represented by the Superintending Engineer/
 Circle _____ Executive Engineer , Division _____

Assistant executive Engineer Sub division as follows:

Whereas the contractor agreed to construct a reinforced cement concrete
 Elevated Service Reservoir / Sump of _____ lakhs litres capacity including
 pipe connections as per departmental plan and designs under _____ water
 supply scheme Rs. _____ (Rupees _____
) as per Lump Sum Agreement No. _____ /and
 two of the conditions of the said agreement are:

1. That the contractor should produce a water tight structure and guarantee its
 water tightness for two years as per clause in Form in General conditions of
 contract, definitions and interpretations.
2. That in lieu of the 40% (Forty percent) of the amount of each bills scheduled to
 be withheld from the payment and kept with the Employer with security deposit till
 the expiry of the above guarantee period and till a certificate of soundness of
 structure is furnished by **the Executive Engineer, TWAD Board, Project
 Division, Nagercoil** the contractor has agreed to execute an Indemnity bond
 vide clauses in Form in General conditions of contract, definitions and
 interpretations of Lump Sum Agreement No.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

And whereas the Employer has agreed to accept a deed of Indemnity from the contractor in lieu of 40% (Forty percent) of the amount of each bill to be withheld from payment.

Now these present witness that in pursuance of the above said agreement and for the consideration above said, the contractor hereby agrees with the Employer that he will at all times indemnify and keep harmless of the Employer as a result of the failure of the contractor to remedy or to replace any failure or defects in the water tight structure for a period of two years from the date of commissioning which includes maintenance period of one year.

The contractor further agree with the Employer that on receipt of the report of the Engineer in charge about any failure or defects noticed in the structure within a period of two years from the actual date of commissioning and handing over to the Employer after maintenance for one year, a joint inspection has to be made immediately by the Engineer of the contractor and the Engineer in charge of water supply scheme and if in the opinion of the **Executive Engineer, TWAD Board, Project Division, Nagercoil**

The failure or defects noticed are due to the defects in the structure (construction) the contractor undertakes to rectify or replace immediately the structure at contractor's cost and the contractor agrees to extend the guarantee period for two more years from the date of rectification of the defects.

The contractor further agrees with the Employer that in the case of any dispute arising between the contractors on one hand and the **Executive Engineer, TWAD Board, Project Division, Nagercoil** on the other hand as to any matter relating to the defects or failure noticed in the structure and the contractor's guarantee for water tightness for a period of two years from the accepted date of completion of the structure as indicated above such dispute shall be referred to the Chief Engineer, TWAD Board , Madurai whose decision shall be final. In witness whereof Thiru. S/o

District and the Chief Engineer / Superintending Engineer / Executive Engineer, Tamil Nadu Water Supply and Drainage Board acting on behalf of the Tamil Nadu Water Supply and Drainage Board have hereunto set their hands on the day and the year first written above.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

PERFORMANCE BANK GUARANTEE (UNCONDITIONAL)

To

The Executive Engineer, TWAD BOARD, Project Division, Nagercoil

----- (Name of Employer)

----- (Address of Employer)

WHEREAS----- (name and address of contractor)

(hereinafter called "the contractor" has undertaken, in pursuance of contract

No.----- Dated

----- to execute----- (name of contract and brief description of works) hereinafter called "the contract"

AND WHEREAS it has been stipulated by you in the said contract that the contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein, as security for compliance with his obligations in accordance with the contract.

AND WHEREAS the contractor has requested us to give the Bank Guarantee

AND WHEREAS we have agreed to give the contractor such a Bank Guarantee unconditionally and irrevocably to guarantee as primary obligator and not as mere surety, all the payments to the -----

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the contractor, upto a total of -----
 ----- (amount of Guarantee) -----
 ----- (amount in words such sum being payable in the types and proportion of currencies in which the contract price is payable, and we undertake to pay you unconditionally and irrevocably upon your first written demand and without cavil or argument, any sum or Sums within the limit of -----
 ----- (amount of Guarantee) as aforesaid without you needing to prove or to show grounds or reasons for your demand for the sum specified therein.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

We hereby waive the necessity of your demanding the said debt from the contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the contractor or of the Works to be performed thereunder or of any of the contract documents which may be made between you and the contractor shall in any way release as from the liability under this guarantee and we hereby waive notice of any such change, addition or modification.

The Bank Guarantee is drawn at -----branch of-----
-----bank in -----Town in Tamil Nadu only.

This guarantee shall be valid until 28 days from the date of expiry of the defects liability period.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank -----

Address -----

Date -----

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

BID SECURITY (BANK GUARANTEE)

WHEREAS, _____ [name of Bidder] (hereinafter called "the Bidder") has submitted his Bid dated _____ [date] for the construction of _____ [name of Contract] (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that We _____ [name of bank] of _____ having our registered office at _____ (hereinafter called "the Bank") are bound unto _____ [name of Employer] (hereinafter called "the Employer") in the sum of _____¹ for which payment well and truly to be made to the said Employer the Bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____ day of _____ **2020** .

THE CONDITIONS of this obligation are:

- 1) If after Bid opening the Bidder withdraws his bid during the period of Bid validity specified in the Form of Bid;
or
- 2) If the Bidder having been notified of the acceptance of his bid by the Employer during the period of Bid validity:
 - (a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or
 - (b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders; or
 - (c) does not accept the correction of the Bid Price pursuant to Clause 28.2;

we undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or any of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date _____ days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

DATE _____ SIGNATURE OF THE BANK

WITNESS _____ SEAL _____

[signature, name, and address]

- 1 The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in Clause 16.1 of the Instructions to Bidders.
- 2 45 days after the end of the validity period of the Bid.

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

BILL OF QUANTITIES

(To be furnished separately as Price Bid)

General

The Bill of Quantities shall contain items for the construction, installation, testing, commissioning and maintenance of the Works to be carried out by the Contractor. The Bill of Quantities will be used to calculate the Contract Price. The contractor shall be paid for the quantum of work done at the rate quoted for each item in the Bill of Quantities.

Where there is a discrepancy between the rates in words and figures, the lesser of the two will only be taken in to consideration.

Where there is a discrepancy between the unit rate and line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.

Where there is an arithmetical discrepancy in the page total as well as grand total, the corrected total by the Employer will govern.

The rates in the BOQ shall be for carrying out the work in conformity to the BIS, TNBP and Technical Specifications and other Terms and Conditions set out in the Bid Document.

All pages in the BOQ should be signed without omission. All corrections/overwriting should be properly attested by the Bidder.

Change in the Quantities

If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item/items, the rates as in the agreement for the relevant items shall be paid.

GST

GST is applicable as per GO. 296, Finance(salaries) Dept. Dt. 09.10.2017, GOI, Ministry of finance – central tax (Rate) New Delhi, notification No. 12/2017/ Dt. 28.06.2017 and 20.10.2017 and as amended from time to time.

From every payment made to the firm/ contractor, deduction at source towards GST shall be made for civil works contract as per Government of India, Ministry of Finance/ Department of Revenue, New Delhi Notification No. 20 / 2017 – Central Tax (Rate) / Dt.22.08.2017 subject to issue of amendments from time to time.

Name of Work: **Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion 12 months)**

Item No.	Description of work	Probable quantity Figures	TNBP No. Other specification	Units in	Rates in		Amount in figures
					Figures	Words	
1	2	3	4	5	6	7	8
Vide separate sheets attached.							

CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

TECHNICAL SPECIFICATIONS INDEX

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CONTRACTOR

Sd/-CHIEF ENGINEER, TWAD, MDU

I MATERIALS

All materials required for the works shall be procured and supplied by the contractor himself. The materials shall be of good quality and conforming to relevant BIS. The materials which are classified for ISI marking should be supplied with ISI marking only.

1. Cement and Steel

1.1. The entire quantity of cement and steel required for the work will be procured by the contractor. The contractor is responsible for all transport and storage of the materials and shall bear all related cost. The Employer shall be entitled at any reasonable time to examine the cement and steel supplied by the contractor.

1.2. The cement procured by the contractor shall comply with requirements of IS 269/1976 with the latest revision thereof for ordinary port land cement. It shall be of the best normal setting quality unless specially rapid hardening or quick setting quality if expressly instructed by the Engineer to be supplied. Each bag shall bear ISI Certification mark and as per specification no.10 of TNBP Volume I.

1.3 The steel bars shall comply with the requirements set forth in the IS 432 Part I, IS 1139, IS 1786 as the case may be with the latest revision thereof and the test as described for ultimate tensile strength, bond test and elongation tests. All reinforcing steel shall be clean and free from oil, grease, loose scales or rust or other coatings of any character which would reduce or destroy the bend. Each band containing the bars shall bear the ISI Certification mark.

1.4 The cement/steel shall be tested in TWAD Board laboratories. Two samples should be taken by the Engineer in charge in the presence of the contractor or his authorized representatives or the technical personnel employed by the Contractor as in the agreement. The contractor shall without extra cost provide samples and cooperate in the testing of the cement/steel. One sample shall be got tested and the other sample shall be retained by making clear identification in the sample by the Engineer in charge so as to identify at a later date. The testing charges will be paid by TWAD Board and for failed samples, contractors have to borne the charges.

CONTRACTOR

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1.5 All cement shall be procured in bags and shall be stored in a dry place for which the contractor shall be responsible. Consignment of bagged cement shall be properly stacked in a manner which will permit easy access for inspection and definite identification. Cement shall be used in approximately in the chronological order in which it is received, but cement that has been stored for a period longer than 4 months from the date of initial sampling shall not be used unless it has been retested at the expenses of the contractor and passed by the Engineer in charge as good quality on the retest. Cement aged more than 180 days from the date of initial sampling shall be rejected.

1.6 Cement which has become caked or perished shall on no account be used on the works and shall be rejected. Although the Engineer may have passed any consignment, he shall however have the power at the subsequent time to reject such consignment if he finds that any deterioration in the quality thereon has taken place.

1.7 A record of the quantity cement /steel procured with the name of dealer, bill number and date shall be maintained by the contractor. This should be produced for examination by the Engineer in charge at any time. The age of the cement shall be reckoned from the date of manufacture and it shall be verified by the Engineer in charge.

1.8 The rejected consignment of cement and steel should be removed from the site within two days.

2. Aggregates

2.1 Sand for use in masonry and plaster works shall conform to relevant specification in TNBP (specification No.7) and I.S. 2116/1985, 1.S.1542/1977.

2.2. The coarse and fine aggregates for concrete shall conform to I.S. 383 /1970 and as specified in the relevant clauses of I.S. 456/ 1978. Other aggregates free from deleterious materials shall be used at the concurrence and approval of the Engineer after sufficient tests have been carried out at the contractor's cost.

2.3. The maximum quantities of deleterious materials in the aggregates, as determined in accordance with I.S 2386(Part II) /1963 shall not be exceed the limits given in table I of I.S.383. Unless otherwise specified all coarse aggregate in RCC shall be graded aggregate of 20 mm. nominal size.

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All aggregates shall be stored in hard impervious surface to ensure exclusion of all foreign materials and as per IS 4082/1977 and specification No.5 of TNBP volume I.

3. Water required for Construction

3.1 The water used in the construction shall be of potable quality and shall be tested at the contractor's cost. The contractor has to make his own arrangements at his cost for water required for construction, testing, filling etc. either from local bodies or from elsewhere, by paying the charges directly and arranging tanker etc., as per necessity. No claim for extra payment on account of non availability of water nearby or extra lead for bringing water shall be entertained. All required piping arrangements and pumping if required for water shall be made by the contractor at his cost. Water for mortar, mixing and curing of concrete shall be free from harmful matter or other substances that may be deleterious to concrete or steel and taken from source approved by the Engineer. Ground water for mixing and curing shall conform to the provisions in the class 4.3 of IS 456/1978.

4. Admixtures.

Only where a beneficial effect is produced shall any admixture be used and that too after test has been carried out to convince the Engineer that no harmful effect will be produced by the use of such admixture and after approved by the Engineer. The admixture shall conform to IS 9103/1972.

5. Form Work and Centering

5.1 Steel/wooden form centering shall be used. If wooden form work is used, it shall consist of planks not less than 40 mm thick and strong props. This shall be providing complying with clause 10 of IS 456 /1978 and specification no. 30.8 of TNBP. The timber of form works shall be best hard wood and got approved by the Engineer in charge. This shall be deemed to be included in the items of contract even otherwise specified.

6. Separator (Cover Block)

6.1 For bottom cover of beams, slabs etc., separators of pre cast cement motor blocks of suitable size with wire embodiment as directed shall be used and tied to

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the reinforcement. Between layers of reinforcements, separators consisting of pieces of bars of suitable diameter shall be used. The required cover shall be provided as per clause 24-4 of IS 456/1978

7. Pipes, Specials and Valves.

7.1. General.

7.1.1 All types of pipes required for the works should be good quality conforming to relevant BIS and should be procured from reputed manufacturer or his authorized dealer. Each pipe should bear the trade mark of the manufacturer, the nominal diameter, class, weight, batch number and the last two digits of the year of manufacture suitably and legibly marked on it. The Engineer shall have the right to conduct any test to ascertain the quality of the pipes supplied by the contractor. The contractor should make all necessary arrangements for testing the pipes. The testing charges will be paid by TWAD Board and for failed samples, contractors have to borne the charges. The materials which are classified for ISI marking should be supplied with ISI marking only.

7.1.2 If on examination of any sample from any portion of the supply, the materials is found to be sub standard and not fully in accordance with the relevant specification, the entire consignment shall be rejected. In case of doubt whether the materials conform to the specification or not, the decision of the Executive Engineer shall be final

7.2 C.I PIPES.

7.2.1 CI pipes shall be procured from the reputed manufacturer and the pipe shall conform to IS 1536/1976 or IS 1537/1976. The pipes shall bear ISI mark. The test certificate furnished by the manufacturer should be produced.

7.3 HDPE PIPES:

MATERIAL : HDPE (High Density Polyethylene)

REFERENCE : STANDARD-ASTM D 3035, F714, ISO, ISI, BSS.

HDPE FUSION WELDING : Fusion welding is commonly used in HDPE and is a Permanent type of joint.

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The pipe should be cut square and face of the pipe should be slightly scrapped prior to remove oxidized layer. At the time of welding, leveling of the pipes is essential. Particularly in case of larger diameter pipes. Welding temperature should be 200 deg. C and surfaces of heating mirror should be 210 deg. C at 5 deg. C heating mirror is a metallic plate heated up to the required temperature either by electrical coil heating inside or blow torch. The word mirror has come because this heating plate radiates heat. The welding of the pipe should be held in either side of the heating mirror with only contact pressure of about 0.2 kg/cm². When the rim of molten material is found the pipes are removed from the heating mirror and immediately the joints is made application of moderate pressure of approximately 1 to 2 Kg/cm² for 2 to 3 seconds. The initial heating time for achieving molten rim, varies from 1 to 10 minutes depending upon the pipe wall thickness and size.

It is essential to see that the rim formed is not excessive.

While jointing, the pressure should be maintained until the joint is luke warm and after the pressure is relieved, the joint allowed to cool completely.

The mirror should be kept exactly around 210 deg. C which needs about 30 minutes time (Form Electrical Mirror). It is also essential to see that the temperature is maintained constant by the proper setting of regulator. For detecting the correct temperature, Crayon chalk is used for example at 210 deg. C the color of crayon dot on the mirror change within 10 seconds. But, the dot made should be thin and if not, time take a will be more indicating a wrong temperature.

STRENGTH:

A satisfactory butt welded joint of HDPE will have the strength factor of one. Temperature is of primary importance and weld efficiency may decrease if the temperature is more or less than 210 deg C.

7.4 Ductile Iron pipe

Ductile Iron pipe shall be procured from the reputed manufacturers and the pipes shall confirm to IS 8329/2000. The pipes diameter given in

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schedule is the clear inner diameter. The pipe and specials should be supplied with inside lining with a cement mortar of standard thickness and specifications and outside coating of Metallic Zinc as per I.S. specifications. The pipes should be with ISI marking. The test certificate furnished by the manufacturers should be produced.

7.5 PVC pipes.

7.5.1. The unplasticized PVC rigid pipes shall strictly conform to IS 4985/2000 and as amended from time to time and shall carry ISI marking in every pipe.

7.5.2. The contractor should procure the PVC rigid pipes from a reputed manufacturer.

7.5.3 The contractor should furnish the test certificate issued by the manufacturer.

7.5.4 The manufacturer's test certificate and third party inspection certificate should be produced by the contractor for the pipes used in the works.

7.5.5 In addition to third party inspection, wherever felt necessary, the Engineer shall have the power to test the PVC pipes for its quality such as specific gravity, impact strength at 0°C, internal hydraulic pressure test, diameter, thickness etc, in TWAD Board laboratory.

7.5.6 The PVC pipes joints shall be with solvent cement of good quality, confirming to IS 14182/1994.

7.5.7 The Engineer in charge, shall verify, in addition to the test certificate, whether the pipes are as per BIS, by visual examination, diameter, weight, wall thickness, flexibility, color etc.,

7.5.8 All the PVC specials required for use in conjunction with PVC pipes, should be got approved by the Engineer-in-charge.

7.6 GI pipes

GI pipes should be procured by the contractor from reputed manufacturer or from their authorized dealer of reputed manufacturer and should conform to IS 1239 /part I, namely the inner and outer diameter, length and weight. The pipes which are found to be not conforming to relevant specification shall be rejected by the Engineer-in-charge.

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7.7 CI D/F Pipes

The CI D/F Pipes procured for use in the work should conform to the relevant BIS Specification and suitable for use in the work.

Valve

- 7.7.1 The contractor should procure reputed make of sluice valves, scour valves, reflux valves and air valves from the manufacturer or his authorized dealer and they should conform to the relevant BIS Specification and suitable for use in the work. The valves shall bear ISI marks.

7.8 CI/PVC/GI Specials and Fittings

- 7.8.1 The specials and fittings should be in conformity to the relevant BIS specification.

7.9 Testing of pipes

- 7.9.1 The manufacturer test certificate/third party inspection certificate should be produced by the contractor for the pipes used in the work. The engineer shall have the right to test the pipes, wherever felt necessary for its quality. The testing charges will be paid by TWAD Board and for failed samples, contractors have to borne the charges.
- 7.9.2 Testing of materials to be used in works, for the quality of finished items shall generally be done in the TWAD Board laboratory by providing requisite materials, transport of test specimen and other assistance required thereof. The testing charges will be paid by TWAD Board and for failed samples, contractors have to borne the charges

8. Water meter

- a) Water meter should be supplied conforming to ISO 4064 Class B
- b) Life cycle test certificate approved by M/S. Fluid Control Research Institute, Palghat (or) through National Physical Laboratories (NPL), New Delhi (or) any other National Accreditation Board of Laboratories (NABL), approved Government Organization should be furnished.

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II. CIVIL WORKS

1.General

1.1 Tamilnadu Building practice (TNBP) shall be strictly followed for carrying out different items of the work for which no standard specifications are available and no alternate specification have been given under the description of works.

1.2 Where any provision of the TNBP is repugnant to or at variance with any provision under BIS or description of work, technical specifications and conditions of contract, the provisions of the latter shall be deemed to supercede the provision of the TNBP.

2.Earth work

2.1 Specification.

Tamil nadu Detailed Building Practice(Specification No. 23 to the extent applicable) shall be followed for earthwork excavation.

2.2 Conveyance

The excavated earth, blasted rubble etc., shall be conveyed and deposited in the departmental lands within 150m. of plant site and as directed by the Engineer in charge.

2.3 Stacking.

Where the location of the work is such and does not permit the deposition of excavated earth while digging trenches for laying pipes, the excavated earth should be conveyed to a convenient place and deposited there temporarily, as directed by the Engineer-in-charge. Such deposited soil shall be re conveyed to the site of the work for the purpose of refilling of trenches, if it is suitable for refilling. The unit rate for trench work of excavated and refilling shall include the cost of such operation

2.4 Disposal of surplus Earth

The excavated soil which is surplus to that required for refilling and after allowing for settlement will have to be removed, spread and sectioned at places shown on the site during execution for purpose of widening or leveling the road. Sectioning is to be done as detailed in TNBP. It is to be understood that no extra payment, will be made for this and the unit rate for trench work of excavation and refilling shall include the cost of removal of surplus earth to disposal site approved by the Engineer-in-charge, its spreading and sectioning at the bidder's expense.

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2.5 Shoring, Strutting and Baling out Water

The rate for excavation of trench work shall include charges of shoring strutting, bailing out water wherever necessary and no extra payment will be made for any of these contingent works. While bailing out water, care should be taken to see that the bailed out water is properly channellized to flow away without stagnation or inundating the adjoining road surfaces and properties.

3. Concrete

3.1 Specification

Concrete for use in the works shall generally comply with TNBP(specification No.30) and the relevant BIS. The concrete mix shall be specified proportions satisfying the maximum aggregate size, water cement ratio and required cube strength and workability as per IS 456-1978. Such concrete must be adequately vibrated to form solid mass without voids. The entire concreting works should be done only with the prior approval and in the presence of Engineer in charge.

3.2 Mixing of Concrete

The concrete shall be proportioned as far as cement and aggregates are considered by volume. The amount of water required being measured either by weight or volume the adjustments must be made to frequent intervals at the discretion of the Engineer or his assistant to account for the moisture content of the aggregates. The mixing operation shall be performed only a mechanical concrete mixer and shall continue until the whole batch of uniform consistency and colour. The mixing of concrete shall be done in accordance with clause 8 and 9 of IS 456-1978.

3.3 *Transporting, Placing and Compacting Concrete*

3.3.1 Transportation, placing and compaction of concrete mix by mechanical vibrators shall be done in accordance with clause 12 of IS 456-1978. It is imperative that all concreting operations be done rapidly and efficiently with minimum re handling and adequate manpower shall therefore be employed to ensure this.

3.3.2 The forms shall be first cleaned and moistened before placing concrete.

3.3.3 The mix should be dropped from such a height as it may cause segregation and air entrainment. When the mix is placed in position, no further water shall be added to provided easier workability.

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- 3.3.4 No concrete mix shall be used for the work if it has been left for a period exceeding its initial setting time before being deposited and vibrated into its final position in the member.
- 3.3.5 While one concrete is being placed in position it shall be immediately spreaded and ramped sufficiently and suitable to attain dense and complete filling of all spaces between and around the reinforcement and in to the corners of form work for ensuring a solid mass entirely free from voids.
- 3.3.6 Construction joints required in any of the structural members shall be provided generally complying with clause 12.4 of IS 456-1978 and as directed by the Engineer in charge. The efficiency of tempering and consolidation will be judge by complete absence of air pockets, voids and honey combing after removal of form works.

3.4 *Curing*

- 3.4.1 Curing shall be done to avoid excess shrinkage or harmful effort to the members generally complying with clause 12.5 of IS 456-1978.
- 3.4.2 The method adopted shall be effective and any special method used must be approved by the Engineer and be subject to complete supervision.
- 3.4.3 Any deficiency in concreting such as cracking, excessive honeycombing, exposure of reinforcement or other fault which entail replacement of the defective part by fresh concrete and whatsoever remedy reasonable required without hampering the structural safety and architectural concept, all at the cost of contractor.

3.5 *Removal of Form Work*

- 3.5.1 Removal of form work shall be done as per TNBP and BIS and as directly by the engineer in such a manner that no damage is caused to the structures. The striping time shall not be less than that indicated in clause 10.3 of IS 456-1978.

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3.6 *Testing of Concrete*

- 3.6.1 During the course of construction works, preparation of test specimens, curing and casting of concrete shall be done in accordance with IS 1199 and IS 516 to ascertain the strength requirements and acceptance criteria indicated in IS 456-1978. The contractor shall provide all apparatus, labour and arrange to test the cubes at his own cost at the test laboratory decided by the Employer.
- 3.6.2 In addition to the above tests, any other test which may if desired by the Engineer in charge be carried out from time to time as per relevant specifications at the cost of contractor. In case the concrete does not meet the strength required. All corrective measures shall be taken at once at the contractor's cost.
- 3.6.3 The inspection and testing of structures shall be done in accordance with clause 16 of IS 456-1978
1. *Masonry*

4.1 All masonry works such as Random Rubble /Coarsed Rubber/Brick work must be done as per TNBP Specification and Bid schedule specification.
 2. *Plastering*

5.1 Plastering would be 12mm, 20mm and 25 mm. thick cement plaster either plain or water proof as may be specified.

5.2 The plastering items shall be executed in thickness and cement mortar of proportion as detailed in respective item in the BOQ. Similarly the plastering shall be either ordinary or water proof as specified in respective item in the BOQ.

5.3 In case of water proof plaster standard and approved water proofing compound shall be mixed in cement mortar in required percentage as directed and then the plaster is applied.

5.4 The finishing shall be either smooth or rough as may be directed by the Engineer unless otherwise specifically mentioned in the BOQ.

5.5 Neat finish wherever directed by the Engineer shall be done at no extra cost.

5.6 Curing and watering shall be done as directed and plaster shall be in alignment and level. Any substandard work is liable to be rejected and shall have to be re-done at contractor's cost. Sand to be used shall be of approved quality only. Cost of all scaffolding shall be included in the rates quoted in the BOQ.

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III. SOURCE CREATION

Name of Work: Providing WSIS to Kuzhithurai Municipality in Kanyakumari District including maintenance for a period of 12 months (Period of completion 12 months)

SOURCE : Surface water from River Kuzhithuraiyar downstream of Nesamony Bridge near Gnaravilai 6.0m dia. In take well - 1 No.

III . 1. GENERAL SPECIFICATION

1. Detailed sieve analysis of the sample of soil is to be made before taking up the work. The contractor should submit a detailed report to the department and get clearance from the Executive Engineer for proceeding with the work further.
2. Reduced levels of various components of collector well cum pump house should be maintained very carefully at every point.
3. Design mix should be verified by the contractor at his own cost by conducting laboratory tests using the actual materials at site. The extra charges will not be paid by the employer.
4. Cube test should be conducted for every work during execution in the nearby laboratory and the results shall be communicated to the Engineer-in-charge then and there. The unit rates quoted in the price bid includes these types of tests also.
5. The results of tests conducted as above should be furnished to the Engineer concerned before carrying out the work and clearance to be obtained then and there before proceeding with the above items of work
6. Plugging of bottom of collector well should be done effectively with special tools and plants to ensure water tightness.
7. The contractor should conduct necessary pumping tests to prove that the radial arms are driven on to correct alignment, levels and without any gap or damage to radial pipes and to prove that required quantity of water should be abstracted during summer. The required pumps, tools and plants should be used by the contractor himself. No separate charges will be paid to the contractor on this account.

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III . 2. EARTHWORK EXCAVATION :

1. The levels in the drawings are only approximate for guidance of the Contractor in general. From the date of execution the Bed level and the sub-soil water level as noted will be reckoned. Thus the payment will be regulated according to the sub-soil water level observed.
2. In regards to the width of the excavation of work above or below water level, sketch will be furnished to the Contractor and payment will be restricted as per section shown in the plans irrespective of the facts that the Contractor excavates the same with more side slopes for his own convenience.
3. The Contractor has to fix up and maintain necessary sight rails and ranging rods etc. as required by departmental officers for checking the various levels.

III . 3. EXCAVATION FOR FOUNDATION :

1. Unless otherwise specified, open well excavation shall be resorted to upto water levels as directed by the Engineer.
2. All precautionary measures for the safety of labourers while excavation shall be made as per the relevant BIS for the safety code for earthwork.
3. The quantities furnished in the BOQ are only approximate. Any omission or excess in quantities may arise during execution according to the site condition. Any alteration of work or any additional work during execution has to be done by the Contractor. If no rate in the BOQ is applicable or derivable for the additional works, the rates will be arrived at as per rules and regulations governing for the working out of rates for supplemental item of work and will be paid to the Contractor.

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IV. PIPE LAYING WORKS

1. General.

- 1.1 The earthwork for the pipe laying work shall generally conform to the details given below:

Sl No.		Dia. of pipe in millimeter	Depth of Bottom of pipe below at ground level in centimeter	Width of trench bottom in centimeter
1.	PVC Pipe up to	140	105	60
2.	For other Pipes up to	150	105	75
3.		200	110	80
4.		250	120	80
5.		300	135	80
6.		350	145	90
7.		400	155	90
8.		450	170	100
9.		500	185	100
10.		600	205	110
11.		700	230	120
12.		750	245	125

- 1.2 Wherever necessary, sand cushioning for the bed shall be given as per IS Standards and as directed by the Engineer in charge. The pipe should be laid true to the alignment line and grade. Wherever necessary, appropriate bends should be used. The pipes laid must be jointed properly and carefully by using approved type of jointing materials.

- 1.3 After the pipes are laid and jointed, the pipelines are to be subjected to hydraulic pressure test as detailed in the relevant BIS Specification for various types as indicated below.

A.C. Pressure pipes	..	Clause 2 of IS 6530/1972
Cast iron Pipes		Clause 6 of IS 3114/1985
MS Pipes		IS 5822/1986
PSC Pipes		Clause 2 of IS 783/1985
DI Pipes		Clause 5 of IS 12288/1987
PVC Pipes		Clause 2 of IS 7634/1975
HDPE pipes		Clause 3.2.3 of IS 4984 : 1995

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In portion of pipe line, where the pipes have developed cracks or sweating, such pipes with jointing materials shall be removed and re laid with new pipes at the contractor's cost and the pipe line shall be re-tested to the entire satisfaction of the Engineer in charge. No extra payment will be made on this account. The bidder has to make his own arrangements for the procurement of the required equipments for testing of pipes which shall be subjected to such test as the Engineer-in-charge deems fit to ensure the accuracy of the gauge.

- 1.4 Refilling shall be done with proper compaction with excavated earth. In no case the contractor shall be allowed to refill the trenches in hard excavated portion to be refilled by the boulders or excavated stuffs. This portion of trench shall be refilled by the soft strata from excavated stuff from distance place at no extra cost. The refilling shall be done in 15cm thick layers duly waiting and compacting each layer. The refilling may be done up to a height of 20 to 30 cm than the natural ground level to allow that sinking afterwards. If the refilling gets sunk below the natural ground level at any time till the completion of the work, the contractor at his cost should make good there filling to the required level as may be directed by the Engineer in charge.
- 1.5 In case of pipe trenches, the Engineer may reduce the width of trench wherever a hard strata is met with, if he feels adequate and just sufficient to lay the pipe line in order to reduce the hard rock quantity. In such case the contractor will be paid as per the actual measurement.
- 1.6 If the work is in a residential area, the contractor should carry out the excavation carefully to avoid collapse of any structure.
- 1.7 Valves shall be provided with valves pits with proper cover to bear the loads coming on it as per bid documents and departmental drawings and specification. Public fountains, Fire hydrants shall be provided as per type design and specification.

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- 1.8 Adequate protective measures shall be taken against surge pressure. Zero velocity valves and air cushion valves should be provided at the appropriate places; Trust blocks and anchor blocks should be provided at all bends and appropriate places.
- 1.9 Water required for testing the pipeline shall be arranged by the contractor at his cost.

2. Laying of Cast Iron/DI Pipes

2.1 The laying and jointing of cast iron pipes shall be carried out as follows.

Before laying the pipes, the contractor shall carefully brush them to remove any soil, stones or other materials which may be therein. An even and regular bed having been prepared and joint pit excavated to form a recess under the socket of each pipe of no greater depth and width than to enable the pipe jointing to be properly done. Each pipe shall then be carefully lowered and placed singly in the trench and shall rest in the solid ground for a distance of not less than two thirds of its entire length. In places where the soil is not hard, cement concrete bed blocks or timber piles have to be provided under the pipes if directed by the Engineer in charge.

2.2 Pipes not Truly Laid

Any pipe or pipes laid, which on inspection are found to diverge from the true lines and levels shall be removed and re-laid to the true lines and levels and the old jointing properly cleared off the pipes and fresh joints made by the contractor at his expense. Any pipes damaged in removal shall be replaced by the contractor at his cost.

2.3 Cutting of C.I./DI Pipes.

Where necessary and as ordered by the Engineer in charge, the Contractor shall cut the pipes and fix and joint common collars for jointing spigot ends. The cut ends of the pipe shall be made truly at right angles with the axis of the pipe.

2.4 Covering up Open Ends.

The Contractor shall take particular care to ensure that the apertures and open ends of pipes are carefully covered whenever the workmen are not actually employed therein.

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2.5 *Jointing of C.I./DI Pipes.*

The trench must be kept quite dry during jointing unless in any particular case the Engineer permits laying of the pipe in wet conditions. Plain spigot and socket pipes shall be joined as follows.

a) Lead joints

Generally lead joints shall be used for all sizes. In the case of 100 mm pipes, cement joints may be used if specified in which case for every ten cement joints, one lead joint shall be used. Provision of lead joints shall also be made at street crossings, at closing joints and for all specials and as determined by the Engineer depending upon the site condition.

The spigot of the pipe must be forced well home into its socket and must be centered, so that the joint may be of even thickness all round. As many laps of white hemp spun yarn as may be needed to leave the space required for the lead shall be driven to the bottom of the socket without being forced through the joint into the pipe but carefully driven home with a caulking tool. The proper depth of each joint shall be tested before running the lead by passing completely round it a wooden gauge, notched out to the correct depth of lead, the notch being lead close against the face of the socket. The joints shall then be run with molten lead in sufficient quantity so that after being caulked solid, the lead may project 3mm beyond the face of the socket against the outside of the spigot but must be flush with the outside edge of the socket.

For pouring lead in the joints, a ring of hemp rope covered with clay shall be wrapped around the pipe at the end of the socket leaving an opening at the top of the socket into which the lead can be poured. The hemp rope shall be supported by clay packing so as to withstand the operation of lead pouring.

The lead used shall be carefully skimmed of all scale, when melted in a cast iron pot or patent melting machine. Sufficient lead shall then be taken by a ladle and run hot into the joint, and the joint filled at one running. The joint shall then be caulked when cool by a suitable caulking tool and a 2 kg. hammer and the joint left neat and smooth.

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The weight of lead and hemp which shall be used in each joint shall be used in each joint shall be in conformity with the table given below or as specified by the Engineer.

Quantity of lead and spun yarn for different sizes of pipes.

Nominal size of pipe in mm.	Lead / Joint In kg.	Depth of Lead joints in mm.	Spun Yarn per joint in kg.
80	1.8	45	0.10
100	2.2	45	0.18
125	2.6	45	0.20
150	3.4	50	0.20
200	5.0	50	0.30
250	6.1	50	0.35
300	7.2	55	0.48
350	8.4	55	0.60
400	9.5	55	0.75
450	14.0	55	0.95
500	15.0	60	1.00
600	19.0	60	1.20
700	22.0	60	1.35
750	25.0	60	1.45
800	31.5	65	1.53
900	35.0	65	1.88
1000	41.0	65	2.05
1100	46.0	65	2.40
1200	50.0	70	2.60
1500	66.5	75	2.80

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Nominal size of pipe in mm.	Lead / Joint In kg.	Depth of Lead joints in mm.	Spun Yarn per joint in kg.
8 Inches	4.54	2.00 Inches	0.29
9"	5.10	2.00	0.31
10"	5.67	2.00	0.34
12"	6.58	2.00	0.48
14"	9.30	2.50	0.63
15"	9.98	2.50	0.68
16"	10.66	2.50	0.74
18"	14.06	2.50	0.95
20"	16.33	2.50	1.04
21"	17.92	2.50	1.08
24"	20.41	2.50	1.21
27"	23.13	2.50	1.33
30"	25.86	2.50	1.46
33"	28.35	2.50	1.65
36"	31.58	2.50	2.40

Note:

The quantities of lead and spun yarn given in the table are provisional and variation of 20 percent is permissible.

- b) Flanged joints.
- c) Flanged joint should be made by painting the facing of the flange with white lead freely and bolting up evenly on all sides. A thin fibre of lead wool may be very useful in making the joints water tight where facing of the pipes is not true.

When packing must be used, it should be of rubber insertion of approved thickness. The packing should be of the full diameter of the flange with proper pipe hole and bolt holes cut out evenly on both the inner and outer edges.

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Where the flange is not fully faced, the packing may be of the diameter of the packing strip only. Proper placing of the packing should be checked before another pipes is joined on.

d) *Cement Joints*

The cement for the joints shall conform to IS269\1996 specification for ordinary, rapid hardening and low heat port land cement.

Cement and water taken in proportion 8: 1 by weight shall be thoroughly mixed. The mixture shall be such that when it is tightly compressed by hand into a ball and the ball is broken into two pieces the break shall be clean. If the hand becomes water stained, it has to be considered that the water is excessive. If there is evidence of crumbling in the break, water added is less than required. The cement mixture shall ring with metallic sound while caulked.

Cement which has been wet for more than one hour or which has undergone initial set shall not be used for jointing.

Making the joints

When new pipes are laid close ahead of a newly made cement joint, the disturbance caused during the forcing home of the pipe ends into the sockets during the adjustment of the pipe to proper alignment may damage the new joint. To avoid this damage, jointing shall be done only when there are at least six pipes laid to the final grade and alignment ahead of the joint to be made of the joint to be made. Starting at the bottom of the joint the joint space shall be filled with wetted cement and caulked. The remaining joint space shall then be refilled with cement and caulked until the joint is practically flush with the face of the socket. The mixture shall be thoroughly compacted to make a water tight joint. No water shall be allowed to touch the joint until the initial set had taken place. Immediately after initial set has taken place, the joint shall be covered with wet burlap, or other approved wet materials to ensure complete hydration of the cement. No water shall be allowed into the pipe until the elapse of 12 hours after the last joint in the line is made. Filling the pipe with water without pressure after this interval will be beneficial to curing of the joint.

e) Rubber Ring Joints

In the case of rubber ring joints or push on joints, the groove and the socket shall be thoroughly cleaned before inserting the rubber gasket. While inserting the gasket it shall be made sure that it faces the proper direction and that it is correctly seated in the groove. After cleaning dirt or foreign materials from the plain end, lubricant shall be applied in accordance with the pipe manufacturer's recommendations.

The Contractor shall make sure that the plain end is beveled as square as sharp edges may damage or dislodge the gasket and cause a leak. When the pipe is cut at site, the plain end shall be beveled with a heavy file or grinder to remove all sharp edges.

The plain end of the pipe shall be pushed into the socket of the pipe and while pushing, the pipe shall be kept straight. If any deflections are to be made in the alignment, it may be made after the joints is assembled. A timber header shall be used between the pipe and crow bar or jack to avoid damages to the pipe while the plain end of the pipe is pushed onto the socket either with a crow bar or jack, or lever puller.

2.6 Fixing Sluice Valve

The sluice valves to be fixed on the pipelines shall be examined, cleaned and placed in the positions as shown in the drawings. The valves shall be placed on the pipe line and valve chambers constructed according to drawings. The depth at which the valve is to be laid and the dimensions of concrete and masonry shall be varied when necessary under the orders of the Engineer.

As the pipes in some instances may be required to be fixed at a less depth than will permit the top of the valve spindle being below the level of the road (but this may only be in cases where the position of the valve is to one side the metalled road) the walls of the valve chamber shall be in such cases be carried up to such height as may be ordered, and the chamber shall have such covering as the Engineer may direct.

The valve shall be supported in the valve chamber so that no stress or strain occurs in the flange or other joints of the valve.

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The valve shall be carefully protected from slime or dust by a suitable mat or gunny covering and the pit itself shall be cleared of all unwanted material.

2.7 Fixing Scour Valve

Scour valves shall be fixed at places shown in the drawings or as directed by the Engineer, and the scour connections from the main shall be carried out completely as per drawings.

2.8 *Fixing Air Valve.*

Air valves shall be fixed at the summits of pipe lines or at places may be directed by the Engineer. The air valve connections etc., shall be carried out as per drawing.

2.9 *Interconnection work*

The Inter connection work between the existing main to the existing main to the laid under this contract shall proceed from the new main to the existing main. Before actually proceeding with the interconnection work, the Contractor shall make ready necessary tools and plants required for the work at site, such as pump sets, shoring materials etc. He shall also keep ready at site necessary pipes, specials, valves if any required for the work. The Contractor shall keep necessary skilled workmen of sufficient strength at site and once the work is commenced, the entire interconnection work shall proceed without interruption by engaging labour for carrying out the work on a continuous basis both day and night till the work is completed. The work shall be executed as per program drawn up by the Engineer and shall be completed within the time ordered by the Engineer, for each individual interconnection. The work shall be carried out under the direction of the Engineer from the beginning to end.

Laying of Specials, valves(except straight pipes from the branch of the new main to the connecting point in the existing main) including conveying specials etc., from the stores or site of stacking, excavation, timbering, pumping, out water from the trenches, lowering, aligning, jointing specials and valves cutting the existing mains, baling out water, inserting the necessary branches, jointing, testing refilling etc., shall comprise as one unit of work and will be paid at the lump sum rate quoted in the schedule for inter connection.

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2.10 *Works to be left Water tight*

The Contractor shall construct the pipes chambers and all other works so that they shall be water tight. Should any leakage appear, it shall be made good by him at his expense by removing and reconstructing the portions of the Work so affected or by other method which will render the Work thoroughly water tight to the satisfaction of the Engineer.

2.11 *Cleaning of Mains*

During the execution of the work the Contractor shall keep the interior surface of the mains free from cement, brick, soil or other superfluous matter and shall hand over the mains perfectly clean and free from deposit on completion.

2.12 *Masonry Chambers*

Chambers for sluice valves, inspection, scour valves, air valves shall be constructed on the pipes in the positions as shown in the drawings or in such positions as the Engineer may direct. The work shall be done strictly in accordance with the detailed drawings or as ordered by the Engineer. The excavation shall not be made lower than necessary to admit of the earth being properly timbered. The bottom of the excavation shall be properly leveled, rammed and a bed of concrete laid thereon. When the concrete has sufficiently set the building of the brick walls shall then be proceeded with and all iron work fixed in as the building proceeds. The inside of all chambers shall be plastered with cement mortar 20mm thick and the outside with cement mortar 12 mm thick. The chamber shall be topped with pre-cast R.C.C. Slabs 1:2:4 or cast iron surface box or valve cover as ordered by the Engineer. The surface box or valve cover shall be fixed on the top of the R.C.C. slab by a layer of cement mortar and sides of the surface box or valve cover covered over with cement concrete.

Where pipes pass through walls of chambers relieving arches shall be turned neatly over the upper half of the pipes or R.C.C. lintels shall be provided to avoid load of the walls transmitted to the pipes.

Cast Iron steps shall be built in each chamber as the work proceeds one being inserted to every 4 courses of brick work, horizontal distance center to center of each row being 30 cms.

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The Contractor shall include in risk rate for brick work cost for fixing steps, frame, cover etc., for completing all chambers in accordance with the drawings and with the above specifications.

2.13 Testing of Main-Hydrostatic Test

After laying and jointing the pipes and specials, the pipe lines shall be tested for hydrostatic pressure in such length as may be specified by the Engineer.

The test pressure shall be equal to 50% or such other higher percent as may be specified in excess of the pressure the pipe will have to withstand subsequently subject to a minimum test pressure of 7 kg./ sq.cm. in the case of lead joints. However in the case of cement joints, the joints may be tested to a minimum test pressure 3.5 kg./sq.cm.

If cement joint show seepage or slight leakage, such joints shall be cut out and replaced as directed the Engineer and the test repeated.

The Contractor shall make his own arrangements to procure, necessary equipments, apparatus etc., required for testing and shall provide necessary labour for filling with water the length of pipes to be tested, fixing all apparatus and for carrying on the testing operations until the length of pipes, specials and connections are finally passed by the Engineer.

The length to be tested shall be provided with two blank flanges fastened on in the usual manner by collar bands and bolts to the end pipes or if the length to be tested shall have a sluice valve at each end, such blank flanges may be dispensed with.

The length of pipes to be tested shall first be filled in with water from a higher section of pipes already laid or with clean water shall be arranged at the contractor's expense with the approval of the Engineer.

Before the actual testing pressure is applied any air which has lodged in the length of pipes to be tested shall be got rid of, by screwing on at the highest part of the length of pipes or temporary air valve, or, by opening a temporary stop-cock or by other mean as the Engineer may direct.

The test pressure shall then be applied to the length of pipes under test by a hand or powered hydraulic test pump. The connection of the test pump to the length of pipes shall either be at the union connection provided at a blank flange or shall be at a temporary stop cock or fountain connection as the Engineer may in the circumstances direct.

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The actual test shall be made by pumping water into the length of pipes under test, until the test pressure as specified as specified above has been reached on the pressure gauge.

The test pressure shall be maintained for one hour or for such other period of time as may set by the Engineer and each joint will be inspected. While the pressure is on, the pipes should be struck smartly with a 2kg hammer.

When a flange joint is found to be leaking, care shall be taken that while tightening up the flanges, the neighboring joints are not affected.

If the length of pipe line under test is found to be satisfactory and on leaks or sweatiness are found at the pipe joints or at the joints of specials and connections then this length of pipe line will be passed by the Engineer.

But should any pipe, joint, special or connection be found to sweat or leak, the contractor shall make good at his cost defective joint and the length of pipe line shall be retested by the Engineer until all pipes, joints, specials and connection are found to be satisfactory.

If any pipe or special leaks or bursts, the damaged portion shall be removed and new pipes or specials shall be laid and jointed at the contractor's cost.

2.14 Restoring Road Surface

The surface of the road or ground shall be finished off to the proper level with the same kind of material as the surface consisted of before the excavation commenced, except in the case of superior roads and tarred roads in which case the surfaces should be finished off with water bound macadam surface. Should any settlement occur after refilling is completed, and upto the end of the period of maintenance, it shall be made good at once and the surface restored to the satisfaction of the authority under whose jurisdiction such road or ground may be, all at cost of the contractor.

2.15 Collection or Rubbish

The Contractor shall, at his cost, on the completion of the work remove all water and all materials or rubbish of every description which may have been collected in the works and find a deposit thereof and anything which may have collected within the works, during the period of maintenance shall also be removed before the works are finally accepted by the Employer.

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3.M.S. Pipes

- 1.1 M.S. pipes shall be procured from the reputed manufacturer and the pipe shall conform to IS 3589/2001. The pipes shall bear ISI mark. The test certificate furnished by the manufacturer should be produced.
- 1.2 The contractor should furnish the test certificate issued by the manufacturer.
- 1.3 The manufacturer's test certificate and third party inspection certificate should be produced by the contractor for the pipes used in the works.
- 1.4 In addition to third party inspection, wherever felt necessary, the Engineer shall have the power to test the MS pipes for its quality standards in TWAD Board laboratory/ other reputed Laboratory.
- 1.5 The Engineer in charge, shall verify, in addition to the test certificate, whether the pipes are as per BIS, by visual examination, diameter, weight, wall thickness, flexibility, color etc.,
- 1.6 The Electrodes used for welding of steel plates should conform to IS 814 (Part 2): 1974.

2. Testing of Pipes

- 2.1 The manufacturer test certificate third party inspection certificate should be produced by the contractor for the pipes used in the work. The engineer shall have the right to test the pipes, wherever felt necessary for its quality. The charges for third party inspection shall be borne by the employer.
- 2.2 Testing of materials to be used in works, for the quality of finished items shall generally be done by the contractor at his own cost in the laboratory approved by the Employer by providing requisite materials transport of test specimen and other assistance required thereof.

3.0 Special Condition for Departmental supply of materials:

The Contractor should agree to utilise the available materials in TWAD Divisional Stores, which are required for this work, after ascertaining the quality of materials at the stores itself.

These quantities of materials so issued will be treated as authorised omission in the contract.

It is the responsibility of the Contractor to convey the Departmental materials to the site of work and the cost thereon will be paid as per Departmental rules in force.

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3. Spirally welded M.S. Pipe Laying and jointing of MS pipes

3.1 General:

The specification for laying and jointing shall generally conform with relevant IS and TNBPSS.

3.2 Designation of pipes and fittings

3.3 Pipes and fittings will be classified according to their diameter, working head and they shall be marked as shown below.

- a. Name of manufacturer
- b. Date of manufacture
- c. Internal diameter of pipe
- d. Test pressure
- e. Permissible working head
- f. Effective length of the pipe
- g. Serial Number

Recessed markings will not be permitted.

3. Design and Manufacture of Steel Fittings:

3.1 DESIGN - GENERAL

This specification covers the manufacture, supply, testing and delivery of spirally welded mild steel pipes(steel grade Fe 410) **suitable for sleeve joints for pumping mains and for butt joints in case of gravity main with lining and coatings.** The contractor shall furnish all fittings and special pieces required for curves, tees, branches, air valves, scour and sluice valves as ordered by the Engineer. Specials shall suit the respective internal dia MS pipes to withstand required test pressure and suit air valves, scour valves and sluice valves and conform to the details furnished in the Bid Documents.

3.2 MATERIALS

The fittings shall be fabricated from plates or sheets conforming to specification IS:7323/2002 or as amended. The minimum thickness of the plate shall be as specified in the Bid Documents. Special attention is directed to these specifications which cover physical, chemical, manufacturing and mechanical equipments, test certificates, inspection and branching. The certified copies of the mill sheets and test certificates for plates and other materials shall be submitted by the contractor to the Engineer for approval before fabrication of the fittings is commenced. No materials shall be used in the fabrication of any pipe or fittings which has not been properly inspected by the Engineer.

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3.3 TESTING OF MATERIALS

All materials shall be properly tested at the contractors expense except third party inspection in accordance with IS:7323/2002. The contractor shall supply free of cost any required specimens of materials for testing by the Engineer at any time during the manufacture of fittings.

3.4 FABRICATION OF FITTINGS

3.4.1 The manufacture of fittings shall be carried out in a workman like manner by the first class labour be in all cases, be of high grade and carefully performed. Manufacturer's equipment for all specials, such as welding, flamed cutting and other operations shall be of a standard and quality necessary to produce specials meeting the specification. Equipment, in general, shall be in good condition and shall be modern as judged by the standards of the industry.

3.4.2 The longitudinal seams of fabricated specials shall be butt welded, shop girth seams shall be butt welded or lap joined welded.

3.4.3 All edges cut to size shall be uniform and smooth. Those edges to be welded that are prepared by flame cutting, shall be free from scale and slag accumulations.

3.4.4 Edges of plates to be joined by an automatic welding machine shall be formed to the shape required for the particular welding process and automatic welding machine shall be employed in carrying out the agreed procedure. Edges of plates to be joined by manual welding shall be formed to the shape required by the purchaser in accordance with the drawings. The resulting edges for welding shall be uniform throughout the entire length of the plate and shall be to a straight line.

3.4.5 Minor defects in the welds of electric welded pipe such as sweats or leaks, unless otherwise specified shall be repaired at the discretion of the manufacturer with the approval of the Engineer. Repairs of this nature shall be made by completely removing the defect, cleaning the cavity and then welding. The workmanship involved in the repair is subject to approval of the Engineer.

3.4.6 Special sections having a butting plates of different thickness shall have the heavier plate sufficiently beveled so that the apex of the weld groove shall correspond with that of the lighter plate.

3.4.7 All lap breaking, rolling, cleaning of plate surfaces to be welded and fittings up operations, as well as the qualification of welding operators, welding procedure, automatic welding, manual welding and correction of welds in specials shall be in accordance with the relevant BIS.

3.4.8 Reshaping special after it is manufactured shall be done by rerolling or by pressure. Reshaping of pipe by excessive hammering or dropping shall not be permitted.

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3.4.9 Diameter of all bolts circle of the flanges shall comply with the relevant IS:1538-1976 for flanged pipes.

3.4.10 Flanged Pipes

Flanged pipes of varying length and diameter shall be externally coated and internally lined with mortar. Dimension of the flanges, welding details and welding procedure shall be in accordance with the relevant BIS. Flanges shall be welded to a section of the pipe before matching.

3.4.11 Flanged Branches

a. Flanged branches shall be fabricated in accordance with the general specification and to the Employer requirements. Wall opening shall be formed by welding fabricated structural steel of approved design to the steel cylinder and shall be lined internally and coated externally.

b. Flanged branches for air and scour valves shall be welded into pipe in the required position. The branch for an air valve shall be vertical and at right angle, to the longitudinal axis of pipe. The invert of the branch for a scour valve shall be horizontal and at right angle to the axis of pipe and shall align with the invert of the barrel of the main pipe.

c. All flanges shall be machined to standard thickness, square to the axis of the pipe and the bolt hole shall be drilled evenly off centre and true to the pitch as per IS:1538-1976. Dimension of the flanges, welding details and welding procedure shall be in accordance with the relevant BIS.

3.4.12 BENDS

Bends to provide change of alignment in main laying shall be manufactured to suit the site condition from completed and tested pipes by angle cutting the barrel or by such other standard procedure and rewelding bends shall be socket and spigot and lined internally and coated externally as given in the Bid Document.

3.4.13 TAPPERS

Tapers shall be manufactured out of steel plates and lined internally and coated externally. The tapers shall be suitable for connections to the slice valve or flanged tail piece on one side and to pre stressed concrete pipe on the other side. Stiffener rings shall be provided to afford rigidity to pipe.

3.4.14 The walls of steel fittings including branches and scour outlets incorporated in the fittings shall be sufficiently thick to ensure that during the hydrostatic pressure test, the stress in the steel shall not exceed 75 per cent of the minimum yield point for steel, provided that, when installed under the specified surge and operating under internal pressure up to the specified working head, the stresses in the steel shall not exceed 60 per cent of the minimum yield point for the steel.

3.4.15 Notwithstanding anything said, elsewhere, the manufacturer shall furnish the thickness of the steel plate used and other relevant details and shall get the approval for these details from the Engineer, before fabrication.

3.4.16 The weight of M.S pipes, specials etc. shall be only without inside lining and outside coating.

3.5 PROCESS OF MANUFACTURE

3.5.1 Any of the following process shall be employed for sleeve and butt welding.

- a) Automatic submerged arc welding
- b) Electrical resistance welding.

All electrodes shall conform to IS:814-1970.

3.5.2 Irrespective of the dimensions calculated for the most adverse conductor of loading, the steel plate thickness shall not be less than that given on table below for the approximate diameter of pipe, branch or scour outlet. The plate thickness for the wall of a branch or outlet shall also be not less than one half of the thickness of plate in the barrel of the fittings.

MINIMUM WALL THICKNESS OF PLATE FOR STEEL SHELL

Nominal internal diameter of finished special (mm)	Minimum thickness of steel plate (mm)
200, 250, 300, 350, 400, 450, 500	5
600	6
700	6.3
800	7.1
900	8
1000 & 1100,	8.8
1200	10

3.6 INSPECTION

All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the contractor of this responsibility to furnish materials and perform work in accordance with this specification.

The contractor shall notify the Engineer in charge concerned in advance of production of materials and fabrication thereof in order to arrange for mill and shop inspection.

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The Engineer in charge may reject any or all fittings (i) that are of the material specified, that are not fabricated in accordance with the outlined procedure and (ii) that do not obtain the prescribed test results, condition of fittings and tolerances set forth in the relevant IS drawings and specification.

3.6.1 The Engineer shall have free access to these parts of all plants that are concerned with the furnishing of materials of the performance of work under this specification.

3.6.2 The contractor shall furnish the inspector reasonable facilities and space without charge for inspection, testing and obtaining of any information he desires in respect of the character of material used and progress and manner of the work.

The contractor shall provide 2 (two) sets of accurate 'go' and 'no go' ring gauges to measure the diameter of fittings for the use of the Engineer at no extra cost.

3.7 INSPECTION OF COATING

The entire procedure of applying the protective coatings will be rigidly inspected from the time the bare fittings are fabricated until the fittings are coated and tested. If any time it is found that the procedure of applying the coating materials is not in accordance with relevant specification, all such coatings shall be rejected. Samples of coating materials will be collected at random and tested and if any sample is not found to conform to the specifications, fittings coated with such materials will be rejected.

3.8 QUALITY OF MATERIALS

The materials used in the manufacture of steel fittings shall comply with the following requirements.

3.8.1 Wire Mesh

Wire mesh for reinforcement of interior and exterior gunnite shall be electrically welded wire fabric or woven wire fabric and specially crimped or otherwise if furring to hold the reinforcement 10 to 13mm away from the surface on which it is applied. The wire mesh shall weigh not less than 12.5 kg/b sqm. The reinforcement shall be free from paint other coating material, loose scale, dirt or excessive rust.

3.8.2 Steel Sheets

Steel sheets shall conform to the IS:2061 or its latest revision.

3.8.3 Electrodes

Electrodes for welding shall conform to the IS:814-1963 or as amended.

3.9.1 Dye penetration/radiographic testing shall be carried out as per BIS for steel fittings.

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3.9.2 Application of mortar lining

The MS pipes and specials shall be cleaned and external lining follow immediately after cleaning. Internal lining shall be applied as far as practicable. Application of cement mortar coating to add exterior surfaces and interior surfaces of bends, specials and other sections whose shape preclude lining by spinning shall be by the gunnite process.

3.9.3 Preparation of surfaces

The interior surfaces of all plates to be lined with Portland cement. mortar shall be thoroughly cleaned by sand or steel grit blasting.

3.9.4 Hand Cleaning

Before blasting, all oil and grease on the surface of the metal shall be removed thoroughly by flushing and wiping using suitable solvents and clean rags. The use of dirty or oily rags will not be permitted. All other foreign materials shall be removed by buffing or by scrapping and wire brushing. After cleaning, the special shall be protected and maintained free of soil, grease and dirt that might fall upon the plate from whatever source until the plate has received its cement mortar coating.

3.9.5 Mechanical Cleaning

All metal surfaces shall be thoroughly blasted to bright metal. Blasted surfaces which acquires a coat of rust by buffing or wire-brushing or at the discretion of the Engineer shall be reblasted. Adequate air separators shall be used to remove all oil and free moisture effectively from the air supply to the blaster. Any plate showing pits or structural defects shall be set aside pending examination.

3.9.6 Immediately upon completion of blasting, surfaces at the end of fittings which are to be left bare shall be given a brush coat of a suitable rust preventive material. Rust preventing coating shall be applied and shielded and maintained during the subsequently application and curing or more lining and application of the exterior coating to protect the surfaces beneath from rusting, pitting or other corrosion. Rust preventive material used shall be of such character that the quality of the weld and other functions of the steel plate will not be impaired by its presence.

3.10 LINING BY GUNNITE

3.10.1 The application of cement mortar lining to angles, bends, specials or other sections whose shapes preclude lining by the centrifugal coating process. shall be lined by the gunnite method except where any course more than 2.15 m long is included in an angle or bend, it shall be coated by the centrifugal coating process.

3.10.2 Gunuiting for interior lining shall conform to the relevant specifications for gunnite. The cement mortar for internal lining shall conform to relevant clauses of IS:7322-1974.

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3.10.3 Reinforcement for internal lining

Suitable reinforcement shall be provided to enable proper bond between the internal cement mortar lining and the steel plate.

The reinforcement in the barrel portion except at the spigot end shall consist of chicken mesh tied to hoops of 6 mm dia. MS rods placed at 30 cm spacing.

At the spigot end, for a length of 15 cm the reinforcement shall consist of weld mesh with one hoop of 6 mm dia MS rod placed below the weld mesh in addition to chicken mesh.

The chicken mesh and the weld mesh shall be free from paint, other coating materials, loose mill scale or dirt. The weld mesh shall weigh not less than 12.5 kg/10 sq.m.

- 3.10.4 Gunnite shall be placed in the top and sides of the pipe, then screened to a uniform thickness and the ground lines or blocks removed. All rebound and waste material shall then be removed by air blowing and gunnite placed in the bottom the fittings and screened. When completed, the lining shall be concentric with the barrel of an even thickness, The entire surface shall then receive a final flash coat of gunnite and shall be steel trowled to a true surface equal in smoothness to the spun lining in such a manner not to impair the bond between mortar and steel plate.

The gunniting and surface finishing shall be complete in one operation before any part of the mortar lining has set and shall be applied continuously without the use of construction joints. Then for any reason whatsoever the cement has got adhered to the wall of pipes and sloughs off, swabbing the pipe with cement solution of mixture shall not be permitted.

- 3.10.5 Material for the final flash coat of gunnite shall be composed of one part of Cement and two parts of sand. Sand used shall pass through 100 per cent rough IS Sieve No. 320 (11W' mesh — B.S. Screen) and not less than sixteen percent shall pass through a IS Sieve No. 30 (50 mesh ASTM Screen).

3.11 APPLICATION OF EXTERIOR GUNNITE

- 3.11.1 Wire mesh shall be applied on the bare steel barrel with initial tension to prevent the freshly applied gunnite from sagging from the pipe. Ends of reinforcing strips shall overlap one full mesh and shall be tied securely at intervals not exceeding 30- cm with 16 gauge steel wire. Successive circumferential strips shall have a gap of 5 cm between them and the longitudinal joint of each course of the mesh shall be staggered with the joints of adjacent courses.

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- 3.11.2 Before applying exterior gunnite, the pipe shall be adequately braced on the interior with timbers or other suitable material. Where braces are placed on coated area inside the pipe sufficient and proper bearing surface shall be provided at the ends of the braces so that no damage will be done to the mortar lining.
- 3.11.3 Gunnite shall be mixed in proportions of one part of cement with three parts of sand. The sand and cement shall be thoroughly machine mixed before being deposited in the placing machine. Gun shall be placed with the machine operating at an air pressure of not less than 2.46 kg/cm² and not more than 2.81 kg/cm² at the gun when 61 m or less hose is used. These pressures shall be increased to 2.27 kg/cm² for every additional 15.25 m of hose and not more than 122m of hose shall be used with any machine. The water pressure at nozzle shall be at least 6.81 kg greater than the air pressure in the machine and the nozzle used shall be of the type which will secure proper hydration of the mix.
- 3.11.4 The gunnite shall be thoroughly and uniformly hydrated without the use of excessive water and shall be shot with the nozzle approximately normal to the surface being covered. Every precaution shall be taken to prevent the formation of sand pockets and if any develop, they shall be cut out and replaced with satisfactory machine placed material. No hand patching will be allowed. The contractor shall apply the coating in such a manner that no sloughing shall occur at any time during or following its application.
- 3.11.5 If for any reason it is necessary to interrupt the placing the gunnite for a length of time that will result in the material taking a permanent set, a square shoulder shall be formed at the ends of the sections and or elsewhere by shooting against a backing up strip or by cutting back with a trowel or other suitable tool the irregular edges of the material last place to a clean unbroken surface perpendicular to the face that will provide a suitable connection or construction joint between such material and the material to be placed subsequently. When performing this work care shall be taken not to shatter or disturb the material remaining in place not disturb the imbedded wire mesh. Before placing fresh material against the surface of such joints, it shall be carefully cleaned and wetted to ensure a good bond between the fresh material and that previously placed. When gunnite has hardened sufficiently to permit sprinkling, it shall be thoroughly wetted by sprinkling and maintained in a moist condition.

3.12 APPLICATION OF COAL TAR ENAMEL

- 3.12.1 When sections are not lined and coated by cement mortar, coal tar primer and coal tar enamel shall be applied to steel surfaces. All the surfaces shall be double coated by applying the enamel with hand daubers. The final brush strokes of enamel shall be made in the direction of flow and at right angles to the first coat. All brush strokes shall overlap and form a continuous coating.

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3.12.2 The contractor shall protect all cement mortar from damage during handling and transportation. After the Internal mortar has been cured, internal bracing shall be placed at the ends of the fitting and elsewhere, if necessary without damaging the mortar lining to preserve the roundness of the barrel of the pipe. All such bearing except those that may interfere with the joining operation shall remain in position until the fitting has been installed and back filled.

3.13 TOLERANCES

3.13.1 Tolerance for steel pipe and fittings shall conform with the requirements of IS 7322-1974 or as amended.

3.13.2 Notwithstanding these tolerances and irregularities permitted, any dimensional variation of surface irregularity permits leakage shall be cause for rejection.

3.14 HANDLING OF SPECIALS

3.14.1 Coated specials that are to be stored on supports shall bear on the uncoated ends only. If bearing on coating is employed the supports shall be not less than 20cm wide and so arranged to prevent damage to the coating.

3.14.2 During transporting of the fittings, coating shall be protected from damage by bearing on well- padded bolsters not less than 20cm wide and placing strips of heavy belting or other approved sheep materials not less than 20cm wide under all ropes or fastening.

4. Laying and Jointing PVC Pipes

a) PVC Pipes

The PVC Pressure pipes for water supply and distribution shall conform to IS 4985/2000.

b) Laying of PVC Pipes (IS 7634/1975)

The trench bottom should be carefully examined and should be free from hard objects, such as flints, rock projections or tree roots etc., The bedding for the pipes should be brought to an even finish providing uniform support for the pipes over their length and pipes laid directly on the trench bottom. In other case the trench should be cut correspondingly deeper and the pipes laid on a prepared under bedding which may be drawn from the excavated material if suitable. As a rule trenching should not be carried out too far ahead of pipe laying. The trench should be kept as narrow as practicable but must allow adequate room for jointing pipes and placing and compacting the back fill. Mains should be laid with a cover of not less than 1 m measured from the top of the pipes to the surface of the ground. Mains which might be brought under road ways by future widening schemes should be so laid that the eventual cover will not less than 1 m.

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c) Jointing of PVC Pipes

The jointing of PVC Pipes are done either by using Solvent Cement Joint or rubber ring joint. The solvent cement used for jointing should be of the quality as specified in IS 14182/1994. The spigot and socket ends of the pipes should be cleared and roughened with emery paper. If the ends are grossly contaminated, they should be cleaned with Acetone or Methyl Alcohol. The solvent cement should be thickly applied on the spigot end and thinly in the socket. For larger sizes the first coat should be allowed to dry and a second coat applied. The spigot is then pushed into the socket and the excess cement wiped off at once with a piece of cloth or rag. The joint should not be disturbed for at least 5 minutes. The pipe should not be subjected to working pressure for 24 hours after jointing.

i) Rubber Ring Joint.

The pipes for rubber ring joints are supplied with both ends chamfered. A mark should be made at a distance from the pipe an end equal to half the length of the coupler. The inner side of the coupler ring and the chamfered end of the pipe should clean and dry. The 'O'ring is then slipped into the coupler. The ring and the chamfered end of the pipe are lubricated with a lubricant. The coupler and the pipe should be carefully aligned and should be truly coaxial. The coupler is then pushed home into the pipe or the pipe is pushed into the coupler to make the joint.

5. Disinfection of Mains. Upon completion of a newly laid main or when repairs to an existing are made, the main shall be disinfected as directed by the Engineer. The mains shall be flushed prior to disinfection except when the tablet method is used. After initial flushing, the hypochlorite solution shall be applied to the water main with mechanically or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solution may be fed with a hand pump.

In the case of mains a large diameter, water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate into the newly laid pipe line. The water shall receive a dose of chlorine also fed at a constant measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at not less than 300 mg/1. The chlorine shall be applied continuously and for a sufficient period to develop a solid column of 'Slug' of chlorinated water that will as it passes along line expose all interior surfaces to a concentration of at least 300 mg/1. for at least 3 hours. As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect the appurtenances.

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the mains is not higher than the generally prevailing in the system or less than 1 mg/1.

After final flushing and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriological quality and shall show the absence of coli form organisms. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. When the samples are satisfactory, the main shall be placed service.

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HDPE pipes shall confirm to the following specifications:

ISO 12162	Thermoplastics materials for pipes and fitting for pressure applications – Classification and designation – overall service (design) coefficient.
ISO 12176-1:98	Plastics pipes and fittings – Equipment for fusion jointing polyethylene systems – Part 1 : Butt Fusion.
EN 712	Thermoplastics piping system – End load – bearing mechanical joints between pressure pipes and fittings – Test method for resistance to pull –out under constant longitudinal force.
EN 713	Plastics piping system – Mechanical joints between fittings and polyolefin pressure pipes – Test method for leak tightness under internal pressure whilst subjected to bending.
EN 715	Thermoplastics piping systems – Mechanical and cemented joints between pressure pipes and fittings – Test method for leak tightness under internal pressure, including end thrust.
EN 921	Thermoplastics pipes – Determination of resistance to internal pressure at constant temperature.
ISO 13953:1995	Polyethylene pipes and fittings – Determination of tensile strength of test piece from butt fused joint.
ISO 13954:1997	Plastics pipes and fittings – Peel de-cohesion test for polyethylene (PE)electro-fusion assemblies of nominal outside diameter greater than or equal to 90mm.
ISO 13955:1997	Plastics pipes and fittings – Crushing de-cohesion test for polyethylene (PE) electro-fusion assemblies.
ISO 13956:1995	Plastics pipes and fittings – Pull out de-cohesion test for polyethylene electro-fusion assemblies.
IS 4984	Specification for High Density Poly ethylene Pipes
IS 7328	Specification for material of manufacturing
IS 7634	Guidance on proper methods for laying and jointing of polyethylene pipe work system

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(a) Material

The HDPE pipe shall be made from base polymer and shall conform to the requirements as specified in MS 1058 Part 1:2002 and IS 4984. The base polymer shall be a single grade of polyethylene, PE 100. No rework material is allowable for the manufacture of the pipes. No additives that may contribute to toxic hazard, impair the fabrication of properties and chemical and physical properties in particular to long term mechanical and strength is allowed. The colour of the pipes shall be black with blue stripes. The material for stripes shall be of the same type of resin as used in the compound for the pipe.

(c) Pipe Classification and dimensions

All HDPE Pipes must be from Class PE 100 with nominal pressure rating be not smaller than the working pressure as shown in the Drawing.

Wall thickness and nominal diameter of PE 100 pipes are given below.

NOM. DIAMETER FOR OTHER PIPES (Outside Diameter) (mm)	WALL THICKNESS (PN 5) (mm)	WALL THICKNESS (PN 8) (mm)	WALL THICKNESS (PN 12.5) (mm)
20	--		2.0
25	--		2.3
32	--	2.0	3.0
40	--	2.4	3.7
50	2.0	3.0	5.2
63	2.5	3.8	6.5
75	2.9	4.5	7.6
90	3.5	5.4	9.2
110	4.2	6.6	11.1
125	4.8	7.4	12.7
140	5.4	8.3	14.1
160	6.2	9.5	16.2
180	6.9	10.7	18.2
200	7.7	11.7	20.2
225	8.6	13.4	22.7
250	9.6	14.8	25.1
280	10.7	16.6	28.1
315	12.1	18.7	31.6
355	13.6	21.1	35.6
400	15.3	23.7	40.1
450	17.2	26.7	45.1
500	19.1	29.7	50.1
560	21.4	33.2	56
630	24.1	37.4	63.1

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(d) Length and appearance

The required length of HDPE pipes in coil for nominal diameter 63 mm and below shall be 100 meter. The standard length of HDPE pipes for nominal diameter 125 mm and above shall be 9m or 12m. The internal and external surfaces of pipes must be smooth, clean and free from scoring, cavities and other surface defects which may affect pipe performance. The ends of pipe shall be cut cleanly and square to the axis of the pipe. Appearance shall be checked at the point of manufacture.

(e) Routine Test

The pipe suppliers shall furnish results of the routine tests carried out in accordance with the requirements as stipulated in MS 1058: Part 1: 2002. The minimum Oxidation Induction Time (OIT) for pipes fitting shall be 80 min.

(f) Pipe markings

All pipes must have the following markings:

- Manufacturer's name or trade mark
- Dimensions
- Material supplier and material class (PE 100)
- Pipe Class (PN)
- Year of manufacture (last two digits)
- Batch production number

(g) Pipe fittings and jointing method

Electro-fusion fittings complying to MS 1058 or EN 12201-3 shall be used. Electro-fusion fittings shall be injection moulded fittings made of PE but incorporating integral heating element(s) to enable fusion jointing with PE pipes. All PE100 fittings shall be jointed by couplers only. Electro-fusion socket fusion shall be used where an electrical resistance element is incorporated in the socket of the fitting which, when connected to appropriate power supply, melts and fuses the material of the pipe and fitting together. Contaminated surface of the pipe over the socket depth has to be removed prior to conducting the jointing work to ensure that a joint is completed effectively.

REFERENCE : STANDARD-ASTM D 3035, F714, ISO, ISI, BSS.

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HDPE FUSION WELDING : Fusion welding is commonly used in HDPE and is a Permanent type of joint.

The pipe should be cut square and face of the pipe should be slightly scrapped prior to remove oxidized layer. At the time of welding, leveling of the pipes is essential. Particularly in case of larger diameter pipes. Welding temperature should be 200 deg. C and surfaces of heating mirror should be 210 deg. C at 5 deg. C heating mirror is a metallic plate heated upto the required temperature either by electrical coil heating inside or blow torch. The word mirror has come because this heating plate radiates heat. The welding of the pipe should be held in either side of the heating mirror with only contact pressure of about 0.2 kg/cm^2 . When the rim of molten material is found the pipes are removed from the heating mirror and immediately the joints is made application of moderate pressure of approximately 1 to 2 Kg/cm^2 for 2 to 3 seconds. The initial heating time for achieving molten rim, varies from 1 to 10 minutes depending upon the pipe wall thickness and size.

It is essential to see that the rim formed is not excessive.

While jointing, the pressure should be maintained until the joint is luke warm and after the pressure is relieved, the joint allowed to cool completely.

The mirror should be kept exactly around 210 deg. C which needs about 30 minutes time (Form Electrical Mirror). It is also essential to see that the temperature is maintained constant by the proper setting of regulator. For detecting the correct temperature, Crayon chalk is used for example at 210 deg. C the colour of crayon dot on the mirror change within 10 seconds. But, the dot made should be thin and if not, time take a will be more indicating a wrong temperature.

STRENGTH:

A satisfactory butt welded joint of HDPE will have the strength factor of one. Temperature is of primary importance and weld efficiency may decrease if the temperature is more or less than 210 deg C.

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(h) Laying of pipe

HDPE pipes shall be joined to form a string above ground prior to snaking into the trench. To prevent scoring, pipe rollers should be used. Before lowering HDPE pipelines into the trench, a check should be made for cuts, deep scratches or other pipe damage and in fusion jointed systems that the system has cooled sufficient before stress is imposed upon any premade joints. When lowering pipe into the trench, care should again be taken to avoid scoring of the pipe by contact with the sides and bottom of the trench. Use should be made of planks and ropes where appropriate but wire ropes or chains should not be used.

Gradual changes in direction of HDPE pipelines can be accommodated by pipe deflection but every effort should be made to keep the pipe as central as possible within the trench to enable adequate compaction of side-fill. The bending of HDPE pipelines is permissible and the properties of fusion jointed systems enable changes of direction without recourse to the provision of special bends or anchor blocks. However, the pipe should not normally be cold bent to a radius less than 25 times the outside diameter of the pipe. For push-fit or mechanical non end-load resistant jointing systems, anchor blocks to withstand the resultant thrusts must be provided. Under no circumstances should hot bending be attempted on site.

For installation of heavy flanged fittings, provision should be made for concrete support both for the weight and to resist the turning moments associated with valves and hydrants.

HDPE pipes and fitting may be partially or completely surrounded by concrete but they should be protected by 3mm rubber membrane to avoid possible damage during pouring or compaction to prevent high localized stresses.

After completion of an installation, pipe work and fittings should be inspected and made ready for testing to ensure the safety and efficiency of the systems. The trench may be backfilled prior to testing; but it is advisable to leave at least the joints exposed throughout the test.

Complete and accurate records should be taken of the installation. To assist the future Location of the pipelines, a marker tape shall be laid along the line. The recommended position of the tape is 350mm below the surface directly above the crown of the pipe.

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(i) Testing of HDPE pipes

The test passed HDPE pipe lot should be used at site within a year. If the test passed pipe lot is not used at site (not laid) and kept idle for one year from the date of supply, then the fresh sample from the same lot should be sent for re-test for internal pressure creep rupture test. After re-testing in TWAD LAB only, the test passed pipe should be used / laid at site. If the delay in laying the pipe is on the part of contractor, then the re-testing charge has also to be borne by the contractor.

PIPES FITTINGS AND VALVES

All cast iron pipes, other pipes, special fittings and valves, meters etc. supplied by the contractor shall strictly confirm to the relevant BIS. Valves shall bear I.S.I. marking and shall be of approved make acceptable to the Engineer. The make of the valves shall be furnished. The Head stocks with worm gear arrangements shall be provided for operation of all filter control valves from operating platform.

OVER LOAD PROVISION

All pipes, measuring devices, rate of flow, controllers, etc., shall be capable of allowing an over load of 25% of flow through the treatment works.

MEASURING DEVICE.

Electronic flow meter with sensors and accessories with digital recorder shall be installed in the treatment plant to record the filtered water input and output in all pumping hours and to give remote indication of totalization of flow rate as well as on computer conductivity including mechanical and electrical accessories

ELECTRICAL AND MECHANICAL EQUIPMENTS

Electrical meters, gear boxes, switches and wiring etc. shall conform to the relevant BIS and shall be of reputed and acceptable to the Engineer.

All conduit piping for electrical wiring shall be as per IE rules. Wiring and installation of Electrical equipment shall be according to the relevant code of practice recommended in BIS & IE rules. All the precautions for the purpose of safety in providing electrical installation shall be as per IE Rules. The contractors shall provide a main Control Panel in the electrical control room of filter house which shall be provided with one incoming TPICN switch fuse with HRC fuses, sufficient number of outgoing switch fuses. Voltmeters phase selector switch and phase indicator lamps etc., to be provided; by the contractor Electrical connections up to the incoming switch fuse in the main Control Panel and also the other wiring from the main panel board to the various units of the plant shall be done by the contractor. Conduits should be used for the electrical cables and should be underground and concealed as far as possible as per IE rules.

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Electric wiring and lighting points with 9 Nos. of fluorescent twin type light fittings and also Sodium Vapor lamp 9 Nos. with stand post MS Pipe with necessary foundation in outside corners of filler house, lightening arrestor at the top of the high level sump as directed by the Engineer For each room. 1 Fan point and 3 plug points.

SUPPLY OF PIPES AND SPECIALS

It is to be clearly noted that all pipes, specials, valves and other fittings required for the work are to be supplied by the contractor.

SPECIAL EQUIPMENTS

1. A hand operated chain pulley block (H.O.T.) of 2 MT capacity with 10m lifting Chain shall be fixed in the Collector well cum pump house for lifting pump sets.

The contractor shall then operate the plant for a commissioning period of one year with his own staff and during this period, he shall train up the departmental staff in plant operation and maintenance and keep accurate records to check the plant performance. He should maintain observation and submit relevant records providing the efficiency etc.

The Contractor shall provide all the necessary consumables including chemicals such as Chlorine etc. for running the scheme during the commissioning period, but the power supply will be provided by the employer at free of cost for maintenance period.

2. ALTERATIONS

If the plant does not perform satisfactorily in all respects, the contractor shall carryout alterations at his own expense and satisfy the employer of performance, after further tests.

3. DOORS, WINDOWS, VENTILATORS AND ROLLING SHUTTERS.

3.1 Doors, Windows, and Ventilators should be provided with Aluminum Frame with glazed panels for filter house in chemical room, chlorination room, office cum laboratory and control room. All other fixtures such as Hinges, wind appliances should be of good quality and non corrosive materials.

3.2 The glass for the doors, windows and ventilators shall also confirm to IS 1081-1960 and the thickness of the glass not less than 5mm

3.3 All wood work shall be done as per relevant specifications in TNBP and BIS.

3.4 The steel rolling shutters should conform to IS 6248-1979. It shall be of push and pull type with 22.5 gauge thick sheet including side bottom rails, brackets, door suspension shafts, housing box at top and mechanical gear operation and locking gear arrangements at both ends. The shutters should be painted with three coats of anti-corrosive paint of approved quality and colour.

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4. M. S Ladder.

The M.S. Ladder if any to be provided shall be of 0.5m wide consisting of 65mm x 12mm flat stringers with 16mm dia M.S. Bars in double row at 25 cm c/c. The item shall include all fixtures and painting with 2 coats of anti-corrosive paint.

5. PAINTING OF METAL SURFACES

All surfaces of metal works shall be thoroughly washed, dried, cleaned and degreased before painting over the top coated primer. The Contractor shall clearly indicate the surface treatment for all metal surfaces of the plant in the schedule of specifications. It shall be generally done complying with relevant clauses of TNBP and IS 1477-1971. The schedule for painting new metal surface shall be strictly adhered to. The following table gives the nature of surface treatment desirable.

Sl.No.	Surface	Treatment
1	All railings and M.S. Ladders	Galvanisation with Chromate Primer and two coats of approved oil paint and one finished coat.
2.	Submerged metallic parts and projections above water level	Bituminous paint/Epoxy paint
3.	Metal parts above water level	Finishing Coat of oil painting over two under coats of red oxide primer.
4.	All indoor fixtures, parts Instruments, electrical Equipments, panels, etc.	Chromium or Nickel Plating.

6. PIPES, SPECIALS AND VALVES.

- 6.1 All pipes and specials shall be cast iron, double flanged conforming to BIS. All pipes and valves supplied should have I.S.I. certification marks with I.S. No. as below:

RCC Pipes NP3 Class	: IS 458/1988
C.I. Pipes	: IS 7181/86
C.I. Specials	: IS 1538/76
Sluice Valve	: IS 780/1984 & 2906/1984
Manhole frame and cover	: IS 1726 (Part II/1974 and Part VII/Section/1974)

- 6.2 The pipes and specials to be fixed in concrete shall have puddle flanges.

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7. MECHANICAL AND ELECTRICAL WORKS

The design, manufacture and erection of the mechanical and electrical equipment should satisfy the provision in the relevant I.S.S. Further to the extent possible all mechanical and electrical items supplied by the contractor should bear necessarily the I.S.I. Certification marks. Conduits should be used for the electrical cables and wiring and should be concealed as far as possible.

8. TESTING OF CIVIL, MECHANICAL AND ELECTRICAL WORKS

The testing of the water retaining structure should satisfy the provisions in T.N.B.P. and I.S. 3370 Part I. The mechanical and electrical equipment when tested should satisfy the manufacturer's specifications which have to be furnished by the contractor and got approved by the Engineer before supplying the equipment. They should also bear ISI certification or satisfy the relevant BIS. Moreover, the electrical equipment should satisfy the test prescribed by the Chief Electrical Inspector or his representative if necessary.

9. SCIENTIFIC APPARATUS AND CHEMICAL FOR THE LABORATORY

The various types of scientific apparatus, instruments, chemicals etc. supplied by the contractor for equipping the laboratory should satisfy the relevant I.S. codes or in its absence, the relevant B.S. Codes, if they are not covered by the above codes they should satisfy manufacturer's specifications which have to be furnished by the contractor.

10. Specification for Mechanical Equipment and works

10.1 Pipes and Specials : All pipes and specials except for sludge drainage arrangements shall be of CI 'LA' class. For sludge drainage arrangement RCC pipes can be used. All pipes and specials which shall be laid below the floors, walls, foundations etc. of plant structure should be of mild steel/CI only, made out of 10mm thick plates. All M.S.Pipes shall be painted from both surfaces with 3 coats of anti-corrosive paint of approved quality.

10.2 Valves/Pen stock/ : All the valves shall be cast iron double flange type and Gates. Shall be of best reputed make valves shall bear the certification of ISI. All valves shall have spur gear/wheel arrangement for manual operations. All sluice valve gates shall be of approved make and with brass lining. It shall be provided with spur gear arrangement/hand wheel for easy manual operation. All penstock shall be brass lined and provided with suitable arrangement for easy and smooth manual operation.

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- 10.3 Water Level Indicator: The indicator shall be of 15 cm, wide enamel quoted MS Plate mounted on teak wood frame necessary graduation in metric units. All allied fixtures such as PVC float copper guide chair, pulleys counter weight indicating arrow etc. shall be got approved from the Engineer in charge.
- 10.4 Cowl Ventilator :AC cowl ventilators shall be 100mm dia and of suitable height. It shall give attractive appearance. It shall be painted with 2 coats of anti-corrosive paint of approved quality and shade.
- 10.5 Finishing : After entire completion of the plant all the Mechanical equipment, fixtures, fastenings shall be first thoroughly scrapped and cleaned and they shall be applied with 2 coats of anti-corrosive paint of approved quality and color and shade.
- 10.6 Lightning Conductor : 1 No. of lightning conductors of the highest elevation shall be provided suitably for the entire plant site. It shall consist of Solid copper rod super terminal 25mm dia. 1.5m long with a knob at the end and with conical spikes on top.
- i. Suitable clamps to fix the conductor to the walls.
 - ii. Copper tape conductor 50mm x 6mm
 - iii. Copper earth plate 1 sqm. in area and 1.5mm thick.
 - iv. Charcoal, commercial salt and sand for filling.
 - v. GI pipe of 50mm dia. up to 3m height above G.L.
- All shall include excavation for the trench to the required depth by filling with charcoal, salt and sand and all the labour necessary as per instruction of the engineer in charge.
- 10.7. Fire Extinguisher: Sufficient number of Fire-Extinguisher shall be provided in panel board room, blower room, wash water pump room, laboratory filter house etc. Each unit shall have a capacity of 10 litres. It shall be of reputed make and shall have to be approved by the Engineer in charge.

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11. Specification for Electrical Installations

11.1 General

i.	All the Electrical installations both internal and external shall be carried out as per latest Indian Electricity Rules
ii	The work shall be carried out through a licensed electrical contractor registered with the Government of Tamil Nadu
iii	All the Electrical installations shall be got approved, tested and certified from the Electrical inspector of Government of Tamil Nadu by the contractor at his own cost wherever necessary
iv	The damages caused to the Civil structures etc., during electrical installations, shall be made good by bringing such locations to their normal conditions i.e Original finish at no extra cost.
v.	All the materials used for electrical installations shall be of standard type and of reputed make as specified at relevant places where after. All the materials shall be got approved from the Engineer-in-charge before it is used in the work. All safety measures shall be adopted for all the installations as per Indian Electrical Rules eg. Providing adequate earthing and proper insulation etc.
vi.	The labour of the internal and external electrification of the entire plant shall be got approved from the Engineer-in-charge well in advance. Necessary modification shall have to be carried out as per instructions of the Engineer at no extra cost
vii	All the external and internal and external c electrical installations shall be properly strapped to poles and walls respectively to withstand storm, rain etc.
viii	The electrical installations internal and external shall be adequate and should have decorative, finish keeping in view of architectural beauty of the civil works.
ix.	The entire electrical installations both internal and external shall be commissioned to the satisfaction of the Engineer-in-charge without any extra cost and shall be covered with guarantee for 24 months for its performance, design, equipment and workmanship from the date of commissioning.

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11.2 Scope of work

The job involved in this, consists of providing erecting and commissioning of electrification necessary allied equipment with its fixtures and accessories for the entire plant structures and yard area as per BOQ both for external and internal including yard premises of the Treatment plant. Adequate electrical power at 400/440 Volts 50 C/S shall be made available for such work to the Contractor, who will design and install the panel board for entire internal and external electrification and power requirements to the prime movers of all mechanical equipment for treatment plant eg. Flash mixer, Clariflocculator including its flocculator equipment for treatment plant. eg. Flash mixer, Clariflocculator including its flocculator mechanism and end carriage, alum solution tank mixing equipment, wash water pumps and Air blowers, sampling cable etc. The contractor shall have to install his panel boards at appropriate places for each installations. External electrification will be done by laying underground cables as per the standard practice and as per Indian Electricity rules

11.3 Item wise Requirements

All the prime movers required for Mechanical equipment of water treatment plant would be of suitable H.P. and 3 phase squirrel cage induction motors working on 440 volts, 50 c/s 1440 rpm, class of Insulation 'B' I.S.I. mark

11.4 Starters

Direct on line starters of all motors up to 5 HP and star delta starters for 5 HP to 15 HP and above 15 HP auto transformer shall be provided. The starters, indicators, switches of all prime movers shall be installed at the appropriate places as directed by the TWAD Board officials and in accordance with I.E. rules.

11.5 Switch Board

Main Panel Board shall be provided with incoming and outgoing switches as indicated in BOQ and shall be as per IE rules.

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11.6 Cables

For connecting motor of various H.P. and panel board suitable 3, 3 ½ and 4 core aluminum armored cable of adequate capacity with regard to starting current of motor shall be provided and shall be reputed make (ISI marks) and laid as per standard practice as per IE rules.

11.7 Wiring

Point concealed wiring with 2.5 /1.5 sq.mm PVC aluminum insulated and PVC sheathed aluminum wire shall be provided in PVC pipe of suitable sized with continuous G.I. earth wire of 14 SWG complete with shock proof accessories erected on suitable electrical fixtures.

a) External

All the external wiring will be done by using cable of suitable size 2 core aluminum armored cable suitably erected with earthing in ground below 60cms. Suitable cable and cable boxes glands shall be provided with suitable earthing arrangements as per Rules

b) Poles

- i) poles for streets light shall be of RCC/MS heavy duty square welder pole and of 100x75x50mm dia. 5.5 meter long and suitable bend at top as per standard practice and of suitable sectional lengths. The erections of pole shall include excavation with 0.6x0.6x1.5m deep and embedded in cement concrete of foundation in CC 1:3:6 ratio with 40cm plinth. The poles shall be placed at a distance not more than 30 meters from C/C.

- ii) All necessary fixtures with necessary C.I .light post, clamps, nuts and bolt, screws, insulators with fuse unit of suitable capacity shall be provided, suitable earthing shall be provided to the poles.

iii) Painting

All the poles shall be nicely painted with one coat of Red oxide and 2 coats of superior quality of anti corrosive silver paint.

11.8 . Illumination

A) Industrial Fluorescent lights & Fittings and Floor Lights.

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i. Internal

White store enameled industrial type fluorescent fitting of 22 gauge M.S. sheet open ended reflector complete with 1.2 meter (4 ft.) x 40 watts tube starter and polyester heavy duty choke, with decorative cover completely mixed up with holders erected on suitable fixtures.

ii) External

- b) Weather proof and water proof street light industrial type of florescent for single 1:2 meters (4 ft.) tube consisting of cast aluminum body finished in silver gray enamel and MS Sheet flat reflector in white store enameled complete with one piece molded plastic cover enclosed in a metallic frame with rubber lining complete, choke and holders erected in a decorative manner on poles. K The fluorescent lights on street shall be spaced not more than 30 meters centre to centre. Fluorescent fittings with tube lights of 40 watts and 1.2 meters (4 ft) long polyester heavy duty choke, holders; starter of approved make

c) Flood lights.

General purpose flood light fittings of weather proof and water proof construction, suitable for and with 500 watts sodium vapour lamp earthed and with necessary fixtures in an approved manner.

d) Sodium vapour (SV) Lamp

12 Nos. of water tight sodium vapour lamps of 125 watts with standard fittings of reputed make shall be provided.

e) Automatic Emergency lighting.

6 Nos. of automatic emergency light unit 0.6m height bulb switch flexible cord and 3 pin plug of reputed make suitable for 230 volts shall be provided with wooden stand.

f. Fans

- i) Ceiling fans of approved type with condenser, A.C. 50 cycles per second, 230 volts, and 1400mm (56") sweep complete with all fixtures eg. Fan clamps, M.S. Plate, Nuts and bolts and hooks etc. With regulators canopy and down rod of required length. The down. rod shall be long enough so that a clear distance between the floor and the fan blades shall not exceed 2.6 meters. The ceiling fans shall be provided for every 294M³ of structure

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volume and located as per directions of the Engineer-in-charge. Ceiling fans shall be provided to all the buildings in the plant as per BOQ except stores, sanitary block and the portion of filter beds only, shall be provided and erected at places as directed.

Exhaust Fans

- ii) Exhaust fans of 45 cms (18") 230 volts, 50 c/s 1400 rpm, with condenser unit and complete with all its accessories and necessary fixtures shall be provided and erected in such a fashion to displace 120/cum/minute of air for cycle of every minutes. The location of the exhaust fans shall be as per the directions of the Engineer-in-charge metal sheet cowl for exhaust fan recess 45cm dia. fabricated for suitable frames of 25x25x3mm angle covered

with 22 gauge G.I. sheet and opening covered by expended metal the cowl to be fixed to wall with grouted bolts of 9mm dia and 12 cms length and nuts 6 nos. Exhaust fans shall be provided totally filter house, chlorine rooms, wash water pump house, etc

11.9 Earthing

Earthing for electrical installations both internal and external including boards and motors with adequate capacity of G.I. wire of suitable gauge shall be provided at suitable places and all earthing stations shall be inter connected so as to ensure maximum safety and GI plate charcoal, salt etc, shall be used and as per Indian Electricity Rules, the earthing wires will run along conduits up to plug points and as per the directions of the Engineer-in-charge.

11.10 Switch Boards, Switches for Building Wiring.

Piano type switches and 3 pin plug shall be provided and properly fixed. Sufficient number of such switch boards for operating convenience shall be provided with indication of fans lights, etc. on it.

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11.11 Power wiring.

Power wiring with 15 Nos. of 5 Amps plug points and 15 amps plug point for 230 volts suitable for operation of electric blower , drilling machine and grinder shall be provided only in filter house. This shall be in addition to the general plug points provided

11.12 Safety Provisions

The contractor shall at his own expense arrange to the safety in his operation as required in chapter safety provision. In case the contractor fails to make such arrangements, the Engineer shall be entitled to cause them to be provided and recover the cost thereof from the Contractor.

5. SPECIFICATION FOR HIGH DENSITY POLYETHYLENE PIPE SYSTEMS

HDPE pipes

- The High and Medium density polyethylene pipes shall strictly conform to IS: 4984/1987 and as amended from time to time.
- The contractor should procure the HDPE Pipes from a reputed manufacturer.
The contractor should furnish the test certificate issued by the manufacturer.
- The manufacturer's test certificate a be produced by the contractor for the pipes used in the works.
- In addition to third party inspection, wherever felt necessary, the Engineer shall have the power to test the HDPE pipes for its quality such as specific gravity, impact strength, internal hydraulic pressure test, diameter, thickness etc, in authorized laboratory.
- The HDPE pipe joints shall be Butt fusion welding/Electro fusion welding & Mechanical Joints
- The Engineer in charge, shall verify, in addition to the test certificate, whether the pipes are as per BIS, by visual examination, diameter, weight, wall thickness, flexibility, Colour etc.,

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3.19. HDPE Specials and Fittings

The Specials and fittings should be in conformity to the relevant BIS specification. The contractor shall flush the Pipeline with air to remove dust, water, mud etc. before fusing the joints. Before jointing, the Contractor shall place packing sand under the pipes on both sides of the joint to keep the pipes in line and at the correct alignment during the jointing process. Alignment clamps with the correct size shells should be used to align the pipe during the electro-fusion cycle.

The Contractor shall ensure that polyethylene pipe is only cut with an approved plastic pipe cutting tool. Before fusion is attempted he shall remove the oxidized surface of the pipe to be inserted into the electro-fusion coupling. The tool must remove a layer of 0.1 mm to 0.4 mm from the outer surface of the polyethylene pipe. It may also be noted that no fusion will be allowed without clamping device and only the approved cutting tools (Hack Saw shall not be allowed for cutting the Pipe) shall be used.

The contractor has to supply all the consumables required for carrying fusion of the joints (like cloth/ paper napkin, acetone etc.).

3.20. Backfilling

Backfilling shall be done after ensuring that appurtenance have been properly fitted and the pipe is following the ditch profile at the required depth that will provide the required cover and has a bed which is free of extraneous material and which allows the pipe to rest smoothly and evenly. Dewatering shall be carried out prior to backfilling. No backfilling shall be allowed if the trench is not completely dewatered. Prior to backfilling it should be ensured that the post padding where required of compacted thickness 150mm is put over and around the pipe immediately after lowering.

Laying and jointing of Ductile Iron Pipes

a) Ductile Iron pipes

The Ductile Iron pressure pipes shall conform to the I.S. 8329/ 200 & specials as per I.S. 9523/ 2000.

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b) Laying Ductile Iron Pipes as per I.S. 12288/1987

The pipe should be lowered into 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 scissor 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 closer 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 pipe should be held down either by partial refilling of the trench or by temporary strutting. All persons should vacate any section of trench into which the pipe is being lowered.

- b.1. On gradient 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 back fill should be well compacted.

c). Jointing of Ductile Iron Pipes

Two main types of joints are used with Ductile Iron pipes and fittings.

i. Socket and spigot flexible joints.

1. Push on joints.

2. Mechanical joints.

ii. Rigid flanged joints.

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Flexible Joints:

The spigot and socket flexible joint should be designed to permit angular deflection in direction and axial movement to compensate for ground movement and thermal expansion and contraction. They incorporate gasket of electrometric materials and the joints may be of the simple push-on-type or the type where the seal is effected by the compression of a rubber gasket between a seating on the inside of the socket and the external surface of spigot. Joints of the latter type are referred to as mechanical joints. Both push-in and mechanical joints are flexible joints. Flexible joints require to be externally anchored at all changes in direction such as at bends, etc., and at blank end to resist the thrust created by internal pressure and to prevent the withdrawal of spigots.

Flanged Joints:

Flanged joints are made on pipes having a machined flange at each end of pipe. The seal is usually effected by means of a flat rubber gasket compressed between two flanges by means of bolts which also serve to connect the pipe rigidly. Gaskets of other materials, both metallic and non-metallic are used for special applications.

Joining procedure:

Procedure for jointing will vary according to the type of joint being used.

Basic requirements for all types are:

- a) Cleanliness of all parts
- b) Correct location of components
- c) Centralization of spigot within socket and
- d) Strict compliance with manufacturer's jointing instructions.

Where the pipeline is likely to be subjected to movement due to subsidence or temperature variations, the use of flexible joints is recommended. A gap should be left between the end of the spigot and the back of the socket to accommodate such movement.

ii) Cast Iron Detachable Joints with Rubber Sealing Rings and Bolts and Nuts (IS 8794/1988)

This joints comprises a central collar, two flanges, two 'O' rings bolts and nuts. The pipe ends should be cleaned and the flanges inserted on pipe ends. The 'O' rings should be placed on the pipes by means of an Asbestos Cement or Wooden Cone and rolling the rubber ring upwards towards the pipe. The rubber rings are brought to the correct position by means of a site gauge. The central collar shall the be placed on the laid pipe and the pipe to be jointed brought close to the laid pipe leaving a gap of about 5 mm between pipe ends. The Collar should be centralized and the rings positioned to touch the collar. The flanges should then be brought closer, bolts inserter and tightened uniformly to ensure a leak proof joint. After every 9 nos. of AC coupling joints, one CI detachable joint shall be used. Whenever it is necessary to cut the Asbestos Cement pipe at site it shall be done to produce a smooth square-cut-end without damage to the pipe and cylindrical to assure joint integrity.

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V. WATER TREATMENT PLANT

SCOPE OF WORK

It is proposed to draw the total net requirement of surface water of 42.50 lakh litres and 48.30 lakh litres lpm for Intermediate and Ultimate stages respectively from Kuzhithuraiyar river near existing head work site. The raw water will be abstracted through 6 M dia. intake well inlet pipes on sides to draw surface water. The water from the intake will be pumped to Aerator of Treatment unit to be setup at near Head works. The treated water will be collected in the existing 2.00 LL sump and then pumped to the proposed and existing service reservoirs and distributed to the Public through Distribution Network.

The water treatment plant shall have a capacity to treat 4.83 MLD in 23 hours. The Contractor shall construct all civil works and install the complete plant including electrical and mechanical works consisting the following.

- i. Providing suitable aeration arrangements with all accessories (Cascade Aerator with 4 trays)
- ii. Channel between Aerator to Stilling chamber.
- iii. Construction of Stilling Chamber and providing raw water measuring device and raw water channel.
- iv. Construction of Flash mixer
- v. Construction of Clariflocculator
- vi. Clarified water channel to Filter house
- vii. Rapid sand filter bed (improvement works)
- viii. Pre and post chlorination arrangement
- ix. Providing all piping arrangements
- x. Recycling sump
- xi. Sludge collection well pit and sludge drying bed
- xii. Shifting of Transformer
- xiii. Providing 250 KVA Genset

AERATOR: Adopting loading rate 0.045 m²/m³/Hour

1. Measurement of Flow

- 1.1. The raw water will be pumped and delivered at treatment unit with a hydraulic level ie., tip of aerator 17.85m with the required discharge head. The raw water shall enter into the raw water channel in which flow measuring devices ie., Venturi flame adopted to measure the flow. The length of the flow channel shall be such that there shall not be any turbulence while measuring.

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- 1.2. An independent gauge chamber shall be provided duly connected to the measuring chamber to indicate the depth causing flow at the measuring device. Any floater gauge for measuring the head of flow shall be installed only in the gauge chamber and not direct in the measuring chamber to permit direct reading to the rate of raw water flow into the treatment plant.

2. Measuring Channel

- 2.1. Measuring channel between stilling chamber and flash mixer shall be RCC M30. It should be of size 1.00 x 0.60m and of length of 10.00 m. In the measuring channel flume type flow meter to measure the quantity of raw water shall be provided. For adding chemicals to the raw water and for inspection and forecast maintenance purpose, a walkway slab shall be provided and MS access ladder is provided for .

3. Chemical House and Chemical Dosing

- 5.1 Chemical treatment shall consist of application of Poly Aluminium Chloride alum solution to the raw water and lime solution if needed. Alum tanks with level indicator scale made of stainless steel, each capable of holding 8 hours requirements of alum solution assuming 5% solution strength and maximum dosage of 50 PPM during monsoon seasons shall be provided The solution tanks shall be of RCC with hopper bottom and inside lined with anti-corrosive, bituminous paint. Electrically operated stirrers of stainless steel shall be provided for mixing and preparing the alum solution..
- 5.2. The alum dosing device shall ensure that the rate of dosage remains constant irrespective of changes in liquid level in the solution and the rate of raw water admission to the plant will not fluctuate arrangements for automatic proportioning of alum dosage to the raw water in flow shall be necessary. Gravity feed arrangements shall be acceptable for alum dosing.
- 5.3. Paddle agitators for stirring alum solution shall be supported properly over suitable beam spanning the solution tanks. The driving motor and the reduction gears shall be totally enclosed and must be made easily accessible for maintenance.
- 5.4. The pipes and valve, for handling the alum solution shall be of rigid HDPE and that for the lime solution shall be galvanized Iron. The valves shall also be of HDPE suitable for chemical resistant.
- 5.5. Lime tanks shall be capable of holding at least 8 hours requirements assuming 5% strength of suspension and 15,00 ppm maximum dosage.
Lime tanks shall be provided with electrically operated stainless steel stirrers capable of working continuously, so as to keep the lime in perfect suspension all the time.
Lime dosing shall be effected by suitable devices which shall ensure that the rate of dosing does not alter with changes in liquid level in the lime suspension tanks. Start and shut off the dosing and changes in rate of dosing shall be effected manually. It shall ensure that the pipeline conveying lime solutions do not get blocked due to deposition.

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As the rate of raw water admission to the plant will not fluctuate, arrangements for automatic proportioning of lime dosage to the water in flow shall not be necessary.

6. Flash Mixer

6.1 Flash mixer shall have a detention period of 60 sec. Provision shall be made for electrically driven mechanical flash mixing equipment for coagulating chemicals with the raw water. The degree of agitation produced is of greater importance during the time over which mixing continuous.

6.2 Flash mixer shall be complete with equipment support for Mechanical reduction gear vertical shaft motor with control and drive. Easy access to the unit shall also be provided. Contractors shall furnish full specification of the equipment. Suitable arrangements shall be made for evenly disposing the chemicals.

7. Clariflocculator

8.1 The clarifier shall have a detention period of 10 to 40 minutes (2 ½ hours) with . surface loading of 3m³/m²/Hour. The surface loading shall not exceed 3m³/sq.m/Hour. per day and weir loading not exceeding 300m³ per day/m. Uniform discharge over the entire length of the weir shall be ensured by suitable means such as saw tooth edges made of non-corrosive material.

8.2 The clarifier shall be provided with rotary sludge scrapper operated by suitably geared electric motors. The scrapper shall be provided with succages to ensure complete removal of sludge from the floor. The designed tip velocity of the sludge scrapper will be 0.4m./sec. The contractor shall guarantee that the movement of the sludge scrappers will not disrupt the sludge. A sludge sump shall be provided in the floor of the clarifier with suitable drain pipes and control valves of size same as that of drain pipe for withdrawing sludge and for employing the clarifier. The sludge draw off pipe shall be 150mm CI LA class up to the end of sludge well.

8.3 As the flocculation chamber and the clarifier are to be built as an integrated unit, the design shall provide suitable intermediate slab or other devices to ensure that the sludge from the clarifier zone is not lifted up to in the flocculation zone due to the turbulence caused by the flocculator paddles.

8.4 Necessary ladders and platforms for access to the top of clarifier and for inspection of equipment shall be supplied and installed by the contractor. Walkway around the clarifier connected to the filter house may also be provided. All piping including sludge draw off shall be supplied and installed by the contractor up to and including the construction of junction manhole conveniently located to serve clarifiers and filters. The contract shall include the junction manhole, the designs for which are to be furnished by the contractor drain and the pumps for disposal of sludge and to be provided for discharging the sludge from the junction manhole to the drainage course.

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- 8.5 The contractor shall indicate the percentage removal of turbidity in the clarifier in relation to the raw water quality with the coagulated sludge being controlled at optimum level by jar test.
- 8.6 The velocity in the inlet pipe from mixing basins to the clariflocculator shall not be greater than 0.30m/sec. The pipeline shall be of cast iron. The flocculator chamber shall be with a detention period of not less than 30 minutes and shall be provided with mechanical flocculators operated by electric power equipment consisting of rotation bridge paddles, two flocculation sludge scrapper gears and motors with controls.
- 8.7 Total areas of all paddles depending on the type of paddle and other conditions shall be between 10 to 25% of the vertical cross sectional areas of the flocculation basin. The speed of rotation of the flocculation paddle shall be such as to give tip velocity not exceeding 0.40m./sec.
- 8.8 The clearance between the paddle and the side walls or floor of the flocculation chamber shall not exceed 30 cm and shall preferably be 15 cm. The shortest distance between the tips of paddles shall not exceed 20 cm. The flocculation chamber shall be provided with electrical driven sludge scrapper which shall scrap the entire flow of the chamber without leaving any dead pockets.
- The paddles and the solid shaft shall be of M.S. with suitable epoxy painting. The maximum thickness of paddle shall be 8 mm and the minimum dia. of shaft shall be 75 mm.
- 8.9 The sludge may be withdrawn through suitable conduits. The scrapper blades shall be provided with squeezer so that the sludge is scrapped clean. A suitable size control valve shall be provided for withdrawing the sludge and emptying flocculator chamber wherever necessary.
- 8.10 The drive of the sludge scrapper shall be designed to take care of tensional and bending stresses, to which it may be subjected to without any undue distortion or vibration. The drive shaft shall be supported by antifriction device and suitable housing. Suitable reduction gear with facilities for lubrication shall be provided.
- 8.11 The contractor shall furnish the full details of all equipments including information and method of adjusting speed. Motors and reduction gear shall be totally enclosed type.

9. Rapid Gravity Filters(existing)

- 9.1 The rate of filtration adoption is 125 to 200 lpm /M2 (7.5 to 12 M3/Hour).
3 m x 4 m size in 3 Nos . (2 Units in each row)
- 9.2 The contractor shall furnish full details of the filter media and under drains. If the standard type of rapid sand filter with supporting gravel and perforated pipe under drain system is proposed the specification shall be as follows.

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It is proposed to upgrade the existing three rapid sand filter units with dual media filters. Anthracite coal will be utilised in the filter media unit top layer followed by sand bed and well supported with gravel bedding at the bottom. Filter gravel shall be rounded and inert. Broken granite stones shall not be acceptable. Gravel shall be of rounded pebbles size of gravels vary from 2 to 65mm at top and 60mm at bottom as per IS 8419/ Part I the total depth being 45cm.

Filter sand shall be inert and the effective size shall be between 0.4 to 0.50 mm with the uniformity co-efficient not greater than 1.70 and not less than 1.30. The depth, of sand shall be 75 cm.

Ignition loss should not exceed 0.7% weight soluble fraction in HCL not to exceed 5% by weigh. Silicon content should not be less than 90%. Specific gravity shall be in the range 2.55 to 2.65. Wearing loss shall not exceed 3%.

Under drain system shall be of non-corrosive materials. The diameter of perforation shall be 6 to 18 mm. The total area of perforation shall not be less than 0.3 times the area of the filter and the spacing of the perforation shall be 30 cm. The total cross section area of the laterals shall not be less than 2 times the total area of cross section of the perforations. The ratio of total area of perforations in the under drain system, to total cross sectional area of lateral shall not exceed 0.5 to 12 mm perforations and shall decrease to 0.25 for 0.5 mm perforations. When the diameter of perforation is 18 mm, the lateral should be of PVC pipe (10 KSC) and length of the laterals shall not exceed 60 times its diameter. The cross sectional area of manifolds shall be 1.5 to 2 times the total area of cross section of the laterals. The end of the lateral on the wall side should be plugged so that during back wash no air is escaped through the end of the laterals.

- 9.3 The wash water gutter shall be so arranged that the horizontal travel of wash water over the surface of the filter is not more than 0.60 m to 1.0m. before reaching the gutter. The gutters shall be large enough to carry all the water delivered to it with at least 8 cm free board. The bottom of the gutter shall be at least 5 cm above the top of expanded sand bed. The top of gutter shall be placed sufficiently above the top of small bed. The laterals shall discharge into a common gutter and not into a main gutter.
- 9.4 Back washing of filters shall be made by use of filtered water from an overhead wash water tank with auxiliary air wash. The wash water tank shall have sufficient capacity for washing one filter unit (two beds) for a period of about 10 minutes at the maximum rate of washing of 600 to 900 lpm/m² after 5 minutes air wash without refilling the tank.
- 9.5 The height of the existing wash water tank is sufficient so that the pressure available in the under drainage system during back washing is 10m. The tank shall be provided with suitable size with scour and overflow pipes. The wash water outlet pipe shall be placed so that no air is drawn with the water due to vortex formation even while drawing water at low levels, at maximum rate. This

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may be achieved by locating the outlet bell mouth in a depressed sump in wash water tank or by other suitable means.

Water level indicator which can preferably read from inside the fitter house shall also be provided for the wash water tank for filling the wash water tank. water shall be drawn from the clear water delivery main.

The contract shall include the supply, delivery and erection of filling pump of suitable capacity in duplicate for filling the wash water tank. The cost shall include necessary pipe connection etc., The contract shall also include necessary sluice valve on the inlet pipe.

- 9.6 Indicating and integrating mechanism shall be offered for measuring the rate of wash water flow. The wash water shall be delivered at a pressure not less than 10 m. measured up to under drains. The contractors shall furnish the hydraulic calculation to show that the above pressure can be realized at the under drains with L.W.L. fixed by them for wash water tank when the water is drawn in the maximum required rate. Provisions shall be made for the supply and installations of a loss of head meter for each filter bed. A rate of flow indicator shall also be supplied and installed for each filter bed.
- 9.7 Each filter bed shall be provided with a rate of flow controller, which shall ensure a constant rate of filtration irrespective of the head loss in a filter bed and equipment shall be furnished in detail and the make shall be indicated.
- 9.8 Filter appurtenances shall thus include
- a. Control valves on the inflow, drain of wash water and wash water outlet lines
 - b. Rate of flow indicator
 - c. Loss of head meter
 - d. Wash water controller
 - e. Rate of flow regulator (Controller)
- 9.9 The influent, effluent wash and waste water pipe together with the rate controllers and appurtenances shall be placed in the pipe gallery. Gallery shall be well, designed to provide adequate space for ventilation, drainage and easy accessibility to all pipe work and other fittings. Piping to the clear water reservoir shall also be supplied and installed by the contractor. All waste water piping will be extended to a common sludge well and disposed off.
- 9.10 There shall be a bye pass from raw water channel to filter inlet to enable clarifier to be bye-passed when necessary. There shall also be a bye-pass from the settled water channel to the filtered water channel before the point of post chlorination to enable filter to be bye-passed when necessary.

10. Chlorination

Pre and Post Chlorination

Necessary suitable gravity feed pre and post chlorination equipments are to be supplied and installed. The pre-chlorination units shall have a capacity to provide at the rate of 3 ppm. The pre and post chlorination may be 0.9 kg./hour individually per chlorinator (one for post and another for pre-chlorinator) 2 Nos. of chlorinators may be provided including supply of 2 nos. of chlorine cylinder of 1 tonne capacity each.

10.1. Clear Water Sump

Clear water 2.00 LL sump (existing)

11. Pipes fittings and valves

All cast iron pipes, other pipes. special fittings and valves, meters etc., supplied by the contractor shall strictly conform to the relevant BIS. Valves shall bear I.S.I .Marking and shall be of approved make acceptable to the Engineer. The make of the valves shall be furnished. The Head stocks shall be provided for operation of all filter control valves from operating platform.

12. Overflow

All pipes, measuring devices, rate of flow controllers etc., shall be capable of allowing an over load of 25% of flow through the treatment works.

13. Measuring Device

Electronic flow meter with sensors and accessories with digital recorder shall be installed in the treatment plant to record the filtered water output.

14. Electrical and Mechanical Equipments

Electrical meters, gear boxes, switches and wiring etc., shall conform to the relevant BIS and shall be of reputed and acceptable to the Engineer.

All conduit piping for electrical wiring shall be as per I E rules. Wiring and installation of electrical equipment shall be according to the relevant code of practice recommended in BIS and IE rules. All the precautions for the purpose of safety in providing electrical installation shall be as per IE rules.

The contractors shall provide a main switch board in the electrical control room of filter house which shall be provided with one incoming TPICN switch fuse with HRC fuses, sufficient number of outgoing switch fuses. Voltmeters phase selector switch and phase indicator lamps etc., to be provided by the contractor Electrical connections unto the incoming switch fuse in the main switch board and also the other wiring from the main switch board to the various units of the plant shall be done by the contractor. Conduits should be used for the electrical cables and should be underground and concealed as far as possible.

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15. Filter House and Yard (existing)

16 Laboratory Room at Chemical House (Existing) .

16.2 Lightings (existing)

17. Supply of pipes and specials

It is to be clearly noted that all pipes specials valves and other fittings required for the work are to be supplied by the contractor.

18. Special Equipments

18.1 Air blower unit and all allied pipings

19. RCC sludge pit – 4 Nos.

The contractor should construct a RCC sludge well of 2m. dia and a depth of 2.50 for collecting sludge from clariflocculator by means of providing suitable scour arrangements as per the design and structural drawing.

Sludge drying beds of size 2.50 m x 5.0 m – 4 nos will be constructed with 1 bed as stand bye

20. Test on completion and maintenance of plant

On completion of the construction and installation of the plant, the contractor shall perform the tests at his own expense and operate it for fourteen days to perform the initial maintenance in accordance with the direction of the Employer as follows.

- a. Contractor shall be given 2 weeks to carry out preliminary test and make necessary adjustments to the plants.
- b. The contractor shall then operate the plant for a further period of one year with his own staff and during this period, he shall train up the departmental staff in plant operation and maintenance and keep accurate records to check the plant performance. He should maintain observation and submit relevant records providing the efficiency of clariflocculator, filter beds. etc.

The contractor shall provide all the necessary consumables including chemicals for running the plant during the maintenance period, but the power supply will be provided by the Employer at free of cost for maintenance period.

21. If the plant does not perform satisfactorily in all respects, the contractor shall carry out alterations at his own expense and satisfy the employer of performance after further tests.

22. Sampling and Testing

Samples of raw water, settled water, filtered water and chlorinated water shall be collected at an interval of 1 week (or such shorter intervals as may be decided by the Engineer) during the trial maintenance of the plant by the

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contractor and tested to determine the efficiency of the treatment plant, The following tests shall be conducted to check and record the quality of the water and the efficiency of the plant.

1. Physical
 - a. Temperature
 - b. Colour
 - c. Odour
 - d. Taste
 - e. Turbidity
2. Chemical
 - a. PH
 - b. Alkalinity
 - c. Hardness
 - d. Residual Alum
 - e. Iron and Magnesium
 - f. Tidy's test for Kmn 04
 - g. Residual chlorine
 - h. Chlorides
3. Bacteriological
 - a. Most probable no. of coli-forms
4. Microscopical
 - a. Algae count

The analysis shall be carried out at the TWAD Water Analysis Laboratories. The cost of analysis shall be borne by the contractor.

23. Doors, Windows, Ventilators and Rolling shutters

23.1 Doors, windows and Ventilators should be provided with Aluminum frame with glazed panels for filter house in chemical room, chlorination room, office-cum-laboratory and control room. All other fixtures such as haunches, wind appliances should be of good quality and non corrosive material. Shutter area of doors, windows, ventilators shall not be less than 20% of the floor area to attract natural ventilation and lighting.

23.2 The glass for the doors, windows and ventilators shall also conform to IS 1081-1960.

23.3 All wood work shall be done as per relevant specifications in TNBP and BIS

23.3 The steel rolling shutters should conform to IS 6248-1979, it shall be of push and pull type with 20 gauge thick sheet including side bottom rails, brackets, door suspension shafts housing box at top and mechanical gear operation and locking gear arrangements at both ends. The shutters should be painted with three coats of anti-corrosive paint of approved quality and colour.

24 MS Ladder

The M.S. ladder if any to be provided shall be of 0.5m wide consisting of 65mm x 12mm flat stringers with 16mm dia MS bars in double row at 30 cm

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c/c. The item shall include all fixtures and painting with 2 coats of anti-corrosive paint.

25. Painting of Metal Surfaces

All surfaces of metal works shall be thoroughly washed, dried, cleaned and degreased before painting over the top coated primer. The contractor shall clearly indicate the surface treatment for all metal surfaces of the plant in the schedule of specifications. It shall be generally done complying with the relevant clauses of TNBP and IS 1477-1971. The schedule for painting new metal surface shall be strictly adhered to. The following table gives the nature of surface treatment desirable.

Sl.No.	Surface	Treatment
1.	All railings and MS ladders	Galvanization with chromate primer and two coats of approved oil paint and one finished coat.
2.	Submerged metallic parts and Projections above water level.	Bituminous paint/Epoxy paint
3.	Metal parts above water level	Finishing coat of oil painting over two under coats of red oxide primer.
4.	All indoor fixtures, parts, instruments, Electrical equipments, panels etc.,	Chromium or Nickel plating

26. Pipes, Specials and Valves

26.1 All pipes and specials shall be cast iron, double flanged conforming to BIS.

All pipes and valves supplied should have ISI certification marks with IS No, as below:-

CI pipes	IS 7181/86
CI specials	IS 1538/76
Sluice valve	IS 780/1984 & 2906/1984
Manhole frame & cover	IS 1726 (part II/1974 & Part VII/Section/1974)

26.2 The pipes and specials to be fixed in concrete shall have puddle flanges

27. Mechanical and Electrical Works

The design, manufacture and erection of the mechanical and electrical equipments should satisfy the provision in the relevant ISS. Further to the extent possible all mechanical and electrical items supplied by the contractor should bear necessarily the ISI Certification marks. Conduits should be used for the electrical cables and wiring and should be concealed as far as possible.

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28. Testing of Civil and Mechanical and Electrical Works

The testing of the water retaining structures should satisfy the provisions in TNBP and IS 3370 Part I. The mechanical and electrical equipments when tested should satisfy the manufacturer's specifications which have to be furnished by the contractor and got approved by the Engineer before supplying the equipments. They should also bear ISI certification and satisfy the relevant BIS. Moreover, the electrical equipments should satisfy the test prescribed by the Chief Electrical Inspector or his representative if necessary.

29. Scientific Apparatus and Chemical for the Laboratory

The various types of scientific apparatus, instruments, chemicals etc., supplied by the contractor for equipping the laboratory should satisfy the relevant IS codes or in its absence, the relevant B.S.Code, if they are not covered by the above codes they should satisfy manufacturer's specifications which have to be furnished by the contractor.

30. Technical Specification (Departmental Design)

The salient features, hydraulic levels and special specification of all the components of the treatment plant are furnished below-

Average ground level for all units proposed is (+)10.300

30.1 Cascade Aerator – 1 No.

4 Nos. of tray of size 1.4,0, 3.20, 2,4,1.60m dia. with a collection circular tray of 6.0 m dia to be provided to treat 4.83 MLD at the loading rate of 0.0045 M2/M3/Hour

Capacity	4.83 MLD
Structure	Foundation & Columns and steps with RCC M30
Pipeline	400mm dia DI D/F pipe and specials

30.2 Stilling Chamber

Size	3.00 x 2.0m and depth 1.78m
Structure	Foundation & Superstructure with RCC M30
Water level	15.10 m
GL	10.65 m

30.3 Raw Water Measuring Channel

Size	1.00 x 0.6m x and 10.0 m length
FSL	at entrance 15.10 m and at weir 15.0m

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30.4 Flash Mixer with outlet chamber– 1 Nos.

Size	1.50 m dia
Effective water depth	1.97 m
Detention period	60 seconds
Water level	15.0 m
GL	10.65 m
Structure	Foundation and Superstructure with RCC M30

30.5 Clariflocculator

No.of units	ONE
a. Flocculation Zone	
Detention time	30 Minutes
Diamter (Inner)	6.75 m
Water depth at centre	3.00 m.
Water level	14.50 m
GL	10.65 m
b. Clarifier Zone	
Detention time	2.0 hours
Diamter (internal)	15m
Water depth	4.375m at centre
Water level	14.50 m
GL	10.65 m
Structure	RCC M30
c. Sludge pit size – 1.0 m dia and 2.0 m depth	
d. Sludge Drying bed – 4 nos	
size	2.5m x 5.0 m

30.6 Clarified water channel -	size 0.40 mx 0.60 m and Length 15.0m
Structure	PCC 1:4:8 for foundation & M30 for others

30.7 Rapid Sand Filter

No. of beds	3 nos. existing
Size of each bed	3.0 X 4.0 M
Anthracite coal depth :	0.30 m
Sand depth	0.45M
Gravel depth	0.45 M.
Water depth above sand	1.20 M.
Free Board	0.50 M.
Structure	Foundation and Superstructure with RCC M30

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30.9	Size of Filter Media	
	Effective size	0.40 mm to 0.70 mm
	Uniformity co-efficient	Not greater than 1.70 and not less than 1.30
	Size of gravel	2 to 65mm at Top and 60 mm at Bottom
30.10	Clear water sump - Structure	2.00 LL capacity (existing) RCC M 30 for Super structure, etc.,

30.11 Filter House

The existing building constructed with RCC M30 foundation, RCC framed structure, brick work in CM 1:5 for basement and walls. Weathering course with brick jelly with pressed tiles over the filter house . Rain water down fall pipes, basement drain around the building shall be provided with ramp and steps wherever necessary. Platform and walkway should be provided with White coloured glassed Ceramic tiles of size 20cm x 20cm x 2cm flooring as per specification.

30.12 Chemical House

The existing building constructed with RCC M30 for foundation and RCC framed structure, column, beams, lintels, sunshades in RCC M30 for water carrying channel lime tanks and alum tanks in RCC M30, brick work in CM 1:5 using country bricks, for basement and wall. Weathering course to be provided with brick jelly and pressed tiles over the weathering course.

Plastering with CM 1:5, 12 mm thick for walls, and CM 1:3 20 mm thick for surface in contact with water and chemical solution tank ceiling plastering with CM 1:3 – 10 mm thick will be provided for soffits of the structures inside. All surfaces of walls and ceiling treated with cement paint of approved colour and shade. White coloured glassed Ceramic tiles of size 20cm x 20cm x 2cm for lab, office room, chlorinator room with passage in first floor and construction of bathroom and toilet, septic tank, stair case and providing with rain water downfall pipes, ramp and steps wherever necessary.

30.14 Wash Water Tank – existing 1.0 LL CAPACITY over the filter house

30.15 Recycling sump

Capacity 1.00 Lakh litres constructed separately with RCC M30

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30.16 Doors and Windows - EXISTING

All pipe connections, valves and fittings for dosing alum and lime shall be of non-corrosive materials and should be of adequate size. All tanks of RCC M 30 with suitable coating of bituminous paint for alum tank and suitable lining in rubber, PVC or epoxy resin for lime tank.

31. Specification for Mechanical Equipments and Works

31.1 Pipes and Specials

All pipes and specials except for sludge drainage arrangement shall be of DI/CI 'LA' class. For sludge drainage arrangement AC/RCC/PVC pipes can be used. All pipes and specials which shall be laid below the floors, walls, foundations etc., of plant structure should be of mild steel/CI only, made out of 10mm thick plates. All MS pipes shall be painted from both surfaces with 3 coats of anti-corrosive paint of approved quality.

31.2. Valves /Pen

All the valves shall be of cast iron double flange type Stock/Gates. and shall be of best reputed make valves shall bear the certification of ISI. All valves shall have spur gear/wheel arrangement for manual operations. All sluice valve gates shall be of approved make and with brass lining. It shall be provided with spur gear arrangement/hand wheel for easy manual operation. All penstock shall be brass lined and provided with suitable arrangement for easy and smooth manual operation.

31.4 Water Level Indicator

The indicator shall be of 15 cms, wide enamel quoted Indicator. MS plate mounted on teak wood frame necessary graduation in metric units. All allied fixtures such as PVC float copper guide chair, pulleys counter weight indicating arrow etc., shall be got approved from the Engineer in charge.

31.5. Cowl Ventilators

AC cowl ventilators shall be 100 mm dia and of suitable height. It shall give attractive appearance. It shall be painted with 2 coats of anti-corrosive paint of approved quality and shade.

31.6 Finishing

After entire completion of the plant all the mechanical equipments, fixtures, fastenings shall be first thoroughly crapped and cleaned and they shall be applied with 2 coats of anti-corrosive paint of approved quality and colour and shade.

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31.7 Lightning Conductor

1 No. of lightning conductors of the highest elevation shall be provided suitably for the entire plant site. It shall consist of solid copper rod super terminal 2.5mm dia 1.5 m long with a knob at the end and with conical spikes on top.

- i. Suitable clamps to fix the conductor to the walls
- ii. Copper tape conductor 25 mm x 16 mm
- iii. Copper earth plate 1 sqm.in area and 1.5mm thick
- iv. Charcoal, commercial salt and sand for filling
- v. GI pipe of 50mm dia upto 3m.height above G.L.

All shall include excavation for the trench to the required depth by filling with charcoal, salt and excavating staff all the labours necessary figures etc., as per instruction of the Engineer in Charge.

31.8 Fire Extinguisher

Sufficient number of fire-extinguisher shall be provided in panel board room, blower room, wash water pump room, laboratory filter house etc., Each unit shall have a capacity of 10 litres. It shall be of reputed make and shall be of have to be approved by the department.

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V. WATER RETAINING STRUCTURES

(Elevated Service Reservoir/ Ground Level Service Reservoir / Sump etc.)

1. Each service reservoir shall be executed as per the drawings and specification and as directed by the Engineer – in- charge.
2. The service reservoir shall be provided with suitable size CI/DF pipes for inlet, delivery, over flow and scour connections and painted with two coats of anti corrosive paint as per BOQ/drawing.
3. Suitable size sluice valves with gear arrangements wherever necessary shall be provided for all inlet and outlet connections with valve pits.
4. Water level indicators enamel painted with float and painted with graduation in metric units shall be provided to indicate water level inside the reservoir.
5. Suitable size and required number of ventilators, manhole covers shall be provided as directed by the employer.
6. RCC spiral staircase shall be provided for outside and access ladder inside the service reservoirs as per specifications.
7. The finishing colour of the service reservoirs shall be aesthetically selected after its approval by employer and double coating shall be applied after water tightness certificate is given by the Employer.
8. Letterings to indicate the capacity and other details as directed by the Employer shall be written on the side wall of the service reservoirs.
9. Valves shall be provided with valve pits and cover to bear the loads coming on it as per departmental type and design and plans.
10. Testing for Water Tightness
 - 10.1 For water retaining structures above ground level, the requirement of the test shall be deemed to be satisfied if the external face shows no sign of leakage and remain apparently dry over a period of observation of seven days after filling up to maximum water level and allowing seven days period for absorption.
 - 10.2 In case of underground structures with top covered, the tanks shall be deemed to be water tight if the total drop in water level over a period of seven days does not exceed 40mm.

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- 10.3 If the structure does not satisfy the condition of the test period, the test may be extended for a further period of seven days and if the specified conditions of the test are satisfied the structures shall be considered to be water tight.
- 10.4 In case of unsatisfactory test results, the contractor shall ascertain the cause, make all necessary repairs and repeat the procedures in the preceding clauses until the test has been passed satisfactorily at no extra cost to the Employer.
- 10.5 In addition to the withheld amount, 40% of the amount of each bill of the contract shall be deducted and will be retained till the date of receipt of certificate of water tightness from the Executive Engineer, TWAD Board. The Whole of the above sum together with any recovery from the payments already made to the contractor as may be assessed by the Executive Engineer shall be forfeited to the TWAD Board if the RCC Reservoir develops structural defects or leaks. The above recovery shall be exclusive of the amount deposited towards security deposit. The fact of carrying out water tightness test should be recorded in M.Book. The lat part bill should be passed only after above certificate is issued. However the contractor shall be permitted to execute an indemnity bond in lieu of the recovery of 0% in each bill in prescribed form in stamp paper for a value of Rs.100/- towards water tightness and structural stability of the reservoir/water retaining structure. The period of guarantee required by the contract shall be two years from the date of completion and commissioning (with filling of water up to maximum water level in the case of service reservoir/over head tank/ water retaining structure). If defects are noticed within the stipulated period of 24 months of satisfactory performance, the defects should be rectified by the contractor at his own cost and the performance period again shall be reckoned from the date of completion of the rectification of defects by the contractor. In the case of service reservoir/over head tanks and other water retaining structures during this period, structure under full working head of water should show no sign of leakage. The test for water tightness should be

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arranged to be carried out and completed within 30 days from the date of intimation, by the Engineer. The testing of the service reservoir/ OHT/ and other water retaining structures should be done by the contractor at his own cost inclusive of all necessary equipment, water etc., complete. The test for water tightness of the structure as well as materials of construction used shall be conducted in conformity with the standard specification as per IS 3370 (Part – I)/ 1965 as amended from time to time and the other specifications as mentioned in the bid document.

11. C.I.Pipe Connections

- 11.1 The vertical pipe connections shall be hoisted and fixed true to plumb without any deviation from the verticality as directed by the Engineer in charge.
- 11.2 The jointing of pipes shall conform to the requirement jointing materials shall be arranged by the contractor at his cost.

12. Scour

- 12.1 Scour and overflow arrangements should be connected and let to a common pit from where it will lead to the nearest open drain.

13. Maintenance

- 13.1 During the maintenance period, the contractor should clean the elevated service reservoir and sump at the intervals as directed by the Engineer.

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VI. PUMPSETS AND ACCESSORIES

General

- 1) All the materials used shall conform to the relevant BIS and should be delivered at site of work. The contractor is responsible for safe custody of machinery and other equipments under this contract till handing over to the employer.
- 2) The rates should include all the minor items of civil works, if any required for installation complete.
- 3) All necessary civil works for condition of all equipments and accessories offered by the contractor under this contract should be done by the contractor.
- 4) Test certificates for machinery and equipments should produced along with supply.
- 5) The bidder should enclose the performance curve duly indicating the duty point for the size of the impeller selected (family curve should not be furnished.). The performance curve should furnish complete range of operation and the curve should be authenticated by the manufacturer or his authorized dealer. In the event of non compliance the offer shall be summarily rejected.
- 6) The contractor shall make necessary arrangements to get of electricity from TNEB for operating the machinery and equipment. Necessary vouchers in original for the payment made to the EB shall be produced to the employer by the contractor which shall be reimbursed by the employer.
- 7) Before supply of machinery, equipments and other accessories prior approval of the engineer should be obtained giving the name of makes and other details required.
- 8) Obtaining approval of electrical layout diagram for the installation of all the equipments (transformer, generators, pump sets and other accessories) and obtaining safety certificate on completion of work from Chief Electrical Inspector to Government of Tamil Nadu arranged and got approved by the contractor at his cot.
- 9) The contractor should get the layout approval in time before execution and for the size and capacity of the equipments before the supply of the same.

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After execution of the Safety Certificate if any modification or alteration suggested by the Chief Electrical Inspector on the installation work done by the contractor should be carried out by the contractor at his cost.

- 10) All the materials should be supplied as per BOQ and should be of standard makes mentioned below : -

SL. No.	Description	Make
1)	Centrifugal pump	Kirloskar, Jyothi, best and Crompton Mather and Platt, Inorthington, Flow More or equivalent
2)	Turbine Pump	Kirloskar, Jyothi Best and Crompton Mather and Platt, Inorthington, Flow more Fair Banks Morse or equivalent.
3)	Submersible pump and motor	KSB, Calama, Waterman, Atlanta, Deccan, CRI and Karvel
4)	Make of motor	Jyothi NGEF, GEC, Crompton and Greeves, Siemens or equivalent
5)	Make of transformer	Kirloskar, GEC Indo TECH, Hindustan or equivalent
6)	Diesel Generator	Kirloskar, GEC or equivalent
7)	Starter	L&T, Cutler Hammer, Siemens, MEI or equivalent
8)	Switch fuse and circuit breakers	L&T, Cutler Hammer, Siemens, MEI or equivalent
9)	Cables	Finolex, Unista, Uniflex, Polycab or equivalent.
10)	Valves	Kirloskar, Venus, Upadyaya CALSONS or equivalent

- 11) The right of choosing the make among the makes offered by the contractors rest with the employer only.
- 12) The submersible pumps centrifugal pumps, turbine pumps submersible motors, motors for turbine and centrifugal pumpset transformer,

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generators, Panel Boards to be supplied by the firm will be inspected by the Inspecting Agency fixed by the Employer at the manufacturers premises and test certificate will be issued.

All tests necessary to ensure that the plan and machinery or equipments complies with the specification and guarantees shall be carried out at site and at the contractor's cost and such test shall be carried out within one month of completion of erection. Should the result of these test not done within the margin specified, the test shall reported within one month from the date of plant is ready for retest and the contractor shall repay to the Engineer all reasonable expenses to which he may be put by such test.

- 13) If the completed plant or any portion thereof is found to be defective the Engineer shall give the contractor a notice in writing to verify such defects. If the contractor fails to rectify the defects within the specified period the Engineer will rectify the defects at the contractor's risk and cost.

3(a) CENTRIFUGAL PUMPS

The pumps shall be designed, manufactured, erected, tested and commissioned as per standards laid down by IS 1520 1980 and as amended from time to time. The standard accessories required for may be supplied along with irrespective of whether such items are specifically mentioned or not in the specification. The design should ensure the noise pollution level below the permissible limit. The rotating parts are to be statically and dynamically balanced. The name plate in stainless steel should indicate the sl. No. discharge, head, speed specific gravity of water to be pumped pump input, motor rating, make etc.

The casing should be free from blow holes, cracks and other imperfections conforming to relevant standard.

Bearing housing shall be of such design to exclude entry of water bearing may used of oil lubricated or grease lubricated type.

The shaft design should ensure the deflection not exceeding. 1 mm per meter length. The flexible tyre type rubber coupling is recommended for coupling pump and motor of horizontal mounting.

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Painting may be done as per relevant Bureau or Indian Standard Specification.

i) CASING :

The casing shall be coarse grained, cast iron split along with the horizontal central line separately machined free from bow holes or other defects. The suction and delivery branches shall be casted integral with the lowest half of the casing so as to permit the removal of the impeller for inspection and repairs without disturbing suction and delivery pipe connections and the pump alignment with the motor.

ii) IMPELLERS

The impeller shall be of phosphor bronze steel. It shall be turned and trimmed to gauge and hydraulically balanced on its pump shaft to ensure the same for running without vibration to suit the required duty to meet the conditions under which the pumps are to be operated.

iii) IMPELLER SHAFT.

The shaft shall be of stainless steel of ample size and stiffness to transmit maximum power without strain or vibration. It should be turned and ground to the exact diameter and key fitted to prevent the impeller rotating with any play. The shaft shall be protected from contact with water at the stuffing box with readily renewable phosphor bronze sleeves.

iv) STUFFING BOX

The stuffing boxes shall be of ample depth and size for the packing and shall be provided with lantern rings and connections for sealing water and pressure to prevent leakage of air.

v) BEARINGS

The Impeller shall be supported by ball or roller bearings mounted in housings. The bearing caps shall be removable and the bearings shall be ample size to ensure cool running with a minimum of attention and shall be provided with an efficient lubricating system. The bearing shall be of standard type of design which are readily available from stocks held in India.

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vi) ACCESSORIES

Each pump shall be provided with the following accessories.

- i) Lifting Hook
- ii) Priming funnel
- iii) Approved type of lubrication system
- iv) Drip water pipes
- v) Pressure gauge as specified
- vi) Compound gauge as specified

vii) NAME PLATE

Each pump shall be provided with name plate bearing the following particulars clearly marked on it.

Make	Index No.
Litres per minute	Total head in metres
No. of Stages	Diameter of delivery branch
Revolution per minute	Diameter of suction branch

viii. BASE PLATE

The base plate shall be of extended type for accommodating the pumps and the motors and it shall be rigid substantial casting with machined faces for the feet of the pumps and motor and it shall be faced on the underside.

ix) COUPLING

The shaft coupling for connecting up the Impeller shaft with the motor shaft shall be of flexible type. It shall be made of cast iron turned over to obtain perfect balance, bored to shaft size and securely keyed to the shaft.

x) CHARACTERISTICS CURVES

Performance curves for the sump indicating the head in meter, efficiency, B.H.P. observed at pump set against the output in litres per minute shall be furnished.

IX. ANNEXURES

I) Pump characteristics

II)

a) Turbine Pumps

b) Motor for turbine

III

a) Submersible pump

b) Motors for Submersible pump

IV Transformer

V Generator

VI Starters

(THE ABOVE ANNEXURES ARE APPLICABLE SHOULD BE FILLED IN AND DULY SIGNED AND ENCLOSED WITH THE TECHNICAL BID – COVER I)

ANNEXURE - IPump Characteristics

SL No.	Description	Technical Details	Remarks
a.	Capacity in LPM (discharge)		
b.	Total head in meters		
c.	Net positive suction head required		
d.	HP absorbed by the Pump		
	i) at duty point		
	ii) at max BHP point given in the range of curve furnished		
e.	HP of the motor offered		

Note :

The motor must not get over loaded, at Positive low head condition due to Maximum W.L. conditions in Bore well / well.

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IX. STARTING :

Motor shall give full load torque when taking 1 to 1.5 times full load current.

The motor shall have a name plate giving the following information.

- a) Induction motor
- b) Name of manufacturer
- c) Manufacturers No. and Frame reference
- d) Type of enclosure
- e) BHP
- f) Rated voltage and winding connections
- g) Rated output in KW
- h) Number of phases
- i) Frequency in HZ
- j) Current approximate in amperes at rated output
- k) Speed in revolutions per minutes at rated output
- l) Current approximate in amperes at rated output
- m) Speed in revolutions per minute at rated output

SPARE PARTS

Supply of spares and tools shall be made as per the list prescribed in BOQ with index card.

TOOLS

Standard tools for the maintenance of the equipments shall be supplied as detailed

D/E spanners	1 set
Ring spanners	1 set
Bearing puller	1 No
Grease gun	1 No
Hand Gloves tested for electrical operation	1 pair
Ball peen hammer	1 No
Screw drivers	1 set
Electrical tester	1 No
Electric megger	1 No

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COMPLETION PLANS

The successful bidder shall be requested to furnish completion plans in triplicate within one month from the date of the first testing of the plants. The plan should show the entire layout of the plant executed. Two copies of plan should be supplied to the Employer and one to be framed and suspended in the Head works. The contractor shall in addition to the above furnish detailed specifications of the equipment provided to the Employer with all technical data.

MAINTENANCE MANUAL:

The periodical maintenance schedules for each equipment shall be given with reference to the hours of operation. Detailed information about the spare parts (part name, identification number etc.) should be given. The copies of the manuals should be furnished within one month from the data of commissioning.

VII. Maintenance Period

The following measures are to be taken essentially by the contractor

- ◆ Necessary maintenance crew with supervisory staff shall be deployed. The staff pattern proposed by the contractor for the maintenance of the completed project should be got approved by the Employer one month before the issue of completion certificate. The entire strength of maintenance crew with the supervisory personnel should be available from the first day of the maintenance period.
- ◆ The contractor should keep all spares required for replacements at the head works, pumping main, distribution system, pump sets etc., readily available to ensure uninterrupted water supply to the beneficiaries.
- ◆ All the equipments that go out of order during the course of the maintenance period shall be rectified / replaced immediately to ensure uninterrupted water supply. If any equipment / machinery is found to be defective either due to manufacture or due to unsatisfactory maintenance, the same should be replaced by the contractor at his cost.

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- ◆ The contractor is responsible for the incidence of any theft, malpractice etc within the project area during the maintenance period and the contractor shall keep the Employer indemnified.
- ◆ During the period of maintenance, all costs towards labour, spares, consumables, repairs and renewals shall be on to the account of the contractor.
- ◆ The electrical energy charges payable to TNEB during the maintenance period shall be borne by the Employer.
- ◆ Complete quality service shall be ensured by the contractor during the maintenance period.
- ◆ Necessary log books indicating the quantity of water pumped, and maintenance carried out and repairs attended with details of spares changed shall be maintained by the contractor on a day to day basis and produced to the Engineer-in-charge whenever called for.
- ◆ Immediately after verification of satisfactory functioning of the scheme by the Implementing division within a period of 3 months, the scheme may be handed over to the TWAD Board Maintenance Division even while the implementation contract concluded with the Contractor is alive. The operation and maintenance
- ◆ clause in the implementation contract can be continued to be done by the contractor until the total expiry of contract period (i.e) 12 months specified in the implementation contract and the enforcement of the contract with regard to the maintenance clause of the contract will be by the Maintenance Division.
- ◆ Completed schemes after six months of Contractor's maintenance shall be handed over to the local body by following due procedures laid down in this regard by the Government along with appropriate presentation to the local body about the scheme details and its maintenance.
- ◆ After handing over the scheme shall be maintained by the Contractor under joint supervision by the TWAD Board and the local body for the next six months.

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VIII. Reference to Specifications / Code of Practice

Description	BIS No.
Ordinary Portland Cement (33 Grade)	269 – 1976
43 Grade Ordinary Portland Cement	8112 – 1989
Pozzolona Portland Cement	1489 – 1991
Hydrophobic Portland Cement	8043 - 1978
Rapid Hardening Portland Cement	8041 - 1990`
Low Heat Portland Cement	12600 - 1989
Standard sand for testing of cement	650 – 1966
Methods of Test for Pozzolonic Materials	1727 - 1967
Methods of sampling and test for water & waste water (Physical & Chemical)	3025 - 1984 (Part I to 37)
Methods of Sampling hydraulic Cement	3535 - 1986
Methods of Physical tests for hydraulic cement	4031 - 1988 (1 to 14)
Methods of chemical analysis of hydraulic cement	4032 - 1985
Aggregates coarse & Fine from Natural resources for concrete	383 – 1970 4082/1977
Sand for Masonry Mortar	2116 - 1965 1542 / 1977
Methods of tests for aggregates for concrete	2386 – 1963 (Part 1 to 8)
Part I - Particle size and shape	2386 - 1963 (Part-I)
Part - II - Estimation of deleterious Materials & Organic impurities	2386 - 1963 (Part - II)
Part III – Soundness	2386 - 1963 (Part - III)
Methods of sampling of aggregates for concrete	2340 - 1986
Specifications for test sieves	460 – 1978 (part - I)
Part I - Wire cloth test Sieves	
Common Burnt clay building bricks	1077 - 1976
Mild Steel and Medium tensile steel bars and hard	432 – 1982
Drawn steel wire, concrete reinforcement, Part I Mild Steel & Medium Tensile Steel Bars Part II Hard drawn steel wire	
High Strength deformed steel bars and wires for Concrete reinforcement	1786 - 1985
High Tensile Steel for PSC Pipes	1784 - 1986 (Part I)
Bending and flexing of bars for concrete reinforcement	2502 - 1969
Recommendation for detailing of reinforcement In reinforced concrete works	5525 - 1969
Methods for tensile testing steel wire	1521 – 1972
Methods of test for determining modulus of elasticity	2854 – 1964

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Description	BIS No.
Glossary of terms relating to cement concrete	6461 - 1972 (Part 1 to 12)
Methods of test for strength of concrete	516 – 1959
Methods of sampling and analysis of concrete	1990 - 1959
Methods of testing bond in reinforced concrete pull out test	2770 -1967
Methods of test for permeability of cement Mortar and concrete	3085 - 1965
Methods of test for splitting tensile strength of concrete cylinders	5816 - 1970
Methods of tests for determining setting time of concrete by penetration resistance	8142 - 1976
Code of practice for construction of Pile foundations (concrete piles) Driven cast-in-situ concrete piles Bored cast -in-situ piles Driven pre-cast concrete piles Bored pre-cast concrete piles	2911 (Part (I) Sec 1 - 1979 Sec 2 - 1979 Sec 3 - 1979 Sec 4 - 1984
Code of practice for construction of raft foundation	2950 - 1981
Design Aids for reinforced concrete	SP 16 - 1980
Explanatory Hand Book on codes for earthwork Engineering	SP 22 - 1982
Explanatory Hand Book on IS Code 456 – 1976	SP 24- 1983
Hand Book on causes and prevention of cracks in buildings	SP 25 - 1984
Hand book on concrete reinforcement and detailing	SP 34 –1987
Brick Masonry	2212 –1962
Construction of Stone Masonry	1957 – 1967
Asbestos cement pressure pipes	1592 – 1989
Concrete pipes with and without reinforcement	458 – 1988
P.S.C. pipes (including fittings)	784 – 1978
Methods of tests for concrete pipes	458 – 1988 3597 – 1985
Materials for M.S. Specials	226 – 1976 & 2062 – 1980
Specification for M.S. Specials for P.S.C. Pipes	
Specification for Steel cylinders reinforced concrete pipes	1916 – 1989
Methods of tests for concrete pipes	3597 - 1985
Special for steel cylinders reinforced concrete pipes	3597 – 1985
Cast iron specials for asbestos cement pressure Pipes for water, gas & Sewage	5531 – 1988
Methods of test for asbestos cement products	5913 – 1989

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Description	BIS No.
Dimensional requirements of rubber sealing ring for CID joints in asbestos cement pipe	10292 – 1988
Centrifugally Cast (Spun) Iron pressure pipes for Water, gas and sewage including fittings	1536 – 1989
Specification for Centrifugally Cast (Spun) D.I. Pipes for Water, Gas and Sewage	8329 – 2000
D.I. fittings for pipes for water gas & Sewage	9523 - 2000
Dimensional requirements of rubber gaskets for mechanical joints and push on joints for the use with C.I., D.I. Pipes	12820 - 1986
C.I. Specials for Mechanical and push on flexible joints for pressure pipe lines for water, gas & sewage	13382 - 1992
Horizontally cast iron double flanged pipes for water, Gas and Sewage	7181 - 1986
Cast iron fittings for pressure pipes for water, gas and sewage	1538 - 1976 (Part 1 to 24)
Cast iron detachable joints for use with asbestos cement pressure pipes	8794 – 1988
Rubber rings for jointing C.I. pipes, RCC Pipes & AC Pipes	5382 – 1969
Rubber rings for jointing P.S.C. Pipes	5382 – 1985
Rubber rings for jointing AC pipes with AC couplings	10292 – 1985
Pig lead (caulking lead)	782 – 1978
Hemp yarn	6587 – 1966
Rubber insertion to be used in jointing CIDF Pipes	638 – 1979
Bolts & Nuts to be used in jointing CIDF Pipes	1363 – 1967
Un plasticized PVC Pipes for potable water supplies	4985 – 1988
Injection moulded PVC socket fittings with Solvent cement joints for water supplies	7834 – 1987 (Part I to 8)
Fabricated PVC fittings for potable water supplies	10124 – 1988 (Part I to 13)
Methods of test for un plasticized PVC pipes for potable water supplies	12235 – 1986 (Part I to 11)
Sluice valves for water works purposes (50 to 300mm Dia. size)	780 – 1984
Sluice valves for water works purposes 300 to 1200mm Dia. size)	2906 – 1984
Surface boxes for sluice valves	3950 – 1979
Manhole covers for sluice valves	1726 – 1974
Laying of Asbestos Cement Pressures Pipes	6530 – 1972
Laying of concrete Pipes	783 – 1985
Laying of Cast - Iron Pipes	3114 – 1985

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Description	BIS No.
Laying of PSC Pipes	126 of APSS & 783 – 1985
Laying of DI Pipes	12288 – 1987
Laying and Jointing of un plasticized PVC Pipes	7634 – 1975 (Part 3)
Batch type concrete mixer	1791 – 1968
Sheep foot roller	4616 – 1968
Safety code for excavation works	3764 – 1966
Safety code for scaffolds and ladders Part I – Scaffolders Part II – Ladders	3696 – 1966 (Part I) 3696 – 1966 (Part II)
Safety code for piling and other deep foundations	5121 – 1969
Safety code for working with construction machinery	7293 – 1974
Tamil Nadu Building Practice	Volume – I Volume – II
Government of India Manual on Water Supply and Treatment	May 1999 (Revised)
Gravel for packing	4091 – 1967
Hard drawn steel wire	1785 – 1983 (Part I and II)
Structural Steel	226 – 1975
Hand rolled mild steel for concrete	1139 – 1966
Hard drawn Steel Wire	1566 – 1982
American Society for Testing of materials	
British Standard	2494 – 1955 Part I
Welding Electrodes	814 – 1970
Steel Sheets	225 – 1975
Guniting	7322 – 1994
Welding Joints	3589 – 1966 and 2041 – 1962
Tensile Test	223 – 1950
Mechanical and Electrical works	
Turbine Pump	1710 – 1972
Submersible Pump	8034 – 2002
Submersible Motor	9283 – 1995
Description	BIS No.
Earthing	3043 – 1966
Transformer	1180 – 1964
Generator	2253 – 4722
HDPE Pipes	4984 – 1995

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