Chennai Metropolitan Water Supply and Sewerage Board

DRAFT CONCESSION AGREEMENT
For
Selection of Concessionaire for Implementation of Continuous water supply of Pallipatu WDS & Thiruvanmiyur WDS under Area XIII of Chennai City under Hybrid Annuity Model (HAM)

Tender No.: CNT/WSS/NCB/AMRUT-GoTN/400 MLD/CP4/012/2024-25

RFP VOLUME – II
SCHEDULES

MARCH 2025

SUPERINTENDING ENGINEER (CONTRACTS & MONITORING)
CHENNAI METROPOLITAN WATER SUPPLY & SEWERAGE BOARD

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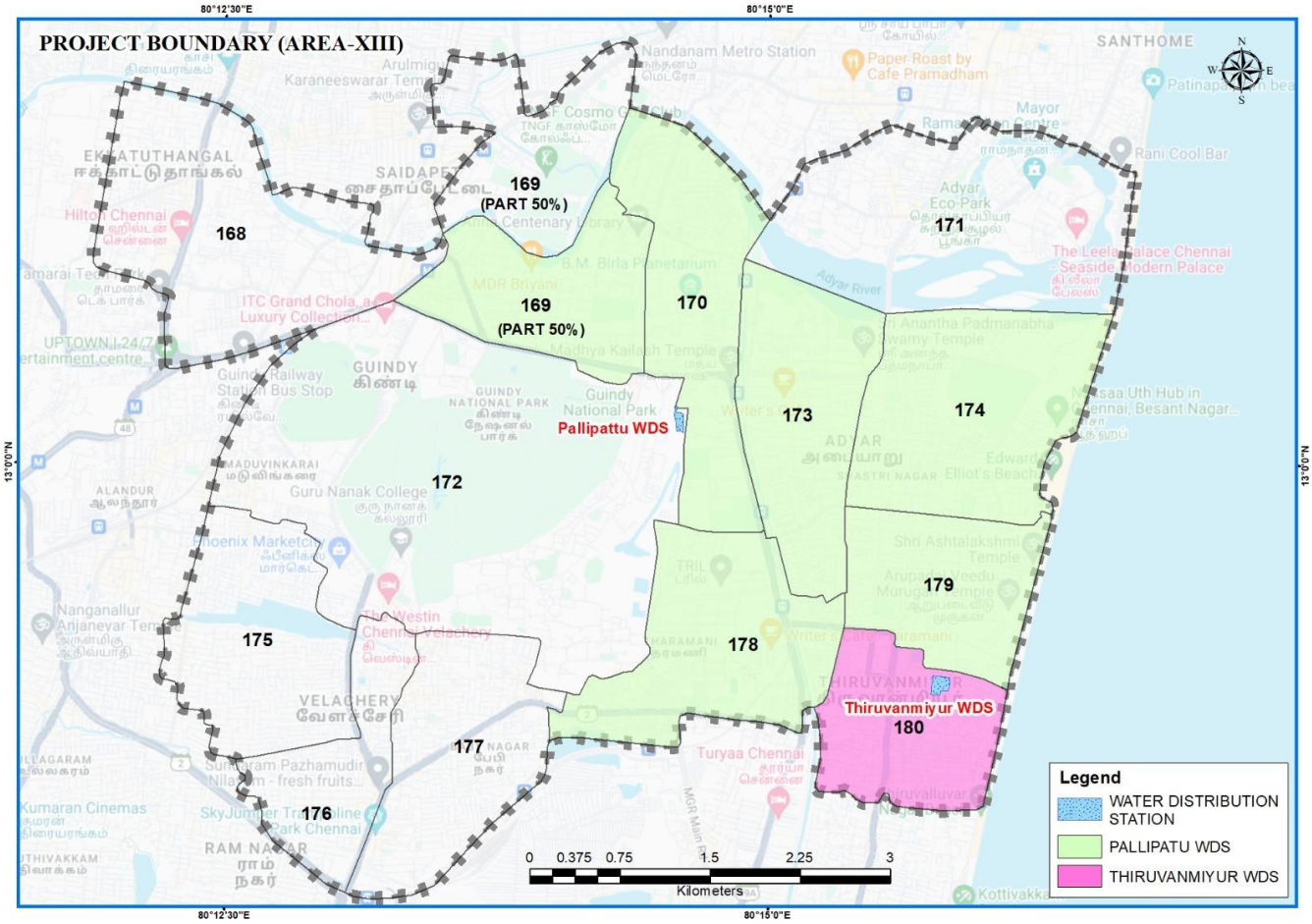
SCHEDULE A: SERVICE AREA OF THE PROJECT

1 The Service Area

The Service Area shall mean and include the Pallipatu WDS & Thiruvanmiyur WDS under Area XIII of Chennai City as identified and described in this Schedule A (including its annexures and appendices)

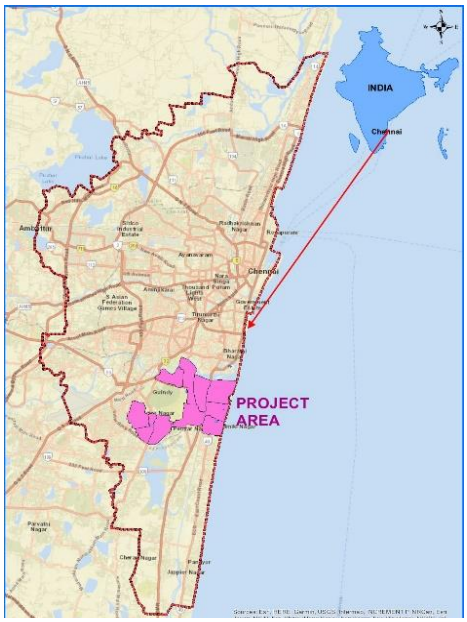


ANNEXURE I: SERVICE AREA MAP

(Schedule-A)

A. INTRODUCTION

1. Chennai formerly known as Madras, is the capital city of Tamil Nadu, the southernmost Indian State. It is the state's primate city both in area and population and is located on the Coromandel Coast of the Bay of Bengal.
2. According to the 2011 Indian census, Chennai is the sixth most populous City in India. The population of Chennai Core city as per the 2011 census was 46,46,732, and the area is 176 Sq km.
3. The city has 7 administrative areas, namely IV, V, VI, VIII, IX, X & XIII, covering 107 Wards/Depots.
4. Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) is responsible for the administration and operation, and maintenance of Chennai City's water production, treatment, storage, distribution, billing, and revenue collection.
5. The present water supply system is intermittent due to various constraints in source, storage facilities and adequacy of the existing distribution system.



Location of the project area within Chennai

6. The Chennai Core city's average per capita water supply is around 100 Liters Per Capita per Day (Lpcd).
7. The mapping of the project area has shown that there is 44.24 km of feeders and a total length of water distribution network of 326.47 km. Most of the pipes of the project area are in Cast Iron, DI, PVC & MS
8. In terms of house service connections, the existing total approximates. 2% of total connections for the Area XIII
9. The project area comprises of two different zones viz. Pallipattu & Thiruvanmiyur for civil operations.
10. The service area is given in following drawing:

ANNEXURE II: EXISTING PROJECT FACILITIES

(Schedule-A)

1. Assets of Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) to be handed over to the Concessionaire for O&M Purposes

The main areas covered in the study are as following:

Thiruvanmiyur WDS	**Pallipattu WDS**
Depot No-180	Depot No-170
	Depot No-173
	Depot No-169
	Depot No-174
	Depot No-178
	Depot No-179

Pumping Stations:

Existing Pump Details of Thiruvanmiyur WDS;

Details of Existing Pump In WDS								
Thiruvanmiyur WDS								
Pump Details								
S.no.	**Type of Pump**	**Head (M)**	**Discharge (LPS)**	**Discharge (m3/hr)**	**HP**	**KW**	**Year Of Installation**	**Age of Pump Set till 2024**
1	HSC	32	105	378	75	55	2013	11
2	HSC	32	105	378	75	55	2013	11
3	HSC	32	105	378	75	55	2013	11
4	HSC	32	105	378	75	55	2013	11
5	HSC	32	105	378	75	55	2013	11
6	HSC	32	105	378	75	55	2013	11

Thiruvanmiyur WDS Pump House

Thiruvanmiyur WDS

Existing Pump Details of Pallipatu WDS;

Details of Existing Pump In WDS

Pallipatu WDS								
Pump Details								
S.no.	Type of Pump	Head (M)	Discharge (LPS)	Discharge (m3/hr)	HP	KW	Year Of Installation	Age of Pump Set till 2024
1	VT	32.5	420	1512	240	180	2000	24
2	VT	32.5	420	1512	240	180	2000	24
3	VT	32.5	420	1512	240	180	2000	24
4	VT	32.5	420	1512	240	180	2000	24
5	VT	32.5	420	1512	240	180	2000	24
6	VT	32.5	420	1512	240	180	2000	24

Palliapatu WDS

Water Source:

		WATER SOURCE			HOUSE USE		
SL.NO.	NEW DEPOT	CMWSSB	BOREWELL	CMWSSB & BOREWELL	RESIDENTIAL	COMMERCIAL	BOTH
1	DEPOT-169	4401	572	6248	10714	340	167
2	DEPOT-170	3464	163	3408	6529	304	202
3	DEPOT-173	6830	442	4154	9543	458	1425
4	DEPOT-174	6143	282	4423	9687	700	461
5	DEPOT-178	5501	18	1166	5644	576	465
6	DEPOT-179	3726	226	5055	7513	329	1165
7	DEPOT-180	7877	29	6657	13345	666	552
TOTAL		**37942**	**1732**	**31111**	**62975**	**3373**	**4437**

SCHEDULE B: DEVELOPMENT REQUIREMENTS

Annexure-1: Scope of Services

The Scope of Services (SoS) described hereunder is neither exhaustive nor complete and is indicative only. The Concessionaire shall undertake detailed investigation of the Project Facilities, study, make assessments and ascertain all by itself the required tasks, interventions, inputs, and all other necessities to determine the complete Scope of Services for achieving the Key Performance Indicators as stipulated in Schedule C.

The Services shall include all technical, managerial, administrative, commercial, social interventions as required in accordance with acceptable, prudent water utility management practices for ensuring safe and sustainable drinking water supply services to the Consumers in the Service Areas.

For detailed study and understanding of the Scope of services envisaged in this tender, the DPR available with the authority is to be referred.

The Scope of Services during each Period of the Agreement is detailed hereunder.

1. Study period

The Concessionaire shall make a comprehensive assessment & due diligence of all water supply distribution infrastructure in the Service Area and prepare a holistic and comprehensive Implementation Plan for improving water services in accordance to the Schedule –8 Performance Standards. This will include studying the Detailed project report including design of water distribution system, asset and consumer survey data, asset condition assessment, baseline water balance, hydraulic network model, strategy for improving services with a focus on optimization of performance of existing assets and improving Consumer services and confirm the design and specifications detailed in the DPR.

1.1. General

The Concessionaire shall:

a. Establish contact with relevant local agencies and other consultants; and become familiar with the standards and guidelines for water supply design and with past and current work ongoing in the Service Area.
b. Satisfy themselves as to the nature and scope of work and the prevailing conditions in the Service Area.
c. Liaise with Authority, Traffic Police and other Government Agencies regarding laws and regulations governing undertaking studies and construction activities

The Authority may extend assistance to the Concessionaire for the required liaison. Statutory fees, if any, will be paid by the Authority.

1.2. Institutional Arrangements and General Compliance

The Concessionaire shall read, familiarize and understand the institutional arrangements and Applicable Laws and determine in detail which roles the Authority, as the asset holding and operating entity play in the following: i) Sanction of Water Connections, (ii) Implementation of water connections, (iii) Disconnections and reconnections and (iv) Billing and collection of user charges.

1.3. Assessment of Distribution System Design

a. During this phase of the work the Concessionaire shall study the water transmission and distribution network within and outside the Service Area to establish and improve network management and for ensuring the minimum Service Levels to the Consumers within the Service Area with reference to the DPR prepared by PMC.

b. The Concessionaire shall review previous studies and reports; interview the existing key staff in the Service Area; line staff, other consultants, companies, and Concessionaires currently working on the distribution system in order to prepare a baseline report describing the water transmission and distribution system including water sources, storage, and supply zones; and their condition to include pipe materials, dimensions, age, and condition; extent of Consumer water connections, meters and their operating condition; current estimates of illegal connections.

c. The Concessionaire shall review the present network management practice and develop an improved robust network management practice for improving the services.

1.4. Flow and Pressure Measurements (FPM)

a. The objectives of the FPM are to get a better understanding of the diurnal pressure profiles in the different parts of the Service Area, to determine the strength and capacity of the distribution for providing continuous pressurized water supply to the Consumers and to achieve the prescribed Performance Standards.

1.5. Hydraulic Network Model (HNM)

a. The Concessionaire shall study and confirm the Hydraulic Network Model (HNM) developed by PMC/IE which includes DMA structuring and all pipelines. The data pertaining to WDS, reservoirs, pipes,

valves and demand allocations shall be studied and reconfirmed by the Concessionaire. The Concessionaire shall then use the data from flow and pressure testing and calibrate the network model to represent the field conditions to provide 24X7 water supply.

b. The Concessionaire shall use the hydraulic model to simulate any changes in the transmission and distribution network for the redesign of Service Area for replacement or strengthening of primary and secondary mains.

c. The Concessionaire shall use the model to run 24-hour simulations as well as an analysis of peak hour demand for two scenarios: (i) the present leakage situation; and, (ii) a future, improved scenario. Steady State Analysis and Extended Period Simulation shall be carried out for a minimum period of 72 hours.

d. Using the hydraulic model and simulating both present and future conditions, the Concessionaire shall review the presently designed distribution zones as required from a continuous water service perspective and propose investments for improving the network efficiency for ensuring continuous pressurized water supply to the Consumers in the Service Area.

e. The Concessionaire shall investigate options for improved network and pressure management considering the migration from intermittent supply to continuous water supply.

f. The Concessionaire shall then develop the future water balance for the Service Area duly considering the Minimum Service Levels as per Schedule C – Key performance Indicators.

1.6. Network Assessment

a. The Concessionaire shall use the available hydraulic model prepared by PMC, to simulate any changes in the transmission and distribution network for the rehabilitation of Service Area or strengthening of primary and secondary mains.

b. The Concessionaire shall investigate options for improved network and pressure management considering the migration from intermittent supply to continuous water supply.

c. The Concessionaire shall then develop the future water balance for the Service Area duly considering the Minimum Service Levels.

1.7. Assessment of the Billing and Collection Systems

The Concessionaire shall:

a. Prepare a profile of water service Consumers in the Service Area describing Consumer categories and for each category: number of Consumers, estimated average volume of water consumed per month; estimated average revenue per month.
b. Develop the basic procedure for (i) for service connection (ii) preparing, issuing, and collecting a bill for water service; (iii) how water consumption is estimated for unmetered Consumers; (iv) procedure for dealing with under-payment or non-payment.
c. Develop: (i) meter reading procedures and arrangements; (ii) meter reader control; and, (iii) efficient and accurate meter reading practices.
d. Develop portable, battery powered, hand-held, electronic meter reading collection and data storage device, complete with the interface to the existing, modified, or proposed billing software.
e. Set up in detail the revenue collection procedures, facilities for achieving the prescribed level of revenue collection efficiency.

2. Implementation Plan

The Implementation Plan essentially comprise of the following:

a. The baseline report on the efficiency levels of the existing distribution system in the Service Area

b. The results of flow and pressure measurements

c. Working Hydraulic Model of the entire transmission and distribution mains responsible for servicing the Service Area

d. Consumer Survey findings

e. Details of works/practices proposed for ensuring the Minimum Service Levels

f. Improving the Financial Management system including billing, revenue collection, accounts, budgetary control, cost control etc.

g. Implementation Plan and Methodology

The Concessionaire shall submit the Implementation Plan within 120 (one hundred and twenty) days from the Effective Date for enabling the Authority to undertake thorough review of the Plan and suggest

amendments if any and obtains the approval of appropriate authority within 150 (one hundred and fifty) days from the Effective Date.

3. Construction Period

The Scope of Services during the Construction Period shall essentially comprise operations and maintenance of the existing water supply facilities along with execution of the Implementation Plan in the Service Area which shall include but not limited to the following.

3.1. Operations and Maintenance of Existing Water Supply Services

From the Preliminary Take Over Date, the Concessionaire shall take over the management responsibilities of the Operations and Maintenance (O&M) of the existing water supply facilities in the Service Area. The O&M tasks essentially comprise but not limited to the following.

a. Providing water supply to the Consumers at the prevailing service levels without further deterioration.

b. Water Demand Management

c. Emergency water supply

d. Network Operations and Management

e. Valve operations for intermittent water supply

f. Flow and pressure monitoring

g. Repair of leaks and bursts and valves

h. New Connections, Disconnections and Re-Connections as approved by the Authority

i. Consumer Services including attending to complaints and their resolution

j. Meter reading, if any, preparation and issuing bills

k. Constructing water meter test bench

l. Collection of revenue and deposit into escrow accounts

m. Information management and reporting

3.2. Capital Investment Plan

3.2.1. Overview of the CIP

a. Based on the findings from the Comprehensive Assessment, the Concessionaire shall prepare the CIP and the activities to be carried out during the Initial Operation Period and the Construction Period in accordance with Applicable Laws and Good Industry Practice

b. The objectives of the activities presented in the CIP shall include but not be limited to the following:
   (i) To ensure safe, efficient, continuous pressurized water supply services to the Users to meet the growing demand needs of the Service Area.
   (ii) To ensure availability of sufficient volume of bulk raw or treated water to meet the growing demands of Users, taking into account the permissible levels of losses in treatment, transmission and distribution;
   (iii) To ensure optimization of performance of existing pumping machinery for energy consumption in the transmission of treated water from source to the User;
   (iv) To ensure an effective program of non-revenue water control including active leakage control by applying continuous and vigilant monitoring, leak detection and good quality and long lasting leak repair techniques;
   (v) To ensure efficient and effective commercial and customer services in management of the Project Facilities for providing un-interrupted water supply to the Users, duly redressing and resolving complaints and problems from existing Users and providing network connectivity to new Users and ensuring timely expansion of networks and system capacities; and
   (vi) To ensure establishment of utility management systems and processes including standard operating procedures for ensuring sustainable water services capable of forward planning, timely decision making and attending to emergencies.
   (vii) To establish performance monitoring systems so as to enable: (i) monitoring of Key Performance Indicators as per Schedule 5; and (ii) overall collection and disclosure of data related to water supply services in the Service Area.

c. In preparing the CIP the following design horizons will be adopted for any investments in physical infrastructure required to meet the Key Performance Indicators. No additional investment is expected beyond the Construction Period except for investments to meet network growth beyond that included in the CIP, and for routine replacement of plant, equipment, and computer systems at the end of their design life.
   (i) Pump Stations – 15 years
   (ii) Treated Water Transmission and Feeder Pipelines – 30 years
   (iii) Storage Reservoirs – 15 years
   (iv) Water Distribution Systems – 30 years

   In case additional land is required for the construction of any new facility the Concessionaire shall inform the Authority and the Authority shall accordingly provide the land to the extent required for the construction of new facility.

d. All proposed interventions or works, installation and workmanship shall confirm to relevant standards provided by Bureau of Indian Standards,

and in the absence of which to the relevant standards of International Standards Organisation and to the guidelines in the CPHEEO Manual.

3.2.2. **The elements constituting the CIP should include, but not be limited to, those outlined below**

(i) Detailed Plan for Setting up District Metered Areas

a. The Concessionaire shall, based on the results of the hydraulic network model, review the present distribution zones and design for setting up hydraulically isolated district metered areas ("DMA"s). Each DMA shall preferably have one inflow point and be isolated by installing boundary isolation valves. The inflow shall be fitted with a pressure reducing valve and an electro-magnetic bulk flow meter of reputable brand synchronized with a sufficient capacity data logger with the facility to record, store, monitor and analyze the consumption and pressure pattern in the respective DMA. The Concessionaire shall identify and propose at least three Critical Measurement Points ("CMP"s) in each DMA for continuous logging of pressure, and the CMPs shall be such that one point shall be at the inlet of DMA, second at the highest elevation within the DMA boundary and the third shall be the farthest point from the DMA inlet. The Concessionaire shall propose necessary actions/tasks for periodical calibration of the flow and pressure monitoring equipment and capture the data generated by the respective equipment, analyze and monitor the consumption and level of losses in the DMAs and take remedial actions as necessary to meet the Performance Standards.

b. It is envisaged that the DMA chambers will be standardized in size and type of equipment to be housed inside including flow control valve, pressure reducing valve flow meter and pressure transducer and the data loggers for speed and efficiency of construction. It is expected that some of the DMA construction and associated telemetry equipment will be part of the Advance Procurement Plan.

(ii) Rehabilitation of Water Supply Transmission and Feeder Networks

a. Using the hydraulic model and simulating both present and future conditions, the Concessionaire shall review the capacity of the networks required from a continuous water service perspective and propose network strengthening measures in a cost effective manner.

b. An essential objective of the treated water feeder main improvements shall be to ensure availability of sufficient supply volume in all neighbourhoods of the Service Area so as to ensure equity and rapid service improvements across the Service Area pending conversion to continuous pressurized water supply.

c. The Concessionaire will identify existing feeders that are in good operational condition and could be utilized to enable the Concessionaire to meet the Performance Standards. Deteriorated

feeders will be identified and replaced or rehabilitated in a cost effective manner. The Concessionaire will assess options for any new feeder mains to serve existing or new storage reservoirs and propose the optimum solution. The works for such new feeders may be considered for inclusion in the Advance Procurement Plan to ensure completion and commissioning of the works by the end of the Construction Period.

(iii) Optimizing Service Storage

The Concessionaire's proposals for ensuring adequate service storage capacity for the Service Area shall use existing reservoirs to the extent possible with abandonment only in the event that a reservoir is structurally unsafe. A key factor to be taken into account is the highly restrictive availability of land for installation of new reservoirs and hence the proposals should focus on expanding the utilizable storage through improved hydraulics and assigned demand patterns.

(iv) Rehabilitation and expansion of distribution networks

a. The Concessionaire should propose a plan for new networks to currently unserved areas of the Service Area and for the optimal mix of rehabilitation, repair, and replacement of the existing distribution network in currently served areas. In the latter case the Concessionaire should optimize capital and operational solutions to develop the most cost effective solutions and using the existing assets to the extent possible.

b. The proposals shall be in two parts with the first part to provide new infrastructure in the areas which are not provided with network access.

c. The second part of the improvements shall be a structured, continuous program of rehabilitation, repair and replacement of existing networks to ensure, by the end of the Construction Period, sufficient network capacity and levels of water losses to achieve the Performance Standards to the end of the Term.

d. The proposed network improvements shall be on the basis of a carefully planned progressive DMA-wise transformation to continuous pressurized supply taking into account possible increased leakage in the short term and the need to minimize supply deterioration in other DMAs serviced with intermittent water supply.

e. The Concessionaire shall identify the relevant specifications, standards on all materials, equipment and goods proposed to be used in CIP. The CIP shall also include a plan for establishing the quality of materials, pipes and fittings to be used, as well as setting workmanship protocols and standards.

f. The Concessionaire shall include in their rehabilitation and expansion plan for replacing house connections and User meters as needed, installing customer meters in non-metered connections, and installing new house connections with meters to unconnected households and those with illegal connections.

(v) NRW Control

a. The Concessionaire shall propose a detailed program of activities for effective reduction and long term control of NRW in the entire water supply chain from source to Customers.
b. The network and service pipe repair, rehabilitation and replacement program covering transmission, feeder and distribution networks shall be based on an effective NRW monitoring activity and active leakage control. Timely and high quality leak repair shall be supplemented by network and service pipe replacement as needed.
c. The Concessionaire shall propose necessary parts of this package of activities under the Advance Procurement Plan.

3.2.3. Miscellaneous Items

In addition to identifying and costing the Capital Works required during the Construction Period, in accordance with the standards of service set out in Schedule B the CIP shall address the following:

a. **Service Delivery Improvement Plans**

The Concessionaire shall prepare a service delivery improvement plan (the "Service Delivery Improvement Plan") which shall outline the following:

(i) Migration Plan from Intermittent to Continuous Water Supply
(ii) Integrated Management Information System linking GIS, Water Resource Monitoring, Water Flow and Pressure Measurement, Billing and Collection System, Asset Register and User Services.
(iii) The Concessionaire will detail a methodology for measurement of performance as per the Performance Standards in Schedule C. The Concessionaire will detail the method for recording of data, method of compilation, reporting formats, and methods for cross verification and frequency of reporting.
(iv) The Concessionaire will also detail the interim arrangements for measurement of performance and reporting that will be followed, including manual record keeping, till the setting up of the Management Information Systems as per the Milestones in Schedule B

b. **Land Requirements**

The Concessionaire shall produce a list of any additional land that will be required to allow implementation of the CIP and inform the Authority.

3.3. Scope of work as per Detailed Project Report

The Scope of work is confined to improvement of water supply in Pallipatu WDS & Thiruvanmiyur WDS. The Pallipatu WDS is supplying water to 6 operation zones namely OZ-169(P), OZ-170 OZ-173, OZ-174, OZ-178 & OZ-179 and Thiruvanmiyur WDS is supplying the water to one operational zone i.e. OZ-180. The above zone boundaries have been frozen based on the considerations to achieve minimum pressure of 17 m at peak hour of the day. These zones are

further divided in to DMAs & Lane sub-Lanes.

Each Operational Zone is divided into number of DMAs, considering ease of operation, control & monitoring of DMAs. Each DMA shall be isolated during breakdown without affecting the water supply of other areas. In the DPR, 97 DMAs have been proposed under Pallipatu WDS and 28 DMAs under Thiruvanmiyur (New) WDS.

The Topographical survey, asset mapping, consumer level survey & conditional assessment has been carried out to find the gaps to prepare intermittent water supply system to 24x7 water supply system.

The population of base year (2026) is 328172, intermediate year (2041) and ultimate year (2056) is 363826 & 402159 respectively.

The surveyed no of premises are 31481 & 7187 of Pallipatu WDS & Thiruvanmiyur WDS command area respectively.

The water demand calculated for base year (2026) is 50mld, intermediate year (2041) and ultimate year (2056) is 55.56mld & 61.58mld respectively. The Authority will provide the required treated water to the Water Distribution Systems for 24X7 continuous water supply.

3.3.1. Upgradation of Water Distribution System (WDS):

a. Civil works includes general arrangement of pump foundations, floor cutting, plastering, exterior & interior painting, repair and replacement of doors & windows, internal access road & landscaping, Command & control room in Pallipattu WDS etc,.

b. Following equipment are proposed to be replaced with the existing equipment in the WDS as presented in table below.

Sl. No.	Components
Pallipatu WDS - Pump Set	
1	Vertical Turbine Pump set (4 Working + 2 Stand By) From Pallipatu WDS to OZ-169 (P), OZ-170, OZ-173, OZ-174, OZ-178 & OZ-179 – 1150 m^3 / hr X 50 m X 365 HP With Diesel Generators, Transformer, VFD & MCC Pannel
Thiruvanmiyur WDS - Pump Set	
2	Vertical Inline Pump set (2Working+1Stand By) From Thiruvanmiyur WDS to OZ-180 – 1243 m^3/hr X 34 m X 125 HP With Diesel Generators, Transformer, VFD & MCC Pannel

3.3.2. Distribution Network Improvement

a) The length of existing distribution network is 296.73 Km in the project area, out of which 263.7 Km existing pipes are proposed to be retained & 33.03 km network is to be replaced which includes replacement of PVC pipes, hydraulically inefficient pipes & poor conditioned pipes. In addition to the replacement of existing pipes, proposed length of additional new pipelines in new area / lanes is 80.60 Km. Hence the total network after implementation

would be 377.40 Km. The concessionaire shall conduct the hydro test prior to commissioning each Pipeline/DMA.

Sl. No.	Components
Operational zones – Provision for Trenchless	
1	Trenchless pipeline in distribution Network- Diameter varies from 250mm to 600 mm. Total length of 2.3 Km
Operational zones – Provision for Flushing & Cleaning	
2	Provision for flushing & Cleaning is 11.34 Km for all 7 operational zones existing pipelines
Distribution Network – Replacement & new proposed Pipelines	
Pallipatu WDS	
Distribution Network – Replacement	
4	OZ-170**-** 2619 m
5	OZ-173- 2022 m
6	OZ-174- 1064 m
7	OZ-178- 1799 m
8	OZ-179- 11574 m
9	OZ-169(p)- 1205 m
Distribution Network – Proposed (new)	
10	OZ-170- 16232 m
11	OZ-173- 3070 m
12	OZ-174- 21765 m
13	OZ-178- 8219 m
14	OZ-179- 6254 m
15	OZ-169(p)- 19215 m
Thiruvanmiyur WDS	
Distribution Network – Replacement	
16	OZ-180- 12755 m
Distribution Network – Proposed (new)	
17	OZ-180- 5907 m

b) **Operational Zone to DMA monitoring & control:** Water Feeder pipeline shall be laid up to entry point of each DMA. A DMA control unit is to be installed which will Control, operate & transmit data to server by OFC cable which will be laid along the length of pipeline from DMA Control unit to nearest PLC panel/server.

DMA control unit comprises of Isolation valve, electromagnetic flowmeter, solenoid valve, pressure gauge and pressure transmitter.

c) **DMA to Lane / sub-Lane monitoring & control:** From DMA to Lane and Sub-Lane, to distribute adequate water with required pressure, and for better control on water audit, Lane-Sub-lane control unit shall be installed at start of lane. This control unit will comprise of isolation valve, basket strainer, Woltman type flow meter with Pulse output (Data transmission with 5 min interval), Air valve, Globe valve & pressure transmitter. The data will be communicated to server through gateways by GSM signal.

d) **House service connection**: The house connections are to be provided with saddle and compression fittings. An AMR flow meter with AMI Infrastructure shall be installed with an isolation valve at consumer point. The AMR meters to communicate data to gateways through LORA band and from gateways to server through GSM services.

3.3.3. Data Collection, Monitoring, Command and Control:

a) Command centre has to be developed at the place provided by authority at Pallipattu. Comprehensive data on flow & pressure of water in feeder and distribution network is to use to control and regulate the water Supply system. It to record and monitor real-time values of flow, pressure & concentration of residual chlorine in any pipe at any point of time. Performance parameter like NRW, leakage is to be analysed through real time data and report periodically. Following components for SCADA & Automation, Instrumentation for Smart Water Management are presented in table below.

Sl.No.	Components
1	SWMS- Data application software
2	**Server** for acquisition of data at command control centre
3	Smart Array Controller & Power supply kit for server for acquisition of data at command control centre
4	Air conditioning unit for sever room
5	Smart Rack with accessories for monitoring of data
6	Smart Rack IT capacity-3KVA with UPS-1*3 KVA, Internal Battery & accessories for Server Rack
7	Data Web Application
8	SCADA software
9	PLC & Street PLC panel
10	Pressure Transmitter
11	Pressure switch
12	Level Indicator: Ultrasonic level transmitter/ for pure water sump/ MBR/ ESR/ Wash Water Tank/ Filter bed
13	Chlorine Analyser
	Communication & Data Transmission
15	**HDPE PIPE: -** PE 100 AS PER IS 4984/2016 / PN6 SDR-21, Supply and Laying of 50MM dia HDPE pipe
16	Laying of Optical Fiber Cable
27	Three phase 5KVA(4 hour backup) online UPS+AUX with ACDB pure sine wave with battery rack and maintenance free battery system including cables power plug, switch etc.as per specification
18	RTU System along with FRP poles and its accessories
19	Wireless Communication Through LORA band
20	Hardware and Firmware for Network DMAs Gateway with UPS Power Back up for power failure

21	Network Meter Reading Device
22	Android Device for Meter Reading for mobile reading

3.4. Implementation Schedule

3.4.1. The Concessionaire shall prepare a detailed project management program showing all the activities to be undertaken during the Construction Period (including the advance procurement plans) the start and end dates and dependencies between the activities. The critical path items will be clearly identified.

3.4.2. Where the implementation plan requires action to be taken by the Authority such activities will be highlighted and separately identified with a clear description of the activity, the projected start date, and the time allowed for the Authority to undertake said activity.

3.4.3. The Implementation Plan shall be in accordance to industry standards and sufficient care shall be taken by the Concessionaire in minimizing the supply interruptions, traffic disruptions and ensuring good and timely communications with the Consumers in the Service Area. All the works, interventions proposed as part of Implementation Plan shall be in conformity with the Construction requirements and O&M Requirements as per Schedule B.

3.5. Other Aspects of Implementation

3.5.1. Improving Consumer Connections

The Concessionaire shall undertake improving the Consumer connections by replacing the existing house service connections with better and higher standard of pipe materials, good network connecting practice, installation of right size ferrules/saddles, installation of a AMI enabled AMR Smart Water meters, accessories and meter chamber at the nearest point inside the Consumer property boundary.

3.5.2. Services to Unauthorized Colonies

It shall be provided as per the applicable policy of the Authority. For unauthorized colony included in government list, water supply shall be provided subject to technical feasibility.

3.5.3. Bulk Water Supply Connections

In case of bulk water supply connections of sizes equivalent or higher than 25mm dia to the apartments, housing societies or private layouts within the Service Area, the Concessionaire shall install a suitable size and accurate consumption meter.

3.5.4. Illegal Connections

The Concessionaire based on the findings from the Consumer Survey, shall identify the illegal or un- authorized connections and inform the Authority and as per instruction of the Authority for approval/ non approval and after payment of prescribed charges by the Consumer, shall then rehabilitate the connection with good plumbing materials and a Consumer meter.

3.5.5. **Network Improvements**

a. Based on the approved Implementation Plan, the Concessionaire shall undertake detailed engineering design of the network improvement works and implement the same on site in accordance to the technical specifications and prudent industry practices. Efforts shall be made to optimize the performance of the existing assets duly assessing the extendable residual life of the assets. The primary objective of the Network Improvements is to ensure rationalized, equitable, continuous and pressurized water services to the Consumer in the Service Area.

b. The improved network shall exhibit increased hydraulic carrying capacity to meet the demand needs for the year 2056 and shall deliver water at a minimum pressure

c. The network shall be fitted with isolation valves such that any intervention for maintenance like extensions, connections, leak repair etc shall not affect more than 100 consumer connections.

3.5.6. **Consumer Service Centre:**

The Concessionaire shall design, develop and set up a Consumer Service Centre (CSC) in the Service Area and a minimum of four numbers of cash collection centers, for facilitating receiving and resolving consumer requests in the areas of new connections, service deficiencies, resolution of billing disputes etc. The Centre shall function on 24 x 7 basis. The CSC shall have reasonable space and furniture for the Consumers to wait, interact and represent their requirements. The Concessionaire shall have a facility to receive Consumer complaints through telephone, fax, SMS, email, we application and any other electronic means including letters or personal visits by the Consumers. The CSC shall be equipped with sufficient hardware and software to facilitate continuous record of consumer requests, monitoring the resolution and reporting requirements.

3.5.7. **Financial Management**

The Concessionaire shall implement a comprehensive Financial Management Plan in respect of all matters including but not limited to:

a. The billings and collection systems;

b. Consumer Services, including data bases relating to complaints and questions and response times with respect to complaints and questions

c. Information systems;

d. Asset registers from the perspective of maintaining a prudent asset management system and accounts; and

e. Provide the necessary financial and accounting information pertaining to the Service Area in the form and nature required by the Authority

3.5.8. **Billing and Revenue Collection Systems**

a. The Concessionaire on studying the present billing and collection system prevailing in the City shall undertake improving the revenue management and recommend either improving the present billing system or installing a new improvised billing system. Necessary software and hardware shall be installed in the designated space in the Service Area with a facility to transfer the data and report online with the existing revenue management servers of the Authority.

b. The Concessionaire shall undertake improving revenue collection system by introducing different measures for improving the access to Consumers as well as simplifying payment procedures. The collection system shall be capable of online update with the billing system so that the account receivables are monitored in real time basis.

c. The improved revenue management system shall be with facility for easy upgrade and improvement this shall include but not limited to.

   i. an effective water billing practices and procedures;

   ii. an effective revenue collection practices and procedures; and

   iii. a simple and efficient connection, disconnection, and re-connection procedure;

d. The Concessionaire further acknowledges that it will, from the Preliminary Take over Date, take over full responsibility for billings and collection in the Service Area for and on behalf of the Authority.

e. The Concessionaire shall:

   i. Collect all amounts due to the Authority as Revenues related to the Water Services through the Authority's/ Concessionaire's billing offices; through banks, electronic transfer; and by other means as may be agreed to by the Authority;

   ii. Identify and record all outstanding accounts and take all necessary measures to collect outstanding accounts;

   iii. Submit to the Authority a summary and analysis of unpaid accounts [every month];

   iv. Manage all aspects of Consumer services with the Consumers.

3.5.9. **Meter Reading**

The Concessionaire shall:

a. Read all Consumer Revenue Meters in accordance with the general instructions of the Authority;
b. Register all Consumer Revenue Meters readings in the appropriate computer database;
c. Develop a monitoring programme of random spot-checks to ensure the accuracy of the meters and the meter reading process and provide written reports to the Authority on the results;
d. Develop and implement a plan the intent of which is to ensure that:
    i. All Consumer Revenue Meters are accurate;
    ii. all Consumer Revenue Meters are read;
    iii. all Consumer Revenue Meters are in suitable locations;
    iv. problems related to unprotected and unsealed Consumer Revenue Meters are resolved;
e. Develop and implement a programme to estimate consumption in circumstances where metering problems exist;
f. Provide advice as to methods to improve the meter reading process to ensure greater accuracy;
g. Convert all Consumer Revenue Meters readings to billings to Consumers;
h. Identify Consumer Revenue Meters which have not been read; and
i. Respond to reports of malfunctioning Consumer Revenue Meters from Consumers.
j. Satisfy consumers queries regarding water meter reading results by testing it on meter test bench.

3.5.10. **Deposit of Consumer Payments in Escrow Account**

With respect to the collection of Consumer Payments under the sole responsibility of the Concessionaire, the Concessionaire shall directly deposit all of the collected Consumer Payments, whether in the form of cash, cheques or other form, into the Escrow Account in accordance with Article 38 of this Agreement.

3.5.11. **Management Information System (MIS)**

The Concessionaire shall set up a simple, easy to understand and easy to scale up Management Information System (MIS) for prudent Asset Management Planning, Asset Registry, recording of maintenance episodes or events or interventions, financial management, accounts etc., including generating the reporting requirements as detailed in Schedule 3.

3.5.12. **Completion of Construction**

On the Scheduled Construction Period Completion Date, all the legal Consumers shall be provided with safe, continuous and pressurized water supply through Consumer service connections at the Minimum Services Levels prescribed in the Agreement and the Concessionaire shall have achieved the Performance Targets.

3.5.13. **Return of Replaced Items**

Throughout the Concession period, upon replacement of any item, as required in the Agreement, the concessionaire shall prepare a stocks inventory and return the replaced items to the authority and store the replaced items at a designated yard / store, per direction of the Engineer in charge, at its own cost.

4. O&M Period

a. During this period, the Concessionaire shall continue to provide water supply services to the legal Consumers in the Service Area at the prescribed Minimum Service Levels. This shall include but not limited to all the tasks, operations, maintenance activities as listed above including attending to any new requirements for new connections, extended boundaries of Service Area etc complete.
b. The Concessionaire shall ensure continuous, pressurized water supply to all the Consumers and any interruptions shall be within the permissible limits as specified in the Schedule C Key Performance Indicators.
c. The Concessionaire shall also implement all rehabilitation or service improvement works required in any extended area of the Service Area or as necessary due to Change in Law as mutually agreed between the Parties.

Annexure-2: Operation & Maintenance Requirements

The Concessionaire shall perform all the obligations under the Agreement with utmost care, effective and efficient and adapt the best practices in all operations and maintenance activities in accordance to the industry standards and in confirmation to the guidelines provided in the Manual on Water Supply and Treatment and the Manual on Operations and Maintenance of Water Supply Schemes published and amended from time to time by CPHEEO, Government of India.

1. Operation and Maintenance Plan (O&M Plan)

i. The Concessionaire shall prepare an annual operation and maintenance plan for the Existing Project Facilities and the Project Facilities (the "O&M Plan") with critical and routine operating tasks at each unit of water supply chain with the objective of achieving and maintaining the Required Service Levels.

ii. The O&M Plan shall comprise the responsibilities for unit operations, monitoring and emergency response, related processes, systems, protocols, procedures including detailed costs for each activity of operations and maintenance etc.

iii. O&M Plan will present in detail the monitoring protocol for water quality measurement around the system. This protocol will cover the whole process from designing the sampling regime, taking samples, testing samples, and reporting samples. The O&M Plan will also present the on-line water quality reporting system required to meet the Concessionaire's obligations under Key Performance Indicators.

The Concessionaire shall undertake the operations and maintenance activities including but not limited to the tasks detailed herein as General O & M requirements & Specific O&M requirements.

2. General requirements:- Operating Functions

Basic Operating Functions

Area of Operations	Key Operating Functions
Pumping Systems & BPS	▪ Conduct routine O&M ▪ Facility management ▪ Asset maintenance ▪ Flow and pressure monitoring

Area of Operations	Key Operating Functions
Storage and Distribution	▪ Conduct routine O&M ▪ Valve inspection ▪ Compliance monitoring for pressure and quality ▪ Flow monitoring ▪ Leak detection and repair ▪ Storage tank inspection ▪ Repairs, rehabilitation, expansion of networks ▪ Replacement of assets as per maintenance schedule
Consumer services	▪ Install new connections ▪ Conduct meter installations ▪ Meter reading ▪ Billing and collection ▪ Consumer complaints redressal, and monitor Consumer satisfaction ▪ Debt management
Water Safety	▪ Water safety plan ▪ Monitoring water quality
Administration	▪ Planning and coordination with other authorities ▪ Procurement of materials, works and services ▪ Project Management and supervision ▪ Accounts and financial management, and training ▪ Information recording and management ▪ Regulatory reporting ▪ Water Meter Test Bench ▪ Stores and Inventory Management

In the above table, the key basic operating functions are only listed and there are many more routine O&M functions which the Concessionaire has to undertake at different time frequencies.

3. Asset Replacement

The general asset replacement schedule is shown in the following Table.

Item	Scheduled Replacement

Item	Scheduled Replacement
Painting of Buildings and OHTs, Pumping Machinery	Once in [3] years
Electrical Motors	Once in [15] years or as and when required
Chlorination Equipment	Once in [5] years or as and when required
Instruments	Once in [5] years or as and when required
Pipe lines	As and when required
Valves	As and when required
Bulk Meters and Pressure Loggers	Once in [5] years or as and when required
Consumer Meters	Once in [4] years or as and when required
Computers Hard Wares and Software	Once in [3] years or as and when required

4. Preventive Maintenance

The preventive maintenance tasks generally required in O&M of distribution systems are given in the following Table.

Component	Daily Maintenance Tasks
Chlorination	Routine Maintenance ▪ Check leakage of Chlorine ▪ Cleaning of chemical deposits ▪ Check fuses and contacts ▪ Check dosing pumps ▪ Check condition of safety equipment
Pipelines	Routine Maintenance ▪ Check residual chlorine - weekly ▪ Surveillance for leakage – pipe breaks and leaks - Daily Pipe flushing once in 6 months ▪ Swabbing and scraping once in three years
Valves	Routine Maintenance (A) Sluice valve and Knife gate valve ▪ Check gland packing of the valve at least once in a month. ▪ Ensure that packings inside the stuffing box are in good trim and impregnated with grease ▪ If necessary, change the packing as often as needed to ensure that the leakage is within limit.

Component	Daily Maintenance Tasks
	▪ Grease should be applied to reduction gears and grease lubricated thrust bearing once in three months. ▪ Check tight closure of the valve once in 3 months. ▪ A valve normally kept open or closed should be operated once every three months to full travel of gate and any jamming developed due to long disuse shall be freed. ▪ Inspect the valve thoroughly for flaws in guide channel, guide lugs, spindle, spindle nut, stuffing box etc. ▪ once in a year. ▪ Do not operate with oversize hand wheel or cap or spanner. ▪ Do not operate under throttled i.e. partially open condition
	(B) Reflux (non-return) valve ▪ Check proper operation of hinged door and tight closure under no-flow condition once in 3 months. ▪ The valve shall be thoroughly inspected annually. ▪ Condition of dampening arrangement should be thoroughly examined once in year ▪ In case of dampening arrangement, check for oil leakage and replace oil once in a year. (C) Butterfly Valve ▪ Check seal ring and tight shut-off once in 3 months. ▪ Lubricate gearing arrangement and bearing once in 3 months. ▪ Inspect the valve thoroughly including complete operations once in a year. ▪ Change oil or grease in gearing arrangement once in a year.
Connections	Routine Maintenance
Water Meters & Test Bench	Routine Maintenance ▪ Check for meter accuracy – once in 6 months or as per requirement ▪ Replace Consumer meters – once in 15 years ▪ Replace bulk meters – once in 15 years

5. Specific O & M Requirements

Specific O & M requirements to be performed by the Concessionaire are described as following: -

A. Concessionaire's obligation

A.1 General Obligations

The Concessionaire shall have the following general obligations as they may be applicable during the term of the Contract.

(i) The Concessionaire shall perform the Services in accordance with this Contract, and carry out its obligations with all due diligence, efficiency, and economy, in accordance with generally accepted professional techniques and international best practices, and shall observe sound management principles, and employ appropriate advanced technology and safe methods. The Concessionaire shall always act in good faith, in respect of any matter relating to this Contract ' or to the Services, to the Authority and shall at all times support and safeguard the Authority's legitimate interest in any dealings with the Customers, sub-Concessionaires or third parties;

(ii) The Concessionaire shall ensure that all materials and workmanship used in the course of the Contract shall be in accordance with the standard specifications. In absence of and appropriate specification, in accordance with the Indian National Standards or the International Standards Organisation as the case may be.

(iii) The Concessionaire shall develop, install, commission and maintain efficient and effective Integrated Information' Management System (IIMS) comprising of all management needs including customer contact management, commercial services including billing, collection, new connections, disconnections, reconnections, consumption and flow monitoring, demand management, financial management, asset management, inventory management, human resources management, monitoring .of operating efficiency etc complete as required for efficient and effective operations and management of the water supply services.

(iv) (a) The Concessionaire shall establish and operate a 24-hour customer service centre to carry out the functions of customer relations, support and complaints in terms of this Contract including but not limited to response and redressal of complaints concerning leakages in the distribution system, water reduction, water quality, low pressure, and provide assistance in imparting education concerning use of water supply, installation of new connection, water usage and plumbing. The customer service centre should be operational during all times of the year round the clock with appropriate staff.

(b) Open House Quarterly Meeting: -

(1) Public Grievances Redressal / Open House Quarterly Meetings shall be conducted by the Concessionaire for public to discuss the water related issues and to create awareness about water conservation.

(2) Public, all Voluntary Organisations, Consumer Action Groups, Residents Associations & Representatives of all other concerned Interested Groups working in the city shall be invited for the meeting through press release.

(3) Open House Meeting shall enable the participant public/ customers to interact with the Concessionaire to present their grievances as well as sharing and contributing in the decision making by offering opinion/advice and suggestions for system improvement wherever necessary.

(4) Minutes for the Open House Meetings shall be prepared and redressal of petitions / complaints received in the Open House Meeting shall be registered & monitored.

(v) The Concessionaire shall install Customer metering on all points of Customer supply and randomly check the calibration of meters installed for accurate reading to establish accurate water balance and monitor water losses;

(vi) The Concessionaire shall establish a fixed area network based data collection and install the automatic data collection gateways at appropriate locations established through a RF study in the project area and ensure automatic meter reading.

(vii) The Concessionaire shall supply water to the properties of the Authority with metered connection

(viii) The Concessionaire shall permit the persons appointed and / or authorised by the Authority to conduct audit of accounts and records of the Concessionaire from time to time relating to performance of the Concessionaire under the Contract after the Appointed Date subject to receipt of prior written intimation from the Authority in this regard and shall fully co-operate with such auditors in the conduct of audit and review exercises and checks and shall provide all requested information to the auditors;

(ix) The Concessionaire shall on a periodical basis update the record of Facilities.

(x) Neither the Concessionaire nor its employees shall indulge, either directly or indirectly, during the term of this Contract, any business or professional which would conflict with the activities assigned to them under this Contract;

(xi) The Concessionaire shall undertake the measures as agreed under the Emergency Procedures as per para 5.1 herein in times of operational exigencies.

(xii) Any complaints received from the consumer/ Authority shall be recorded and the appropriate remedial measures shall be effectively implemented to the satisfaction of the Authority duly documented.

(xiii) Any leakages observed in the distribution line, rising main and feeder main shall be attended immediately and water supply restored within 12 Hours of the receipt of complaint for leakage.

(xiv) The billing and collection of water revenue shall be ensured as per the performance targets during the entire term of contract.

(xv) The Concessionaire shall be responsible for maintaining required quantities of spares for preventive maintenance, periodical maintenance and breakdown maintenance as enlisted hereafter in this document. The Concessionaire must also keep the minimum stock of spares for emergency repairs as required for prudent operational practices.

A.2 Specific Obligations of the Concessionaire for Operations & Maintenance

1. The Concessionaire shall have the following obligations:

a) Review of operating and maintenance manuals if any, spare parts lists, recommended spares, warranty period from equipment suppliers and connected matters;

b) identifying and procuring workshop equipment and capital spares as may be required, at his cost.

c) select suitably qualified Suppliers of Spares, Consumables, Chemicals and the external Concessionaires required during Operations.

d) Set up a fully functional office with computers, personnel, equipment, furniture and communications and 24-hour customer service desk at convenient locations.

e) Appoint adequate personnel (minimum of 3 persons) to collect water samples and submit the same to the Authority's testing centres/ laboratories. The Concessionaire shall collect all water samples related to the system required by Applicable Law and provide and submit in a timely manner all such samples to the CMWSSB for analysis unless otherwise directed by CMWSSB or its Authorized Representative. All results of analysis shall be certified and provided to the CMWSSB Authorities (and to the applicable Governmental Authorities) if required by Applicable

Law) in a timely manner and in accordance with the requirements of this Agreement.

f) The Concessionaire shall also construct a building for water meter test bench as per the specifications provided in Schedule B for works contract. Concessionaire shall perform water meters testing at test bench as per the requirement or as directed by the Authority. Space for the test bench shall be provided by the Authority.

g) The Concessionaire shall assist the Authority in evaluating and verifying the reasonableness of the Operations and Maintenance Plan and answer all queries, explain the assumptions, projections, calculations etc. and shall make available all the concerned staff who had prepared the respective plans.

2. Notwithstanding the above obligations the Concessionaire shall have the following obligations during Operation & Maintenance

(a) Provide prudent management, operation and maintenance services as per the prescribed-standards of performance;

(b) Undertake efficient demand management and meet the entire demand for water as required during the time of operation;

(c) Comply with Performance Standards at all times, in accordance with the terms of the Contract;

(d) Undertake customer commercial services including reading meters, raising invoices for services, giving water connections, disconnecting defaulters, reconnecting as per the general conditions of contract.

(e) Manage and maintain the Integrated Information Management System (IIMS) to ensure efficient and transparent information, record keeping, financial management and accounting and decision making. Under IIMS, set up a robust integrated information system comprising of the following areas:

(i) Technical services such as service levels of water quality, consumption, pressure, losses, monthly real time water balance;

(ii) Commercial services such as customer contact, complaint redressal, customer consumption, billing, revenue collection;

(iii) Business services comprising accounts, financial management, procurement, inventory management and human resource management;

(iv) Hydraulic network Modelling - A hydraulic network model representing the WDS wise water supply system shall be developed using suitable software such as Water GEMS. The

model shall be calibrated, reconciled and established and fully functional for continuous updating for management of the system;

(v) Asset Management Program including covering each type and category of asset, its servicing schedule, replacement frequency, etc. for all assets in water system including but not limited to:-

(A) Valve inspections
(B) Tank inspections
(C) Pipeline inspections
(D) Leak detection process
(E) Preventive maintenance of all mechanical, electrical and instrumentation equipment

(vi) Set up operating and maintenance procedures for each of the unit operation including Standard Operating Procedures, Standard Maintenance Procedures, Emergency Procedures, Health and Safety Procedures etc incorporating Original Construction Concessionaire's Operating and Maintenance Manuals;

(f) Maintain effective and efficient customer complaints redressal system, at the prescribed performance standards;

(g) Undertake timely and cost effective asset management program;

(h) Maintain the automated water quality surveillance system;

(i) Operate and maintain all mechanical, electrical, instrumentation and information technology installations, equipment, machinery etc as per the respective standard operating and maintenance procedures;

(j) Undertake preventive and breakdown maintenance for all pipelines, appurtenances, mechanical, electrical and instrumentation equipment in relation to the above referred Facilities, along with appropriate documentation to facilitate warranty and insurance claims, if required;

(k) Ensure effective and efficient planning, procurement and inventory management for all spares, chemicals, consumables etc;

(l) Provide robust security arrangements for all the facilities within the scope of this project, including restriction of entry of unauthorised persons;

(m) To organize for monthly reading of customer meters, consumption, updating the records, preparing a bill based on the water tariff fixed by the Authority from time to time and issuance of bill to the customers in the prescribed time;

(n) To collect the revenue through cash, cheques, demand drafts, electronic clearing services etc and issue receipts of acknowledgement for payment to the customers on behalf of the Authority;

(o) To remit cash, cheques and all other forms of payment collected into the designated accounts of the Authority within 12:00 hours of the next business day with appropriate reconciliation accounting system;

(p) To prepare monthly accounts of demand, collection and balance and report to the Authority on the revenue management;

(q) Manage and maintain the water distribution management system (WDMS) for the entire water supply in the project area, including all pumping stations, water and storage facilities, flow measurement and quality surveillance systems etc. complete;

(r) Comply with all relevant local laws including environmental, industrial and labour laws;

(s) Maintain healthy working relations with all stakeholders including the Authority, the customers, Water resources department, Greater Municipal Corporation of Chennai (GCC), State Pollution Control Board, and power utilities; etc.

(t) Maintain detailed documentation and prepare periodical reports including monthly, quarterly and yearly reports for submission to the Authority including data on quality of raw and treated water, leakage levels, flow and pressure of water at designated check points, service level, billing, collection, debt management etc. complete as set out in.

(u) Submit Monthly invoices to the Authority including accounts receivable, adjustment for errors in billing, accounting for realization and generation of overdue receivables;

(v) Training of the operating personnel from the Authority or any other designated authority for taking over the system at the end of Contract Term;

(w) To undertake emergency chlorination measures at times of outbreak of epidemics and any such emergency situations;

(x) Rectify all defects attributable to the Concessionaire and notify

the Authority of defects, developed within defect liability period of the commissioned components of Water supply system;

(y) Follow all reporting requirements;

(z) Maintain the Performance Indicators, Quality Assurance, Safe Operation Procedures (SOPs);

(aa) To summarize, the services provided by the Concessionaire shall include the following:

- Operation of all Facilities;
- Provision for 24 hours a day operation and emergency cover;
- Maintenance of all the Facilities;
- Ground and buildings maintenance;
- Unscheduled and emergency maintenance;
- Responding to customer enquiries;
- New service connection surveys and estimates;
- Making new service connections;
- Investigation of illegal connections and disconnections;
- Responding to requests from utilities and others for water supply lines;
- Quality control and assurance;
- Data collection and reporting;
- Holding emergency exercises;
- Incident management;
- Safety inspections;
- Supervision of sub Contractors, enforcement of specifications;
- Operational liaison;
- Updating of the MIS;
- Preparation of all plans, procedures and budgets relating to operational matters, as required within the Contract.
- Any other work necessary to ensure the continued operation and availability of the system.

(bb) Maintenance Work for the pumping stations at WDSs is divided into four categories Preventive, Corrective, Replacement, Minimal Maintenance;

1) Preventative maintenance (PM) is defined as those maintenance procedures that are implemented repetitively at regular interval. The works carried out shall consist but not be limited to:

- Greasing, oil changing, provide fuel, distilled water, recharging gas;
- Cleaning from dust, mud and sediments, testing, calibrating, checking of tightness of all connections, general cleaning for the body, charging, cleaning filters;
- Check gauges, adjust gland-packing and repair or replace if required;
- Replace worn-out drain lines, fittings replace fuses, bulbs and similar, if required;
- Inspecting all fans, compressors, motors wiring, switches,

controls, protection devices;
- Check for correct operation;
- Any other related works in accordance with manufacturer specifications and instructions.

2) Corrective Maintenance is defined as those maintenance works performed to repair parts to correct the situations. The works carried shall include but not be limited to:

- Dismantle the unit;
- Check the body (casing) and covers and clean it. If the casing is corroded, the Concessionaire shall submit the filling material, coat it with suitable paint to the Authority's approval;
- Check all connections and fittings and repair the corroded and closed fitting wherever needed;
- Clearance work should be to the manufacturer instructions and specifications. If the clearance is above the range, the Concessionaire shall replace wearing and any other fittings or materials to keep the unit in its range;
- All wearable parts such as gland packing, packing bushes, oil seals, O-rings, gaskets, rubber parts, fuses, bulbs shall be replaced;
- Repair the part which is needed to be repaired according to the work orders;
- Assemble the unit and check for proper operation;
- Any other related works in accordance with the manufacturer specifications and instructions.

3) Replacement Maintenance is defined as those maintenance works applied in response to situation that cause equipment to be out of service and beyond repair.

4) Minimal Maintenance comprises a suitably qualified person visiting a pumping station and carrying out an inspection possibly with basic items of maintenance such as greasing and bulb changing. Such work can be expected to be completed by one person, within an hour.

(cc) All instruments shall be maintained, checked, calibrated and serviced periodically and will always be kept in operating condition. The calibration shall be checked whenever necessary and corrected. Calibration data shall be submitted to the Authority for approval. As a minimum, all instruments shall be calibrated once per year.

(dd) For the purpose of complying with the requirements of this contract, the Concessionaire will need to provide:

i) An adequate and skilled workforce, supervisors, managers and

technical support staff;

ii) Administrative and financial support staff and computer and business support systems;

iii) All necessary mobile plant and equipment, vehicles and incidental equipment;

iv) Health and Safety equipment and staff protective clothing as well as traffic and footpath barriers and signs;

v) Necessary chemicals and fuel;

vi) Stores suitably stocked with adequate spare parts and replenished within a store policy that recognizes frequency of use and delivery periods;

vii) Suitable depot and office premises.

(ee) The Concessionaire shall carry out the complete cleaning & disinfection of ground service reservoirs, master balancing reservoirs etc. once in a year.

(ff) The Concessionaire shall carry out operation and maintenance of meter testing facilities.

B. Standard Operating Procedures (SOP)

Operating Instructions and Safe Operating Procedures (SOP) shall be formulated for each Site comprising of process equipment schedules, operation & maintenance data, sampling and analysis with frequencies etc. The operating parameters shall be optimized based on the data collected on commissioning of the facilities. All the activities in the preventive maintenance schedule shall be followed without any lapse. Indicative functions that are expected to be performed at each site are given below:

1. Water Supply

Water pumping stations at WDS

(a) Check operation of all pumps

(b) Take all relevant meter readings

(c) To ensure compliance with agreed withdrawals and to bring to notice of the Authority any excess or short withdrawal

(d) Check operation of all valves along the transmission main

(e) Flow and pressure measurement

(f) Checking operations of electrical & mechanical equipment

(g) Check the power factor and power consumption

(h) Inspect the overflow devices

(i) Take all meter readings at such times of the day, as agreed with the Authority

(j) Check distribution of flows to feeder mains

(k) Checking operations of electrical & mechanical equipment

Supply Network

(a) Take all relevant meter, flow and pressure readings
(b) Check operation of all equipment
(c) Periodically check water meters, test bench and take readings
(d) Check for Chlorine residual, flow and pressure at the Critical Measurement Points (CMPs)
(e) Checking operations of electrical & mechanical equipment

C. Maintenance and Repairs (Mechanical, Electrical and Instrumentation)

C.1 Management and Maintenance Plan

A properly designed water system shall be capable of delivering desired output at all times. Considering that every mechanical system shall have to be given a downtime for maintenance purposes, the Concessionaire shall schedule a plant downtime of one hundred twenty hours, on a cumulative basis in a year for the facilities in consultation with the Authority so as to minimize disruption in services.

A. Routine inspection and maintenance of all equipment;
B. Planned and scheduled maintenance (preventive);
C. Unscheduled maintenance (breakdown);
D. Cost and budget planning.

C.2 Routine Inspection and Maintenance of Equipment

The Concessionaire shall carry out routine monitoring of the equipment and ensure that the equipment is properly maintained to meet the desired output. Typical tasks that shall be undertaken are:

(A) Mechanical

(a) Checking the lubrication and necessary follow-up
(b) Replacing of glands that are leaking
(c) Servicing as per supplier's instructions
(d) Stripping down of pumps to observe clogging if any
(e) Checking for unusual vibrations and noise

(B) Electrical

(a) Checking electrical contacts and wiring
(b) Checking motor heating and noise level
(c) Assessing efficiency of electrical equipment

(C) Instrumentation

(a) Cleaning and calibration of probe / sensors
(b) Fault diagnosis

These maintenance tasks shall be issued on a weekly basis through computer aided management system and the Concessionaire shall incorporate it in the operating work schedule. All observations shall be recorded in the properly designed record system and would be analyzed for initiating corrective actions, if any.

C.3 Planned and Scheduled Maintenance (Preventive)

A work schedule chart listing identification of critical equipment, work assignment, timing shall be prepared. Critical equipment is defined as those items where failure would adversely affect the quality and quantity of output or those that risk the safety of employees or customers. The schedule shall identify the responsible person / agency who shall be intended to complete the task e.g. in - house technician or specialist Concessionaire etc.

The overall yearly plan schedule shall be issued to all parties to enable forward planning of anticipated manpower requirement and equipment down time. The indicative maintenance schedule is provided further in the following table. This shall be finalized during the preparation of the Operation and Maintenance Plan.

C.4 Breakdown Maintenance

The aim of routine and preventive maintenance is to keep breakdown to minimum for items of critical equipment which shall directly affect the performance of treatment processes. However certain breakdowns may occur in spite of proper maintenance. The Concessionaire shall take the breakdown maintenance on top priority to keep disruption to the systems at a minimum level.

The Concessionaire shall have the option to call other available staff and also the services of the local skilled Concessionaires should the breakdown occur.

C.5 Spare Parts

The Concessionaire shall store spares of all the critical equipment on respective sites and the inventory shall be assessed according to anticipated usage and in conformity with Annual Operating and Maintenance Plan and Annual Budget.

The Concessionaire shall obtain consumable items required for maintenance e.g. grease, gaskets etc. from local suppliers, as and when required.

Annual reports on the cost of replacement spare/million litre of water supplied shall be provided to the Authority, for the purpose of monitoring usage and cost control.

C.6 Maintenance Report

To assist the Concessionaire in the management of the maintenance activities, Computer Aided Maintenance Management (CAMM) shall be implemented by the Concessionaire which shall be integrated with the MIS system. Appropriate proprietary CAMM packages shall be utilized by the Concessionaire for maintenance purposes. This package shall incorporate features such as Facility details, maintenance history records, and scheduling of maintenance activities. The use of such package shall allow the Concessionaire to predict when the maintenance activities need to be carried out.

Record of maintenance jobs carried out shall be reported in the record system, which shall provide the Authority the past history, time and cost involved for each category. The report shall include:

(a) Details of number of jobs completed
(b) Frequency of breakdown, time required repairing and costs involved.
(c) Personnel involved / Concessionaires used

Input data along with the base data and license, if assignable, would be made available to the Authority.

D. Emergency Action Plan

The Concessionaire shall provide Emergency Plan of Action, as per the following:

(i) The Authority may, at its election, intercede and take, or direct the Concessionaire to take, any and all actions reasonably necessary to respond to an Emergency. The Concessionaire shall, upon learning of an Emergency or the probable occurrence of an Emergency, (1) immediately provide oral notice to the Authority or its Authorized Representative of the same and (2) as soon as possible, but no later than twelve (12) hours, provide Notice to the Authority or its Authorized Representative of such event or probable event; provided however, if Applicable Law shall provide for a more expeditious oral or written notice of any Emergency to the Authority, the Concessionaire shall so comply by providing such notice to the Authority or its Authorized Representative.

(ii) The Authority and Concessionaire or their Authorized Representatives shall coordinate with each another prior to, during and after the occurrence of an Emergency including 1) the planning and implementation of actions designed to prevent or mitigate damage to the System and the environment and (2) the attendance of all meetings related to such planning and implementation.

(iii) The Concessionaire shall interact and cooperate with appropriate departments of the public entities comprising the Authority and other jurisdictions.

(iv) The Concessionaire shall supply standby employees from normal system staff ready to address an Emergency in an expeditious manner.

(v) Response Times and Emergencies:-

The Concessionaire commits itself to a high standard of effective response. To indicate commitment, the Concessionaire shall establish 'Standards of Service' which shall define the Concessionaire's response to any emergency with the intention of minimizing the possible impact of an emergency or failure on the output of the Facilities. These standards shall be agreed with the Authority and would typically include:

Situation	**Response**	**Target Time**
To any alarm or non-conformity during normal work time, or when the Facilities are being manned.	Any threat to public or personal health.	Immediate
	To attend to and assess the required action and the resources needed to effect remedial action. Effect first call repairs where possible	Immediate
	If the problem requires further resources, to have remedial work on site rectifying the problem.	2 Hours
To any alarm Or non-conformity occurring outside normal Operating hours or when Facilities are unmanned	Any threat to public or personal health.	Immediate
	To attend to and assess the required action and the resources needed to	1 Hours
	effect remedial action. Effect first call repairs where possible	
	If the problem requires further resources, to have remedial work on site rectifying the problem	2 Hours

A dedicated problem-solving team shall be appointed by the Concessionaire and this team shall have the responsibility of tracking problems through to a satisfactory outcome.

Major events that threaten public, employee or process safety or security shall be managed directly by a Concessionaire's Representative, who shall have full authority to utilize whatever resources he considers fit to

rectify any emergency situations. In performing these duties, this manager shall have full responsibility for ensuring proper and adequate communications with the Authority and other relevant bodies.

E. Permits

1. Both the Authority and the Concessionaire will be responsible for obtaining various permits, authorizations and consents to enable them to carry out their duties. These will include, but not be limited to the following:

2. **Permits to be obtained by the Authority**

a) Abstraction licences from various departments
b) Planning permissions
c) Public way-leaves that may be required from time to time
d) Building permits
e) Discharge consents
f) Disposal licenses for sludge
g) Permissions to enter public and industrial properties

3. **Permits to be obtained by the Concessionaire**

a) Vehicle and plant licenses
b) Licenses to store and use chemicals
c) Licenses to use machinery
d) Waste management licenses
e) Health and Safety certificates
f) Fire certificate
g) Approval from Labour Inspector
h) Approval from District Health Officer
i) Insurance as appropriate
j) Licenses to carry out water operations
k) Right to use Electrical power

F. Sampling, Testing, Reporting Requirements

F.1 Meter Testing

The Concessionaire shall perform water meters testing at employer approved NABL accredited laboratory/Employer's test bench test bench as per the requirement or as directed by the Authority.

All the equipment and necessary tools required for carrying out in house repairs and maintenance, troubleshooting, maintenance for smooth operations will be made available by the Concessionaire and stored in an area allocated by the Authority for that purpose.

The Concessionaire shall keep at least 5% of the total house connection meters as spares in its inventory and during the time of testing of water

meter, shall install the spare meter at the consumer end.

F.2 Sampling and Analysis

The Concessionaire shall collect all water samples related to the system required by Applicable Law and provide and submit in a timely manner all such samples to the designated Laboratory of Authority for analysis unless otherwise directed by the Authority or its Authorized Representative. All results of analysis shall be certified and provided to the Authority (and to the applicable Governmental Authorities, if required by Applicable Law) in a timely manner and in accordance with the requirements of this Agreement.

It should be noted that the measures referred to above are to ensure that the quality of supplied water from UGR/WDS within standard norms. Other parameters will be monitored on a regular basis to determine performance against a number of determinants to determine whether the Concessionaire is liable to pay Liquidated Damages.

F.3 Reporting Problems

The Concessionaire shall immediately notify and provide the Authority or its Authorized Representative with any and all information as the same becomes available related to any activity, problem, event or circumstance that is an abnormal condition, including overflows and bypasses on the System, that threatens or may threaten compliance with the requirements of this Agreement, the public health, safety or welfare of the residents of the Authority's Service Area as identified in Schedule A or disrupts System operations or requires notifications to Governmental Authorities. To the extent the Concessionaire, is required by Applicable Law to notify the applicable Governmental Authorities, it shall do so in compliance with the timeframe required by Applicable Law provided, however, the Concessionaire shall always endeavor to notify the Authority or its Authorized Representative of such abnormal condition before it notifies the applicable Governmental Authorities, if required, of such condition. The Concessionaire shall continue to update and provide any and all information regarding such act or event to the Authority 's Authorized Representative and, to the extent required of the Concessionaire by Applicable Law, to the applicable Government Authorities, as such information becomes available. The Concessionaire shall take all reasonable steps necessary under the circumstances to develop and provide to the Authority 's Authorized Representative within four (4) hours after becoming aware of the abnormal condition, the reasons or events giving rise to the abnormal condition, a full and complete assessment of the situation based on such available information, provide recommendations as to the responses that are and should be undertaken by the Concessionaire to address and cure the abnormal condition and continuously update the Authority or its Authorized Representative of the same as information becomes available. Further, the Concessionaire shall

immediately, but in no event later than period of time prescribed, as applicable, above, commence (1) all necessary investigative, corrective and mitigative actions required by Applicable Law, (2) implementation of the Emergency plans as required, to the extent it is applicable to the situation, (3) implementation of the activities required by this Agreement, (4) implementation of Capital Repairs or Replacements, Material Capital Repairs or Replacements and Emergency repairs and (5) physical inspection and gathering of information and other data from field locations as may be necessary and appropriate to assess the range of responses that may be available and appropriate to the situation, including that information and data as may be requested by the Authority or its Authorized Representative.

G. Failure to Comply

Failure of the Concessionaire to comply with the requirements shall lead to withholding the performance fee due to the Concessionaire.

H. Service indicators

Level of service (LOS) Indicators which measure the effectiveness of service and operation levels will be developed and monitored as per following Table.

Level of Service Indicators			
Sl. No.	**Level of Service Indicators**	**Frequency of Monitoring**	**Response Repair Time**
1	Bursts in the transmission mains and-feeder mains of water supply system. -	Weekly	Response time within 6 hrs
2	Bursts in the distribution network pipelines	Weekly	Response time within 4 hrs
3	Billing complaint	Monthly	Response time within 3 days
4	Downtime of pumps/ T/w at all pumping stations.	Monthly	Repair time within one day except for major repairs and replacement which shall be within 7 days

I. Digital Water Management System (DWMS)

The Concessionaire shall establish, develop and maintain Digital water management System (DWMS). The DWMS shall have capabilities for receiving data of flow, pressure and quality from strategic locations of the network at 5 second intervals for real time monitoring of the operation. The system shall be capable of facility management, inventory management, billing and collection management, operational job management and records and data management as well as all capabilities necessary for safe and efficient management, operation and maintenance

of the Facilities.

I.1 The Concessionaire's and the CMWSSB Responsibilities.

(a) The Concessionaire shall be establishing, keeping and maintaining the DWMS in consultation with the Authority. The Concessionaire shall collect and keep up to date information on the facilities, both above and below ground.

(b) All Facilities taken over by the Concessionaire shall be entered into the IMIS.

(c) The Concessionaire shall verify all information in accordance with procedures agreed with the Authority.

(d) The Facility Register shall be supported by operational information on compliance with Performance Standards, part wise.

(e) The Concessionaire shall be responsible for operating the Facilities and the Conveyance System in the correct manner and for maintaining them in a professional manner.

(f) The Concessionaire shall use the data to plan the Annual O&M Plan in consultation with the Authority.

(h) The Authority may use the information to gain an overall view of the Facility's value, performance and condition.

I.2 Facility Register

The Facility Register shall be a schedule (a computerized database, but also available on prayer for ease of inspection) of all the Facilities and the Conveyance System to be maintained under the responsibility of the Concessionaire as agreed with the Authority. The Facility Register shall be used to perform, or support, the Services carried out by the Concessionaire

The format of the Facility Register shall be designed in consultation with the Authority.

The Authority shall have the right to verify the Facility Register and Concessionaire's procedures for keeping it up to date.

I.3 Facility Numbering

Each above ground Facility shall be given a unique number within the Facility register. Numbering system shall be designed in consultation with the Authority. The number shall refer to the site and the type of Facility.

I.4 Performance and Condition Grades

Performance grades shall define whether the Facility is meeting the required quality standards or levels of service standards or is suitable for

its function. Condition grades shall define the structural condition of the Facility. This may be from an assessment of the structural condition or from recording of the frequency of failures of the Facility.

Following Table describes the meaning of some of the Grades of the Facilities. Detailed definition of these Facilities shall be formed within six months of appointed date of Operations Period, for each Part, in consultation with the CMWSSB.

Definition of Facilities		
Grade	**Description**	**General Meaning**
1	Good	Of sound structure with components that are operable and well maintained
2	Fair	As 1, but showing some minor signs of deterioration Routine repair, refurbishment and maintenance required with review of condition in the medium term
3	Adequate	Functionally sound, but affected by minor cracking, staining or minor leakage. Some reduced efficiency and minor failures. Review of conditions required in the medium term with action likely to be needed in the medium term to prevent deterioration to Grade 4
4	Poor	Condition has a significant effect on the performance of the Facility with components requiring significant repair or maintenance to remain operational. Shall require major overhaul / replacement within the medium term.
5	Bad	Condition of the Facility has a serious effect on its performance. Effective life of mechanical and electrical plants and other components is exceeded and incurring excessive repair and maintenance costs due to unreliability. Shall require major overhaul/replacement in the short term.

I.5 Timing Definitions and Differentiation between Facility Types

a) Performance Aspects

The Concessionaire shall develop a clear understanding of the exact meaning of the phrases 'Immediately', 'Short Term' and 'Medium Term' used in association with the performance Grades with the Authority, within six months of the appointed date of the Operating Period.

b) Condition Aspects

Different Facilities shall have different expected life span. Buildings or Civil (usually reinforced concrete structures) Facilities are expected to have a Facility life of 30 years. Electrical and Mechanical Facilities are expected to have a Facility life of 15 years. Bulk water mains would be expected to have Facility life in excess of 30 years, or may be taken as having an indefinite life.

The terms 'immediate', 'short term', 'medium term' need to describe

approximately when major work shall be required related to the Facility's normal life.

J. Records to be Produced and Maintained

The scope of the Facilities to be included is summarized in following Table:

Scope of the Facilities	
Type	**Facilities**
Management and General	Workshops
	Stocks
	Computers and associated equipment
	Land
	Vehicles
	Plant & machinery
	PS
	UGR etc.

K. Operational Job Management

The Concessionaire shall establish and maintain a suitable job management system, in consultation with the Authority. This job management system should provide detailed information on Facilities such as the type and make of motors, maintenance schedules etc.

L. Record Drawings

Data on Facilities shall be mentioned on Record Drawings. The Authority shall ensure that the Concessionaire is given available Drawings of all Facilities. The Concessionaire shall accept the As-Built Drawings as per the scales and standards utilized by the Original Construction Concessionaire(s). The data can then be extracted and summarized on the IMIS. The Concessionaire shall establish and maintain up to date Record Drawings for both above ground and below ground Facilities.

The Concessionaire shall update the Record Drawings and Facility Register to include the Facilities taken over, together with any work that are subsequently undertaken. The Record Drawings shall be updated by the Concessionaire within 3 months of any modifications being carried out in the Facilities.

M. Accuracy of Data.

The Concessionaire shall assign 'Confidence Grades' to the data to validate its accuracy. The Concessionaire shall develop the definitions of these grades and how they are to be used in consultation with the Authority.

N. Inventory Management

The Concessionaire shall operationalize a computer-based inventory management system to enable effective control of spares and consumables on the commencement of the Operations Period. This system shall use standard proprietary software and shall be linked by the Concessionaire to IMIS. The Concessionaire shall provide monthly reports from this system to the Authority in support of the expenses incurred.

O. Customer Service Management System

Customer service encompasses a broad range of activities. The Customer Service Management System shall have an interface with the Customer's premises to ensure required performance parameters are met (e.g. water pressure and flow) and proper response are given to customer enquiries. The following provisions shall be integrated into the customer service management system:

i) At least 24 hours advance warning of planned supply shut off for repairs and renewals
ii) Advice Customers during emergencies
iii) Recording and Responding to Customer Complaints.
iv) The Concessionaire shall develop a Customer management strategy with a view to establish world class quality of Customer Services.
v) The strategy prepared by the Concessionaire shall include, but not be limited to, a comprehensive strategy to establish a Customer Service Centre.
(iv) The Concessionaire shall receive and handle all customer queries and complaints, including, but not limited to, queries and complaints related to

- Water bills;
- Malfunctioning or inaccurate meters;
- Meter readings;
- Water quality;
- Water pressure;
- Leakage and damaged pipes;
- Change in meter location;
- Changes in customer names;
- Cancellation of connection by the customer

P. Systems and Procedures for Creating and Updating Customer Database

Pursuant to Article 38 of the agreement, the Concessionaire shall operationalize a Customer Database, with which all customer contacts with respect to billing and provision of services can be controlled.

Information held shall include the Customer name, reference number, mailing address, telephone number and account history information. The supporting data shall be made available by the Authority sufficiently in advance. The Concessionaire will update the database from time to time.

Q. Meters and Meter Reading

The Concessionaire shall establish a fixed area network-based data collection and install the automatic data collection gateways and access points at appropriate locations established through a RF study of the project area and ensure automatic meter reading.

The Concessionaire 's personnel shall read the bulk water supply meter and the end use meters on a periodic basis, for the meter data which is not captured through automatic data collection system. The Concessionaire shall enter the meter readings into hand-held data entry machine (ITRON or PSION or similar) provided by him. The individual readings shall be downloaded at a central terminal at regular intervals to create a billing schedule. All bills shall have digital photographs of meter reading printed on the consumer bill. The Concessionaire shall:

i) Read all Customer Meters in accordance with the general instructions of the Authority;

ii) Register all Customer Revenue Meters readings in the appropriate computer data base;

iii) Develop a monitoring program of random spot-checks to ensure the accuracy of the -meter calibration and the meter reading process and provide written reports to the Authority on the results of the monitoring programme;

iv) Develop and implement a plan the intent of which is to ensure that:

- All Customer Meters are accurate;
- All Customer Meters are read;
- All Customer Meters are in suitable locations;
- Problems related to unprotected and unsealed Customer Meters are resolved;

v) Provide advice as to methods to improve the meter reading process to ensure greater accuracy;

vi) Convert all Customer Meters readings to billings to Customers;

vii) Identify Customer Meters which have not been read; and

viii) Respond to reports of malfunctioning Customer Meters from Customers.

R. Meter Replacements / Refurbishment / Calibration by Concessionaire

As per contract and Schedule B as may be applicable

S. Customer Service

A 24-hour customer service desk shall be established by the Concessionaire. The customer service desk will be integrated with the IMIS. All enquiries and customer complaints shall be recorded into the system along with the resolution mechanism, time of resolution, action taken and feedback procedures.

T. Financial Management and Customer Services

T.1 Financial Management

The Concessionaire shall prepare a comprehensive Financial Management Plan in respect of all matters including but not limited to:

(i) financial management, including accounting systems;
(ii) the billing and collection systems;
(iii) Customer Services, including data bases relating to complaints and questions and response times with respect to complaints and questions;
(iv) information systems; and
(v) asset registers from the perspective of maintaining a prudent asset management system and accounts.

T.2 Billing and Revenues Collection

T.2.1 Billing & Collection system

The Concessionaire shall develop a robust billing, collection and revenue management system with facility for easy upgradation and improvement. This shall include but not be limited to:

(i) Effective water billing practices and procedures;
(ii) Effective revenue collection practices and procedures; and
(iii) a simple and efficient connection, disconnection, and re-connection procedure.

T.2.2 Billings and Collection of Revenues

The Concessionaire further acknowledges that it will take over full responsibility for billings and collection in the Service Area for and on behalf of the Authority.

The revenue collection system shall support all the Authority's standard payment methods at the minimum and would be designed to incorporate additions. In addition, it will cover the following:

- Preparation and issue of a debtor statement
- Timetable for the issue of reminders and recovery notices shall be established and issued to consumers at the regular

intervals based on the inputs.

- Intimation to the Authority of continued debtors for the Authority 's action like disconnection etc.
- Additional charges such as disconnection/reconnection fees, damage cost and late payment penalties shall be billed.

T.2.3 The Concessionaire shall:

(i) collect all amounts due to the Authority as Revenues related to the Services.

a) through the Concessionaire's billing offices;

b) through banks, electronic transfer;

c) by other means as may be agreed to by the Authority.

(ii) Identify and record all outstanding accounts and take all necessary measures to collect outstanding accounts;

(iii) submit to the Authority summary and analysis of unpaid accounts (every month);

(iv) manage all aspects of customer services with the Customers.

SCHEDULE C: KEY PERFORMANCE INDICATORS (KPI)

The Concessionaire shall ensure and procure compliance of the below Key Performance Indicators (KPIs) in a diligent manner:

1. Construction Period:

During the construction period the Concessionaire shall have the obligation to achieve the following construction targets:

(a) A minimum of 40% of connections identified in the CIP or 18,000 connections whichever is lower, by the end of one year from the Appointed Date

(b) A minimum of 100% of connections identified in the CIP or 38,000 connections whichever is lower, by the end of two years from the Appointed Date

Each connection shall be considered completed upon:

(i) Installation of User Meter

(ii) Inclusion of customer in the GIS based customer database

Provided however, if the Concessionaire has failed to achieve any or all of the mile-stones as mentioned in (a) and (b) above, the Liquidated Damages will be computed as provided below:

Sl. No.	Time Period from date of scheduled completion	Liquidated Damaged INR/Day
1.	Upto 60 (sixty) days	Rs. 1,00,000
2.	Beyond 60 (sixty) days up to 120 (one hundred and twenty) days	Rs. 2,00,000
3.	Beyond 120 (one hundred and twenty) days up to 270 (two hundred and seventy) days	Rs. 5,00,000
4.	Beyond 270 (two hundred and seventy) days	Termination under Article 31

However, it is expressly clarified that this Liquidated Damage shall not be payable if the delay is due to any reason not attributable to the Concessionaire's fault, and for which the Authority has provided Extension of time to complete the obligations.

It is further clarified that in the event of levy of any Liquidated Damages on account of non-performance of 1(a) above, the same shall be adjusted against the computation of Liquidated Damages at the time of CoD. To illustrate, if the milestone mentioned in 1(a) is delayed by 10 days and the Concessionaire is levied a penalty of Rs. 10,00,000, and the overall project is completed in 10 days from the Scheduled CoD, no further penalty shall be levied at the time of CoD. In the above illustration, if the overall project is completed on the scheduled completion date, the Liquidated damaged levied on the Concessionaire shall be reimbursed.

2. Initial Operation Period

The Concessionaire has to achieve the following minimum performance standards as detailed here in below during the Initial operation Period.

(1) Per Capita Supply of Water:

Rationale	Adequacy of Water supply
Frequency	Monthly
Required Service Level	Quantity of water pumped into the system out of the total quantity received from CMWSSB at the storage reservoirs
Measured by	Quantity of water pumped through the WDS
Data Requirements	Amount of water pumped through the WDS at the pumping stations as recorded by the flow meters
Calculation	$\frac{\text{Water pumped through the WDS}}{\text{Water received from CMWSSB}}$
Monitored by	A register maintained by the Concessionaire; the register shall include details of water supplied through the WDS and the population of the areas served. The register shall have the following details: • Time and Date • Quantity of water Supplied • Population of the served area
Allowable Exclusions	Water Shortage Period
Penalty/damages	Rs. 25,000 per day for every 1% reduction in supply
Incentives	No incentive

(2) Quality of Water Supplied

Rationale	Poor quality of water can pose serious health hazard
Frequency	Monthly
Required Service Level	At User Tap: 90% samples conforming to the permissible level of residual chlorine to be maintained, other than where the Emergency Response Plan is triggered. (up to COD)
Measured by	Number of samples from User taps tested and not conforming to residual chlorine levels based on a minimum of 10 samples for every 1,500 connections on a quarterly basis.
Data Requirements	Analysis sample of various points within distribution system.
Calculation	$\frac{\text{Total numbers of samples that meet the specified standards}}{}$

	Total number of samples tested
Monitored by	An electronic registry maintained by the Concessionaire; the registry shall include detailed database and summary tables for both routine water quality tests and tests necessitated due to Complaints from Customer on poor quality of water. At least 30% of samples as prescribed by CPHEEO manual shall be collected and tested by third party approved lab or CMWSSB lab. • The water quality testing database shall include: • Time and Date • Sample Location • Sample Number • Details of water quality tests conducted • Details of Remedial Actions taken in case of water quality problem • The customer complaints database shall include: • Time and Date • Complaint Identification Number • Customer Identification Cod • Nature of Complaint on water quality • Action Taken Report • Time and Date of Resumption of Service Level
Allowable Exclusions	Pollution event covered by Emergency procedures
Penalty/damages	For each sample at consumer tap not confirming to residual chlorine standards, Rs. 1,000, escalated at the rate of 5% per annum from the Appointed Date.
Incentives	No incentive

3. Operation Period

The Concessionaire has to achieve minimum performance standards as detailed here in below:

In the event the Concessionaire achieves exceptional service levels, a mechanism has been provided to remunerate these exceptional services. Similarly for poor performances below the minimum performance standards will attract penalties.

Minimum performance standards to be maintained during the Agreement Period:

Sr. No.	Service Level Benchmark	Target	Targeted performance
1	Coverage of Water Supply	100%	Two years from Appointed date
2	Continuity of Supply	24 hrs	Two years from Appointed date
3	Functioning of Meters	100%	Two years from Appointed date

Sr. No.	Service Level Benchmark	Target	Targeted performance
4	Extent of Non-revenue water	15%	20% at the end of Construction Period; 1% reduction each year to reach 15% in 5 years from COD
5	Efficiency in Redressal of Complaints	90%	90% of complaints to be redressed within the stipulated time from COD
6	Quality of Water	Permissible level of residual chlorine at User tap level	Two years from Appointed date
7	Efficiency in collection of water related charges	95%	Three years from CoD

Calculation methods:-

Above Service level benchmark shall be calculated using following formula and the Performance Parameters, Penalties and the Measurement framework shall be as detailed below:

(1) **Coverage of Water Supply:**

Rationale	Basic mandate of CMWSSB to provide direct metered connect
Frequency	Quarterly
Required Service Level	100% of households within the Service Area
Measured by	Total number of Properties with metered direct water supply connections as percentage of total number of Properties in the service area.
Data Requirements	Total Number of households from satellite image & consumer survey. Total number of consumers (Registered/ Unregistered) connected with pipe network or alternatively % of area covered under piped network.
Calculation	Number of metered connections to consumer X 100 Total number of Properties
Monitored by	• As built map of network after construction period with respect to location of registered and unregistered consumer. • GIS map • House to house survey data

	• CMWSSB network should enable to connect 95% of the consumers with maximum 40 mtr of connecting pipe. In exceptional cases consumer connection is allowed up to 100 mtr of connecting pipe (not more than 1%). • Distance excludes the pipe length with in the premises of consumer. • Connecting pipe Length shall be measured from ferrule point to consumer boundary.
Allowable Exclusions	1. Unauthorized colony where CMWSSB is not allowed to supply water 2. Area outside CMWSSB jurisdiction (with in the service area) 3. Consumers who have not applied for a connection 4. Area excluded as instructed by CMWSSB. 5. Legal dispute on ROW for laying the pipe line and not resolved by authorities.
Penalty/Damages	Quarterly O&M Fee x 20% x % of consumer not covered in service area. Where % of consumer not covered = 100% ***less*** (% of consumer of service area within 40 mtr of CMWSSB network + number of consumers in Areas as per allowed exclusion + number of consumer allowed by CMWSSB exceeding 40 mtr of connecting length (maximum 1%) ***divided by*** Total properties within Service area as per house-to-house service connection and GIS map
Incentive	No incentive

(2) **Continuity of Supply:**

Rationale	Continuity & reliability of supply.
Frequency	Monthly
Required Service Level	*Continuity of supply:* 24X7 water supply with 17m residual pressure at Critical Measurement Points with a compliance level of 100% to be achieved at the end of CONSTRUCTION PERIOD and maintained throughout the Contract Term ***Pressure at Connection:*** 17m residual pressure at Critical Measurement Points with a compliance level of 98% to be achieved at the end of CONSTRUCTION PERIOD and maintained throughout the Contract Term
Measured by	***Continuity of Supply:*** Percentage of readings measuring to more than or equal to 17m pressure at the

	Critical Measurement Points (CMPs) plus the total number customer complaints on 'no water' resolved in 24 hours over the total number readings based on a continuous pressure logged at all CMP plus the total number of customer complaints on 'no water' during the Six months under review. ***Pressure at Connection:*** Percentage of readings measuring to more than or equal to 17m pressure at the Critical Measurement Points (CMPs) plus the total number of customer complaints on low pressure resolved in 120 hours over the total number of readings based on a continuous pressure logged at all CMP plus the total number of customer complaints on low pressure during the Six months under review
Data Requirements	Number of hours of supply in each of the operational zones base and Pressure readings
Calculation	***Continuity of Supply:*** 100* (Total Number of Readings of pressure equal to or more than 17m +Total number of Customer Complaints on 'no water' resolved in 24 hours)/ (Total number of readings of pressure + Total number of customer complaints on 'no water') ***Pressure at Connection:*** Pressure Compliance = 100* (Total Number of Readings of pressure equal to or more than 17m+Total number of Customer Complaints on low pressure resolved in 72 hours)/ (Total number of readings of pressure + Total number of customers.
Monitored by	An electronic registry maintained by the Concessionaire; the registry shall include detailed database and summary tables for both pressure logs and record of customer complaints. The pressure log database shall include: • Time and Date • CMP Identification Number • Pressure in Meters The customer complaints database shall include: • Time and Date • Complaint Identification Number • Customer Identification Code • Nature of Complaint on Low Pressure • Action Taken Report • Time and Date of Resumption of Service Level
Allowable Exclusions	I. Planned Maintenance Periods II. Low pressure at the Command Reservoir III. Mains Bursts in networks operated by the Authority

	IV. Shortage of bulk water supplied by CMWSSB V. Abnormal Demand; this shall not include daily peaks and weekly peaks but includes annual peaks like major festivals and shall not be more than 5 incidents in a year VI. Third Party Causes like power failure and Fire Fighting
Penalty/Damages	1% of the Monthly O&M fee per day of failure to supply water (continuous /scheduled) at desired pressure. Penalty applicable if no. of affected consumers exceeds 5% of total registered consumers To illustrate, if the supply is continuous but the pressure is less than 17m, the penalty shall apply. Similarly, if the pressure is at 17m, but the supply is not continuous (intermittent supply at 17m pressure), the penalty shall apply.
Incentive	No incentive

(3) **Functioning of Meters:**

Rationale	Adequacy to meet city needs for treated water supply
Frequency	Monthly
Required Service Level	100% of total consumer meter should be functional and bills shall be issued as per actual meter reading for each billing cycle.
Measured by	Total number of functional metered connection as a percentage of total number of metered connections
Data Requirements	Total number of connection & number of registered metered connection.
Calculation	Total number of functional metered connection. Total number of metered connections
Monitored by	• Electronic consumer data base with initial meter reading and final reading for each billing cycle • Consumer numbers in database • Photo of each reading with date and meter number, consumer number • Meter reading statement with linked photograph • 1% random check by independent engineer for each billing cycle
Allowable Exclusions	Maximum up to 5% is allowed to be issued bills with average consumption and or non-issue of bills 1. Meter damaged / stolen and reported by

	consumer 2. Access to meter is blocked temporarily 3. Meter non functional 4. Refusal by consumer and reported to CMWSSB 5. Disconnected by CMWSSB (will be deducted while calculating % from total consumers)
Penalty/Damages	Penalty (Meters) = {Total of non-functional meter and or bills issued on average basis beyond 5% x Monthly O&M fees X 20%} The computation will be done on a monthly basis and the penalty will be levied quarterly
Incentive	No incentive

(4) **Extent of Non-revenue water:**

Rationale	Financial and Environment sustainability
Frequency	Monthly
Required Service Level	20% at the end of Construction Period; 1% reduction each year to reach 15% in 5 years from COD
Measured by	Percentage of total billed volume of water including the volume of measured free water supplies authorized by CMWSSB measured in Kilo Liters during the month under review over the total Supply Input Volume in Kilo Liters continuously measured at the bulk water supply points fixed on the transmission mains originating from pumping station or any other source.
Data Requirements	Total water input & total billed volume
Calculation	Revenue Water% = 100* (Total Billed Volume in Kilo Liters +Total volume of measured Free Supplies authorized by CMWSSB) / (Total Supply Input Volume in Kilo Liters) NRW %= 100- Revenue water%
Monitored by	An electronic registry maintained by the Concessionaire; the registry shall include detailed database and summary tables for Supply Input Volume, Billed Volume and Authorized Free Supplies Volume The database shall include: • Month

	• Cumulative Supply Input Volume • Cumulative DMA wise Distribution Input Volume • Total Billed Volume during the month • Total Measured Volume of Authorized Free Supplies
Penalty/Damages	X being the Annual NRW (in %) achieved during the period under review, the applicable damages will be: Year 1 after COD: (X-20%) of applicable Monthly O&M Fee Year 2 after COD: (X-19%) of applicable Monthly O&M Fee Year 3 after COD: (X-18%) of applicable Monthly O&M Fee Year 4 after COD: (X-17%) of applicable Monthly O&M Fee Year 5 after COD: (X-16%) of applicable Monthly O&M Fee Year 6 onwards after COD: (X-15%) of applicable Monthly O&M Fee The computation will be done on a monthly basis and the penalty will be levied quarterly
Incentive	X being the Annual NRW (in %) achieved during the period under review, the applicable incentive will be: Year 1 after COD: (20%-X) of applicable Monthly O&M Fee **Divided** by 3 Year 2 after COD: (19%-X) of applicable Monthly O&M Fee **Divided** by 3 Year 3 after COD: (18%-X) of applicable Monthly O&M Fee **Divided** by 3 Year 4 after COD: (17%-X) of applicable Monthly O&M Fee **Divided** by 3 Year 5 after COD: (16%-X) of applicable Monthly O&M Fee **Divided** by 3 Year 6 onwards after COD: (15%-X) of applicable Monthly O&M Fee **Divided** by 3 The computation will be done on a monthly basis and the incentive will be provided quarterly

(5) **Efficiency in Redressal of Complaints**

Rationale	Responsive to consumer needs
Frequency	Monthly
Required	90% of complaints should be resolved within the time

Service Level	period provided for respective category of complaint. ***Complaints to be resolved within 24 hours***: Complaints related to water quality ***Complaints to be resolved within 48 hours***: leakages in HSCs, No Water ***Complaints to be resolved within 7 days***: Complaints related to delay in providing connection, meter not working properly, delay/errors/problems in billing and collection, change in customer database, reconnection, temporary disconnection, arrears and other complaints connected to customer database, billing or collection. Complaints for which Redressal beyond the control of the ***Concessionaire to be listed separately and to be certified by the Independent Engineer***. In the event a complaint is not redressed within twice the time period provided for such redressal period, the same shall be considered as an additional complaint by the same Complainant. The accumulation of complaints shall continue till it has been resolved. It is hereby clarified that the complaint resolution targets of the Concessionaire shall not include complaints pertaining to water shortage and / or resultant low pressure during the period of inadequate water supply by CMWSSB. Supply shortage is defined as any deficit in the daily volume supplied at outlet of WDS against the measured daily demand and the approved NRW losses for the given Concession Year
Measured by	Percentage of total number of customer requests resolved during the month under review, including those resolved until the 7th of the succeeding month (where the time period allowed in 7 days) over the total number of customer requests received and recorded during that month under review
Data Requirements	Total number of water supply complaints received per month and total number of complaints redressed within 24 hrs, 7 days, 15 days and beyond 15 days.
Calculation	Total number of complaints redressed within the stipulated time for the respective category /Total number of complaints received in a month in the respective categories
Monitored by	An electronic registry maintained by the Concessionaire, the registry shall include detailed database and summary tables including: • Time and Date • Complaint Number • Consumer Name

	• Consumer Identification Number • DMA Number • Nature of Complaint • Time and Date at which Consumer is provided with response • Action Taken Report • Time and Date of resolution of Complaint
Allowable Exclusions	Complaints relating to • No Water • Poor quality of water other than residual chlorine However, the above will be excluded only if the reason for 'No water' is on account of CMWSSB not supplying the required quantity at the WDS or supplying poor quality water.
Penalty/Damages	(90% - % of Total customer complaints redressed within the stipulated timelines during the quarter) x 50% of the Monthly O&M Fee
Incentive	No incentive

(6) **Quality of Water Supplied**

Rationale	Poor quality of water can pose serious health hazard
Frequency	Monthly
Required Service Level	At User Tap: 100% samples conforming to the permissible level of residual chlorine to be maintained, other than where the Emergency Response Plan is triggered.
Measured by	Number of samples from User taps tested and not conforming to residual chlorine levels based on a minimum of 10 samples per DMA on a quarterly basis.
Data Requirements	Analysis sample of various points within distribution system.
Calculation	$\frac{\text{Total numbers of samples that meet the specified standards}}{\text{Total number of samples tested}}$
Monitored by	An electronic registry maintained by the Concessionaire the registry shall include detailed database and summary tables for both routine water quality tests and tests necessitated due to Complaints from Customer on poor quality of water. At least 30% of samples as prescribed by CPHEEO manual shall be collected and tested by third party approved lab or CMWSSB lab.

	The water quality testing database shall include: • Time and Date • Sample Location • Sample Number • Details of water quality tests conducted • Details of Remedial Actions taken in case of water quality problem The consumer complaints database shall include: • Time and Date • Complaint Identification Number • Customer Identification Cod • Nature of Complaint on water quality • Action Taken Report • Time and Date of Resumption of Service Level
Allowable Exclusions	Pollution event covered by Emergency procedures
Penalty/damages	For each sample at consumer tap not confirming to residual chlorine standards, Rs. 10,000, escalated at the rate of 5% per annum from the Appointed Date.
Incentives	No incentive

(7) **Efficiency in collection of water related charges**

Rationale	Financial sustainability
Frequency	Quarterly
Required Service Level	85% at the end of construction period and 95% from the completion of 3 years from CoD
Measured by	Percentage of total revenue collected against volume billed during the period under review over the total volume billed during period under review. For the purpose of computing incentive for arrear collection, arrears shall mean amount billed but not collected within 30 days from the end of the quarter in which the bill is raised.
Data Requirements	Data from budget for current revenue collected and current revenue billed. (excluding arrears).
Calculation	**Current Collection:** $\frac{\text{Total amount collected during the given quarter}}{\text{Total amount billed during the given quarter}}$ The Collection efficiency shall be finalised based on collections which were billed during the relevant quarter and collected within 30 days after the end of the quarter. **Arrear Collection:**

	For the purpose of the computing incentive for arrear collection, the collection of arrears that are due for a period of less than 9 months from the end of the relevant quarter shall only be reckoned.
Monitored by	• An electronic registry maintained by the Concessionaire; the registry shall include detailed database and summary tables for total revenue billed, arrears, amounts collected during the period under review. The database shall include: • Month • DMA Number • Total Amount and volume Billed – Arrears and Current Revenue Demand against volume in kilo liters • Total Revenue Collected – as against Arrears and as against Current Demand against volume in kilo liters • Total arrears with volume in kilo liters • Total disputed cases • Other Income collected as against Connection Charges and Deposits received from Customers
Allowable Exclusions	• Amounts written off of or exceptionally permitted by CMWSSB to be excluded • Defaulter customers identified by Concessionaire, informed to CMWSSB. No action taken by CMWSSB for recovery as per applicable rule within the given time. • Any free connection permitted by CMWSSB
Penalty/Damages	X being the Quarterly Collection Efficiency (in %) achieved during any year, the applicable damages will be From year immediately after COD to 3rd year from COD: (85% - X) of Applicable quarterly O&M Fee From 4th year onwards: (95% - X) of Applicable Quarterly O&M Fee
Incentive	**For Current Collection** X being the Collection Efficiency (in %) achieved during any Quarter, the applicable incentive will be: From year immediately after COD to 3rd year from COD: (X - 85%) of Applicable Quarterly O&M Fee **Divided** by 3 From 4th year onwards: (X - 95%) of Applicable Quarterly O&M Fee **Divided** by 2 **For Arrear Collection** For collection of arrears against the billing up to the required level of service, 50% of the Penalty Charged for such shortfall in collection shall be given as incentive For collection of arrears against billing over and above the applicable target collection (85% for the first three years after COD and 95% thereafter), 50% of the Incentive which would have been otherwise due and payable for such amount, had it been collected in the relevant quarter.

SCHEDULE D: TECHNICAL SPECIFICATION AND STANDARDS

1. Technical Specifications

(Concessionaire needs to provide minimum specifications as given below however Concessionaire is expected to exceed the specifications of material for better performance of System.)

1.1. CONSTRUCTION REQUIREMENTS

Section 1

1.1.1. General

1 The technical specifications governing the Agreement shall confirm to all the relevant guidelines, standards, standard operating procedures detailed in the relevant Standards Codes published by Bureau of Indian Standards and shall be in conformity to the following standard manuals.

a. Manual on Water Supply and Treatment published by Government of India.

b. Ministry of Urban Development, CPHEEO as amended up to date

c. Manual on Operations and Maintenance of Water Supply Systems, published by Government of India, Ministry of Urban Development, CPHEEO, January 2005 and as amended up to date.

Section 2

Construction Requirements: General

1.2. Equivalency of Standards and Codes

Except where otherwise specified the Works under this Agreement shall comply with the requirements of the referenced or relevant Indian Standards (IS), British Standards (BS), AWWA standards, ISO standards AWS standards, ASTM standards, etc. Other equivalent national or international standards or similar other organizations may be considered at the sole discretion of the Engineer or as may have been agreed in the Agreement. All standards used shall be the latest versions.

The Concessionaire shall obtain at least two copies of each IS, BS, or other approved standards or reference material which are referred to in the specification and a copy of all other standards which apply to materials which are being supplied to, or workmanship executed on the works. One copy of these standards and reference material shall be submitted to the CMWSSB/IE.

Where the requirement of any such standard specification or regulation conflict with Employer's Requirements, then the Concessionaire should refer to the Independent Engineer for clarification before proceeding with mat section of the Works.

1.2.1. Types of Pipes

a. Any rehabilitation of pipes required in the Distribution System shall be with appropriate pressure class, Ductile Iron for sizes higher than 200mm and High Density Poly-Ethylene for sizes 200mm and smaller.

b. Pipes shall be laid with a minimum cover of 1 meter over the crown of the pipe.

c. All new and relocated water mains shall be located at least 2m horizontally from all gravity or pressure type sanitary sewers. If the bottom of a potable water main is located 150mm minimum above the top of a gravity type sewer main, the horizontal distance can be reduced to 1m minimum. Also, all new and relocated water mains shall be located at least 1m horizontally from all storm water drains.

d. Any new or relocated water mains that cross any gravity or vacuum-type sanitary sewer, pressure-type sanitary sewer, storm water main, shall cross above (preferred) or below such pipelines with a minimum vertical distance of 300mm between the outside of the water mains and the outside of such pipelines. Such crossings shall be arranged so that all pipe joints are equidistant from the point of crossing with no less than 3m between any two joints (or alternatively, the mains at such crossings shall be placed in sleeves to obtain the equivalent of the 3m separation between joints).

1.2.2. Valves

a. The Sluice Valves proposed for replacing the existing or installed new shall of appropriate class Ductile Iron make only.

b. Number of isolation valves shall maintain such that any supply interruption due to planned or unplanned shutting of supply shall not affect more than 100 consumer connections.

1.2.3. House Service Connection

a. House Service Connections shall be fixed only on rider mains and up to 200mm size principal mains only. Connections shall be avoided on all principal mains higher than 200mm dia size.

b. Tapped connections in the barrel of a pipe shall be less than the diameter of pipe being tapped except 100mm pipe which may be tapped with a 100mm tapping sleeve and valve. No taps shall be made within 1.5m of a joint.

c. Service Connections shall be connected to the distribution rider main

by way of fixing a Mild Steel saddle on DI mains and/or HDPE Saddle welded by Electro Fusion on HDPE Pipes.

d. The Service Pipe for House Service Connections shall be of appropriate class Polyethylene coil only with least number of joints.

e. Service Pipe shall be sleeved by a Mild Steel cover pipe wherever the Service Pipe crosses surface drains.

f. Connections shall be provided up to the Consumer Meter which shall be installed at a possible location nearest to the consumer property boundary.

g. The Consumer meters shall be of AMI enabled AMR Smart Water meters conforming to relevant IS standards and shall have been certified by EEC/OIML & IP-68. The meters shall be installed in lockable meter chambers made of strong rigid plastic materials.

h. In case of consumers having existing service connections directly connected to a ground level sump, the portion of service pipe between the meter and the sump shall be borne by the Consumer and in the absence of which the connection shall be provided with a regular tap at an appropriate place. The Concessionaire shall inform and pursue with such consumers for ensuring a standard working float valve in the sump for avoiding overflows from the sump when the supply becomes continuous.

1.2.4. Connections to Urban Poor

a. CMWSSB policy is to provide an individual, metered, private water supply service connection to each of the household in the Service Area. The Concessionaire shall make all efforts to ensure provision of individual, metered, private service connections to all consumers including the urban poor households.

b. Wherever such private connections are not feasible due to lack of space or restricted areas of working, group or shared connections shall be permitted by CMWSSB selectively however all such connections shall be metered.

c. As the provision of private or shared service connections are installed covering each household, the Concessionaire shall progressively disconnect the existing public taps in the Service Area with prior permission from CMWSSB.

1.2.5. Road Restoration

Roads which are cut for pipeline laying, pipe repair, or for house service connection the trench shall be refilled by proper refilling practice & well level & compacted with suitable instruments & excess material should be disposed at suitable place as instructed by engineer in charge so it will

not cause any problem to traffic or daily routine of work. The restoration of the top surface of the road will be the responsibility of the Authority.

2.1 GENERAL TECHNICAL SPECIFICATIONS

2.1.1 Clearing Site

Clearance of the site shall also include the demolition and removal of all articles, objects, trees, shrubs and obstructions, which are expressly required to be cleared. The Concessionaire shall ensure that the parts of the site to be occupied by the permanent works are clear and shall maintain the remainder of the site as may be required for access and temporary works areas.

The Concessionaire shall remove the material arising from such clearance and dispose it off in a manner and at a location, on or off the site.

The Concessionaire shall fill and make good with appropriate materials dispose cavities and loses of soil, which result from clearing the parts of the site not subsequently to be occupied by the works.

2.1.2 Road Works

The Concessionaire and its Sub-Contractors shall obtain permission from concerned road authorities for carrying out works such as excavation on the existing roads. The Concessionaire shall be responsible for establishing and maintaining temporary road diversion for the duration of the road works. The road shall be kept clean at all times during the road works period and the work shall be carried out in such a manner to minimize the disruption to other users of the road.

While the execution of any work is in progress in any street or thoroughfare, the Concessionaire at his own cost shall have adequate provision for the passage of traffic, for securing safe access to all premises approached from such street or thoroughfare, and for any drainage, water supply, or means of lighting or any other utility services which may be interrupted to reason of execution of the work.

Whenever it may be necessary to stop the traffic in any street or thoroughfare, permission must first be obtained from the concerned authorities and the Concessionaire shall put up such barriers and adopt such other measures or take precautions as may be necessary for regulation of traffic. The work shall in such cases be executed night and day or for as long a period as practicable if so ordered by the Independent Engineer / PMC, and with such speed and vigour as he may require, so that the traffic may be impeded for as short a time as possible. The Concessionaire shall remove the barriers as soon as necessary and shall be taken by the Concessionaire to cause the least obstruction to traffic during the progress of the work.

2.1.3 Sign Board

The Concessionaire shall supply and erect signboards at his own cost at locations. The layout and dimensions of the signboard and their construction shall be as approved in the Implementation Plan and the lettering in both Hindi and English shall be black on white background. Concessionaire shall take care of signboard and replace it in case of loss, damage, theft etc.

2.1.4 Barricading and safety signs

During construction statutory safety signs and barricading shall be adequately provided. All signs shall be positioned at highly visible points. Special attention shall be given to areas designated hazardous. Any accidents due to improper warning, barricading by the Concessionaire shall be the risk of the Concessionaire.

2.1.5 Clearance and reinstatement of site after completion of the Works

On completion of the works, the Concessionaire shall clear any temporary works and temporary access roads and reinstate the area to the original condition and to satisfaction of the Independent Engineer / PMC.

2.1.6 Samples and Tests

The Concessionaire shall, as part of the Implementation Plan, submit to the Independent Engineer / PMC for his consent a detailed description of the arrangements for conducting the quality control programme during execution of the works, including details of his testing laboratory, equipment, staff and general procedures. If following submission, or at any time during the progress of works, it appears to the Independent Engineer / PMC that the Concessionaire's quality control programme is not adequate to ensure the quality of the works, the Concessionaire shall produce a programme, as desired by the Independent Engineer / PMC, who will be adequate to ensure satisfactory quality control.

All costs of such sampling, testing and reporting of test results will be borne by the Concessionaire. The Concessionaire shall furnish certified copies of all test reports to the Independent Engineer / PMC within 3 days of completion of the specified tests.

Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted Engineering practice to the directions of the Independent Engineer / PMC.

2.1.7 Protection of Utilities

The Concessionaire is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water supply, sewers, storm

water drains, culverts, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Concessionaire shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. The cost of such relocations shall be borne by the Concessionaire.

In case the alignment of the pipeline crosses the high tension electrical transmission lines, the Concessionaire shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Concessionaire will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities.

2.1.8 Units and measurement system

The international metric system will be used for all measurement and technical drawing.

2.1.9 Areas outside the site

In the event of the Concessionaire making use of any special or temporary way leave or accommodation acquired by him or any tip for the disposal of surplus materials, or any borrow pit or quarry, he shall obtain the written concern of the owner, occupier or authority having charge of the land in which such way leave, accommodation or tip is situated and shall make a record agreed by the owner, occupier or authority as aforesaid of the condition of the surface of the land before entering there on.

The Concessionaire shall permit the Employer, Independent Engineer / PMC and any person authorized by the Employer or the Independent Engineer / PMC access for the purpose of the Project to any such special or temporary way leave or additional accommodation.

The Concessionaire shall restrict his activities to within the working area to be approved by the Independent Engineer / PMC after the Concessionaire submits the proposal for the same. On completion of the works in this area, the Concessionaire shall reinstate the area to its original condition to the satisfaction of the Independent Engineer / PMC. For the purpose of this clause, “Accommodation” shall be deemed to include housing, offices, workshops, warehouses, and storage areas.

2.1.10 Access to the Employer and the Independent Engineer / PMC

The Concessionaire shall permit the Employer, Independent Engineer / PMC and any person authorized by the Employer or the Independent Engineer / PMC including work-man of the Employer, other

Concessionaires or utility undertakings access for the purposes of the Project to all the areas of the site and to any additional accommodation or temporary way leave for the duration of the Agreement period.

2.1.11 Water supply for Works

Water supply for the purposes of constructing the Works and testing pipelines shall be arranged by the Concessionaire at it's own cost.

2.1.12 Sanitary and washing facilities

Throughout the period of construction of the works, the Concessionaire shall provide, sufficient sanitary and washing facilities for use by his employees. He shall ensure that his employees don't foul the site but make proper use of the facilities provided to them. Wastewater shall be disposed off clear of the site so as to cause no damage or complaint.

2.1.13 Electricity for Works

The Concessionaire shall arrange at his cost the electrical supply for the purpose of constructing the Works, through a legal means.

These electrical installations shall comply with all the relevant regulations, Indian standards and codes of practice, and health and safety requirements, etc. The Concessionaire must take every possible precaution to ensure is the safety of these installations.

Refuse disposal onsite

Refuse and Rubbish of every kind, generated by the work of the Concessionaire, shall be removed from the site and disposed off the by the Concessionaire at his own expense, frequently and regularly so as to keep the site in tidy condition.

2.1.14 Noise

The Concessionaire shall ensure that construction activities do not cause annoyance to the customers living adjacent to the site. If the Concessionaire wishes to work in the night, he shall do so after obtaining the written permission from the Independent Engineer / PMC.

2.1.15 Working hours at the site

The proposed site working hours shall be informed by the Concessionaire for concurrence from Independent Engineer / PMC. The Concessionaire with advance notice shall inform any increase in working hours.

2.1.16 Advertisement

The Concessionaire shall not use any part of the site for any form of advertisement without the prior written approval of the Independent Engineer / PMC.

2.1.17 Protection of trees and vegetation

Trees designated by the Independent Engineer / PMC shall be protected from damage during the course of work and earth level within one meter of each such tree shall not be changed.

Where necessary, such trees shall be protected with temporary fencing. All such cost is borne by the Concessionaire.

The Concessionaire shall ensure that his employees and sub-Concessionaires (and also their employees) shall not damage the flora and fauna in the Service Area, especially when these are endangered species. The Concessionaire shall be liable for any penalties levied by the concerned authorities for infringement of this regulation.

2.2 SAFTEY PRECAUTIONS WHILE EXCAVATION/LAYING PIPE/HOUSE SERVICE CONNECTION:

The Concessionaire shall provide adequate safety measures during excavation. They shall include:

1. Barricading all sides of the open trenches.

2. Red danger lights as can be easily visible from dusk to dawn at an interval of 20 m and at all the road crossings.

3. Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.

4. Adequately safe wooden plank / board or steel plate over the trenches at every 15 meters interval to facilitate crossing by the public residing on either side of the trench.

5. Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorized intrusions.

6. Where a road or footpath is to be kept opened up in the course of work, special care shall be taken to see that proper protection is provided to prevent any accidents from occurring. Work shall be done in such a manner that it will not unduly inconvenience pedestrians or occupants of buildings or obstruct road traffic.

7. Care shall be taken to see that apparatus, tools or other excavating implements are not left in a dangerous or insecure position as to fall or be knocked into the trench thereby injuring any workmen who may be working inside the trench.

8. When working in deep trenches in loose soil, timbering up the side will prevent soil subsidence. The excavated material shall be kept far enough from the edge of the trench or pit. Vehicles or heavy equipment must not be permitted to approach too close to the construction site.

9. The flags and the lamps shall be placed in conspicuous position so as to indicate the pedestrians and drivers of vehicles the full extent, i.e. both width and length of the obstruction.

10. Where any excavation is not clearly visible for a distance of 25 mtrs. to traffic approaching from any direction or any part of the carriage way of the road in which the excavation is not clearly visible for a distance of 25 mtrs. to traffic approaching from any direction or any part of the carriage way of the road in which the excavation exists, a warning notice shall be placed on the kerb or edge of all such roads from which the excavation is not visible. Such warning shall be placed at a distance of 25 mtrs. from the excavation or as near the distance as is practicable but not less than 10 mtrs. From the junction of an entering or intersecting road with in the road in which the excavation exists.

11. All warnings, in these cases shall have a red back ground and shall be clearly visible and legible. All warning lamps shall exhibit a red light, but white lights may be used in addition to facilitate working at night. Wherever required a passage for pedestrians with foot bridge shall be provided. At excavations tools and all materials likely to offer obstruction shall be properly folded round and protected.

12. Concessionaire shall provide the caution board of appropriate size at his own cost on all the sides of the WORK stating “Caution, Chennai Metropolitan Water Supply and Sewerage Board work is progress.”

3.1 EXCAVATION:-

EXCAVATION IN TRENCHES FOR PIPES, CABLES ETC. AND REFILLING

This shall comprise excavation not exceeding 1.5 mts in width or 10 sqm in plan and to any depth trenches for pipes. Cables etc. and returning the excavated material to fill the trenches after pipes, cables etc. are laid and their joints tested and passed and disposal of surplus excavated material upto50 m lead.

3.1.1. Width of Trench

(a) Up to one meter depth the authorized width of trench for excavation shall be arrived at by adding 25 cm to the external diameter of pipe (not socket/ collar) cable, conduit etc. Where a pipe is laid on concrete bed/ cushioning layer, the authorized width shall be the external diameter of pipe (not socket/ collar) plus 25 cm or the width of concrete bed/ cushioning layer whichever is more.

(b) For depths exceeding one meter, an allowance of 5 cm per meter of depth for each side of the trench shall be added to the authorized width (that is external diameter of pipe plus 25 cm) for excavation. This allowance shall apply to the entire depth of the trench. In firm soils the sides of the trenches shall be kept vertical up to depth of 2 meters from the bottom. For depths greater than 2 meters, the excavation profiles

shall be widened by allowing steps of 50 cm on either side after every two meters from bottom.

(c) Where more than one pipe, cable, conduit etc, are laid, the diameter shall be reckoned as the horizontal distance from outside to outside of the outermost pipes, cable, conduit etc.

(d) Where the soil is soft, loose or slushy, width of trench shall be suitably increased or side sloped or the soil shored up as directed by the Engineer-in-Charge. It shall be the responsibility of the Concessionaire to take complete instructions in writing from the Engineer-in-Charge regarding increase in the width of trench. Sloping or shoring to be done for excavation in soft, loose or slushy soils.

(e) The maximum permissible width as specified below or the actual width excavated whichever is less shall be recorded and paid for. Extra width at collars, joints and also at specials for working facility shall neither be measured nor paid for:

Sr. No.	Diameter of Pipe	Permissible Width of Trenches
1.	1000 mm	1.70 M
2.	900 mm	1.60 M
3.	800 mm	1.60 M
4.	700 mm	1.30 M
5.	600 mm	1.20 M
6.	500 mm	1.10 M
7.	450 mm	1.10 M
8.	400 mm	1.00 M
9.	350 mm	0.95 M
10.	300 mm	0.90 M
11.	250 mm	0.85 M
12.	200 mm	0.85 M
13.	150 mm	0.75 M
14.	100 mm	0.75 M

3.1.2. Dressing and Consolidation of the Trenches :-

The bed of the trenches shall be well rammed before laying the pipe. Hollows if any shall be filled with morom duly rammed without extra cost. The whole bed of the trenches shall be so dressed in grade and line that the pipes are given continuous bearing for their whole lengths except at sockets, or the collars and specials joints etc. Necessary pits for socket collar and specials joints etc. shall be provided in approved manner without any extra cost and as directed by the Engineer.

3.1.3. Filling in Excess Depths :-

Depths of pit / trenches excavated in excess of requirements shall be refilled by selected hard morom well rammed and watered for trenches to the required level and grade at the cost of the Concessionaire.

3.1.4. Classification of Excavation :-

For pipe line trenches all the materials and strata encountered in the excavation shall mainly be classified in three categories as specified in BOQ.

3.1.5. EXCAVATION IN ALL KINDS OF SOILS

a. All excavation operations manually or by mechanical means shall include excavation and 'getting out' the excavated materials. In case of excavation for trenches, basements, water tanks etc. 'getting out' shall include throwing the excavated materials at a distance of at least one meter or half the depth of excavation, whichever is more, clear off the edge of excavation. In all other cases 'getting out' shall include depositing the excavated materials as specified. The subsequent disposal of the excavated material shall be either stated as a separate item or included with the items of excavation stating lead.

b. During the excavation the natural drainage of the area shall be maintained. Excavation shall be done from top to bottom. Undermining or undercutting shall not be done.

c. In firm soils, the sides of the trenches shall be kept vertical up to a depth of 2 meters from the bottom. For greater depths, the excavation profiles shall be widened by allowing steps of 50 cms on either side after every 2 meters from the bottom. Alternatively, the excavation can be done so as to give slope of 1:4 (1 horizontal : 4 vertical). Where the soil is soft, loose or slushy, the width of steps shall be suitably increased or sides sloped or the soil shored up as directed by the Engineer-in- Charge. It shall be the responsibility of the Concessionaire to take complete instructions in writing from the Engineer-in-Charge regarding the stepping , sloping or shoring to be done for excavation deeper than 2 meters.

d. The excavation shall be done true to levels, slope, shape and pattern indicated by the Engineer-in- Charge. Only the excavation shown on the drawings with additional allowances for centering and shuttering or as required by the Engineer- in-Charge shall be measured and recorded for payment.

e. In case of excavation for foundation in trenches or over areas, the bed of excavation shall be to the correct level or slope and consolidated by watering and ramming. If the excavation for foundation is done to a depth greater than that shown in the drawings or as required by the Engineer-in-Charge, the excess depth shall be made good by the Concessionaire at his own cost with the concrete of the mix used for levelling/ bed concrete for foundations. Soft/defective spots at the bed of the foundations shall be dug out and filled with concrete (to be paid separately) as directed by the Engineer-in-Charge.

f. While carrying out the excavation for drain work care shall be taken to cut the side and bottom to the required shape, slope and gradient. The surface shall then be properly dressed. If the excavation is done to a depth greater than that shown on the drawing or as required by the Engineer-in-Charge, the excess depth shall be made good by the Concessionaire at his own cost with stiff clay puddle at places where the drains are required to be pitched and with ordinary earth, properly watered and rammed, where the drains are not required to be pitched. In case the drain is required is to be pitched, the back filling with clay puddle, if required, shall be done simultaneously as the pitching work proceeds. The brick pitched storm water drains should be avoided as far as possible in filled-up areas and loose soils.

g. In all other cases where the excavation is taken deeper by the Concessionaire, it shall be brought to the required level by the Concessionaire at his own cost by filling in with earth duly watered, consolidated and rammed.

h. In case the excavation is done wider than that shown on the drawings or as required by the Engineer-in-Charge, additional filling wherever required on the account shall be done by the Concessionaire at his own cost.

i. The excavation shall be done manually or by mechanical means as directed by Engineer-in-charge considering feasibility, urgency of work, availability of labour/mechanical equipment's and other factors involved. Concessionaire shall ensure every safety measures for the workers. Neither any deduction will be made nor any extra payment will be made on this account.

3.1.6. EXCAVATION IN ORDINARY/HARD ROCK

a. All excavation operations shall include excavation and 'getting out' the excavated matter. In case of excavation for trenches, basements, water tanks etc. 'getting out' shall include throwing the excavated materials at a

distance of at least one meter or half the depth of excavation, whichever is more, clear off the edge or excavation. In all other cases 'getting out' shall include depositing the excavated materials as specified. The subsequent disposal of the excavated material shall be either stated as a separate item or included with the item of excavation stating lead.

b. During the excavation, the natural drainage of the area shall be maintained. Excavation shall be done from top to bottom. Undermining or under cutting shall not be done.

c. Where hard rock is met with and blasting operations are considered necessary, the Concessionaire shall obtain the approval of the Engineer-in-Charge in writing for resorting to the blasting operations. Blasting operations shall be done as specified in para 2.6 and chiseling shall be done to obtain correct levels, slopes, shape and pattern of excavation as per the drawings or as required by the Engineer-in- Charge

d. and nothing extra shall be payable for chiselling.

e. Where blasting operations are prohibited or are not practicable, excavation in hard rock shall be done by chiselling.

f. In ordinary rock excavation shall be carried out by crowbars, pick axes or pneumatic drills and blasting operation shall not be generally adopted.

g. If the excavation for foundations or drains is done to a depth greater than that shown in the drawings or as required by the Engineer-in-Charge. The excess depth shall be made good by the Concessionaire at his own cost with the concrete of the mix used for levelling/ bed concrete for foundations. Soft/ defective spots at the bed of foundations shall be dug out and filled with concrete (to be paid separately) as directed by the Engineer-in-Charge.

h. In all other cases where the excavation is taken deeper by the Concessionaire, it shall be brought to the required level by the Concessionaire at his own cost by filling with earth duly watered, consolidated and rammed.

i. In case the excavation is done wider than that shown on the drawings or as required by the Engineer-in-Charge, filling wherever required on this account shall be done by the Concessionaire at his own cost.

j. Only the excavation shown on the drawings or as required by the Engineer-in- Charge shall be measured and recorded for payment except in case of hard rock, where blasting operations have been resorted to, excavation shall be measured to the actual levels, provided the Engineer-in-Charge is satisfied that the Concessionaire has not gone deeper than what was unavoidable.

k. The excavation shall be done manually or by mechanical means as desired by Engineer-in-Charge considering feasibility, urgency of work,

availability of labour/mechanical equipment's and other factors involved Concessionaire shall ensure every safety measures for the workers. Neither any deduction will be made nor any extra payment will be made on this account.

3.1.7. EARTH WORK BY MECHANICAL MEANS

Earth work by mechanical means involves careful planning keeping in view site conditions i.e. type of soil, nature of excavation, distances through which excavated soil is to be transported and working space available for employing these machines. The earth moving equipment should be accordingly selected. The earth moving equipment consists of excavating and transporting equipment. Excavating equipment's may be further classified as excavators and tractor based equipment's.

a) Excavators

Excavators generally used at site are as follows:

(i) **Dipper–shovel :** It is used for excavating against a face or bank consisting of open-top bucket or dipper with a bottom opening door, fixed to an arm or dipper stick which slides and pivots on the jib of the crane. It is suitable for excavating all clay chalk and friable materials and for handling rock and stone. However, it is not suitable for surface excavation for which a skimmer is used.

(ii) **Backhoe :** It is similar to face shovel except that the dipper stick pivots on the end of the jib and the dipper or bucket works towards the chassis and normally has no bottom door but is emptied by swinging away from the chassis to invert the bucket. It may be designed to carry both a front –mounted bucket loading mechanism and a rear mounted backhoe. It is mainly used to excavate trenches and occasionally used for the excavation of open areas such as small basements.

In the backhoe mode the bucket lifts, swings and discharges materials while the undercarriage is stationary. When used in the 'loader' mode, the machine loads or excavated through forward motion of the machine, and lifts, transports and discharges materials.

(iii) **Skimmer :** This arrangement is similar to the face shovel except that in this case the bucket slides on rollers directly along the jib and thus has a more restricted movement. It is used for surface excavation and levelling in conjunction with transport to haul away the excavated material.

(iv) **Dragline :** It is usually fitted with a long slender boom or jib and the bucket, which in operation faces towards the machine and has no door, is supported by cable only as on a crane. It works from the side of the excavation at normal ground level and is used for excavating large open excavations such as basements when the depth is beyond the limit of the boom of a backhoe. It is commonly used for open cast

mining operations.

(v) **Clamshell :** It consists of two hinged half-buckets or jaws pivoted to a frame which is suspended by cable from a long jib of an excavation. The grab is used for deep excavations of limited area on all types of soil except rock. Crane and Grab is a variant of this type of equipment.

b) Tractor–based Equipment

It is a self–propelled crawler or wheeled machine used to exert a push or pull force through mounted equipment. It is designed either as attachments to normal tracked or wheeled tractors or as machines in which the earth moving attachments and the tractor are designed as a single integrated unit. A tractor, which is hydraulically operated, can be rigged as :

(i) **Loaders :** It is used for loading, light dozing, scraping and grabbing operations, lifting and transporting the materials (loose earth, rubble, sand, gravel aggregate etc) at various sites through forward motion of the machine.

(ii) **Tractor Shovel :** This consists of a tipping bucket at the front attached by strong pivoted arms or booms to the frame of the machine. It is used for stripping top soil, excavating against a face, bulldozing and for loading spoil or loose materials. It is similar to crawler dipper-shovel.

(iii) **Trench Digger :** It operates on the same principle as a backhoe excavator except that the bucket is controlled by hydraulic rams instead of cables and pulleys.

(iv) **Scraper :** Scrapers provide unique capability to excavate, load, haul and dump materials. Scrapers are available in various capacities by a number of manufacturers with options such as self – loading with elevators, twin engines or push-pull capability. They are cost effective where the haul distance is too long for bulldozers, yet too short for trucks. This distance typically ranges from 120 m to 1200 m; however, the economics should be evaluated for each project. Scraper has an open bowl with a cutting edge positioned between the axles, which cuts, loads, transports, discharges and spreads through forward motion of the machine. Loading through

forward motion of the machine can be assisted by a powered mechanism (elevator) fixed to the scraper bowl.

(v) **Bulldozer and Angle-dozer :** The most common equipment used for clearing and levelling activities is a bulldozer. The terms bulldozer is used to define a tractor mounted with a dozing blade. The bulldozer consists of a rectangular steel blade with renewable cutting edge set at right angles (capable of only tilting but not angling) to the direction of travel and attached by steel arms to the

side frames of a crawler tractor. It may be used for excavating natural soil or for moving loose soil or debris, which is pushed forward as the tractor forces it ahead.

(vi) Angledozer is capable of both tilting and angling

c) Transporting Equipment

This implies horizontal movement primarily but it can involve some vertical movement too.

(i) **Dumpers :** These are self-propelled wheeled machines, having an open body. It is designed for the transport of excavated materials and consists of a shallow tipping hopper or skip mounted on a wheeled chassis, such as, power barrow, dumper, multi-skip dumpers, high discharge dumpers, dump truck, etc. These can be rear dump, side dump or bottom dump.

(ii) **Vibratory Roller :** It is a single Drum Vibratory Roller for compaction of embankments, etc. The smooth drum version is for compaction of granular and mixed soil. The sheepsfoot Roller consists of a hallow cylindrical steel drum or drums on which projecting feet are mounted. These feet penetrate into the fill as a roller moves forward and cause compaction. The geometry of the foot may be sheep, club pyramid, cone or cylinder foot. Such rollers are employed for compaction (densification) of cohesive and semi-cohesive soils.

d) Providing, Temporary crossing over the Trenches :-

Where the trenches are excavated across roads or along roads in a village or town area, suitable and safe temporary crossing, duly approved by the Engineer shall be provided. Such crossings shall be maintained in proper conditions till the completion of the work. As for as possible trenches along/across roads, shall be excavated in such a way that at least 5.0 M. clear width of the road is available for the traffic. In case this is not possible, adequate diversion shall be provided by the Concessionaire at his cost, such costs being deemed as included in the unit rates for these item of excavation. All crossings and diversions shall be suitably barricaded with railing on either side of the road and lighted at night.

e) Refilling of Trenches of Pipeline :-

In execution of this item following work is included.

Filling in trenches shall be commenced soon after the joints of pipes, cables, conduits etc. have been tested and passed. The space all-round the pipes, cables conduits etc. shall be cleared of all debris, brick bats etc. Where the trenches are excavated in hard/ soft soil, the filling shall be done with earth on the side and top of pipes in layers not exceeding 20 cm in depth. Each layer shall be watered, rammed and

consolidated. All clods and lumps of earth exceeding 8 cm in any direction shall be broken or removed before the excavated earth is used for filling. In case of excavation trenches in ordinary/ hard rock, the filling up to a depth of 30cm above the crown of pipe, cable, conduits etc. shall be done with fine material like earth, morom or pulverized/ decomposed rock according to the availability at site. The remaining filling shall be done with boulders of size not exceeding 15cm mixed with fine material like decomposed rock, morom or earth as available to fill up the voids, watered, rammed and consolidated in layers not exceeding 30cm. Excavated material containing deleterious material, salt peter earth etc. shall not be used for filling. Ramming shall be done with iron rammers where feasible and with blunt ends of crow bars where rammers cannot be used. Special care shall be taken to ensure that no damage is caused to the pipes, Cables, Conduits etc. laid in the trenches.

f) Filling Trenches with Stone Dust :-

The stone dust shall be got approved from the Engineer-in-charge. So also the work shall be carried out as per the directives of the Engineer-in-charge. No extra lead or lift shall be payable.

g) Crossing of pipe lines, cables and underground obstructions etc. :-

Since the alignment passes through township, there is every possibility of coming across pipelines of water supply, drainage lines and cables of telephones and Electricity Board. This item includes the risk and restoring cost of damaged cables for rejoining as well as for carefulness and awareness during excavation, to avoid breakage of water pipe lines of small and larger dia and also drainage pipe lines, cables etc. The item covers the cost of renovation of any damaged cables / pipelines during excavation. The Concessionaire is therefore requested to go through all the details of existing lines / cables etc. along the alignment of distribution mains before submission of tender. No extra claim on any account shall be entertained afterwards. No claim on account of change in alignment shall be entertained.

4.1 PROVIDING OF CI / DI PIPES :-

4.1.1 Cast Iron Pipes :-

a) General:

The specification pertains to Cast Iron spigot and socket spun pipes (suitable for Joining with rubber gaskets) with ISI mark and in standard length , and of classes mentioned in the bill of quantities conforming to IS - 1536 – 2001 with all upto date amendments and revision inclusive of all taxes. , transportation , loading , unloading from the railways wagons ,carting to site of work , stacking at site of work (F.O.R. site of work) including all taxes and duties.

b) Material :-

The material used for manufacture of pipe shall confirm to the appropriate grades specified in IS-210-1978 Material for rubber gasket shall conform IS - 12820-1989 and IS : 5382 - 1985 in quality.

c) Manufacture :-

The metal used for the manufacture of pipe shall be good quality cast iron. The pipes shall be casted centrifugally. Pipes shall be stripped with all precautions necessary to avoid wrapping, and shrinking defects. The pipes shall be free from defects other than unavoidable surface imperfections. The pipes shall be such that that they could be cut, drilled or machined.

d) Test:-

Mechanical and hardness tests as specified in the I.S.I. Code No. 1536 - 1989 shall be carried out during manufacture of Pipes. Hydraulic test shall also be carried out after the manufacturing of pipes and pies shall be tested for hydrostatic pressure as tabulated below for sizes from 80mm to 600 mm dia)

Class of Pipes	**Hydrostatic site test pressure In Mpa**	**Suggested Maxim hydraulic working pressure in Mpa**
LA	1.60	1.00

e) Rubber Gasket

Rubber gasket used for jointing shall be of EPDM Rubber gasket and physical properties of gasket material shall confirmed to IS: 5382-1985 and the dimensions & shore hardness shall be as per IS: 12820-1989

f) Test Report

The Concessionaire shall have to produce the original copy of manufacturer's test certificate & third-party inspection certificate from the agency approved and authorized by CMWSSB for quality and strength of C.I pipes.

g) Transportation :-

The pipes shall be transported by railways wagons from factory and through trucks to the site of work or directly through trucks from factory to the site of work through trucks to the site of work. Necessary care shall be taken during loading, unloading, transporting, stacking of pipes to avoid damages, cracks etc. Transporting, loading, unloading, stacking, shall be done by the Concessionaire at his own cost. No. payments will be done for the damage or crack pipes.

4.1.2 Ductile Iron Pipes :-

a) General :-

The specification pertains to ductile iron spigot and socket spun pipes (suitable for jointing with rubber gaskets) with ISI make and in standard length and of classes mentioned in the bill of quantities confirming to IS - 8329/ISO 2531 with all up to date amendments and revision inclusive of all taxes, transportation loading, unloading from the railway wagons, carting to site of work, stacking at site of work (F.O.R.) site of work including all the taxes and duties. Ductile Iron pipe manufacturer must have ISI license for the entire range of DI pipes required for this tender as on date of submission of tender.

b) Material :-

The material shall confirm IS 1387 of 1993 (second revision) for General requirements for supply of metallurgical materials.

c) Manufacture :-

The Ductile iron pipes shall be manufactured disconfirming the procedure laid down in clause 7 of IS 8329-2000.

d) Mechanical test :-

Shall confirm clause10 J IS: 8329-2000

e) Hydraulic test :-

Shall confirm clause 10 J IS: 8329-2000

f) Cement motor lining :-

Shall confirm Annex B of IS: 8329-2000

g) Rubber gasket :-

Rubber gasket used for jointing shall be of EPDM rubber gasket and physical properties of gasket material shall confirmed to IS: 5382-1985 and the dimensions & shore hardness shall be as per IS: 12820-1989

h) Test Reports :-

The Concessionaire shall have to produce the original copy of manufacturer's test certificate & third party inspection certificate from the agency approved and authorized by CMWSSB for quality and strength of D.I pipes.

i) Transportation :-

The pipes shall be transported by railway wagons from factory and through tracks to the site of work. Necessary case shall be taken during loading, unloading, transporting, stacking of pipe to avoid damages, cracks etc/ Transporting, loading, unloading, stacking shall be done by the Concessionaire at his own cost. No payments will be done for the damage or crack pipes.

4.2 LOWERING, LAYING, JOINTING D.I./C.I. PIPES :-

The DI /C.I. pipes will be transported to the site of work where actually they are to be laid and jointed. All necessary steps shall be taken to prevent damage to pipes during transport, loading, unloading, operations etc. only approved method for conveyance loading and unloading, stacking operations etc. Only approved method for conveyance loading unloading, stacking operations such as winch and chain pulley block tripod, etc. may be adopted. The DI /C.I. pipe should be laid as per IS 12288 and as given below.

4.2.1 Laying of Pipes Under Ground :-

The pipes should be lowered into the trench with tackle suitable for weight of pipe. Either a well designed set of shear legs or mobile crane shall be used for lowering of pipe into the trench. When lifting gear is used the positioning of the sling to ensure proper balance should be checked when the pipe is just clear of the ground. The pipe should be clearly cleaned of any debris inside the pipe either before or just after joint is made. When the laying is not in progress the temporary end closure should be securely fitted to the open end of pipe line.

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 socket of the laid pipe during jointing operation. As soon as the joint assembly is completed. The pipe should be held in position while the trench is back

filled over the barrel of pipe.

The designed anchorage shall be provided to resist the thrust developed by internal pressure at bends, tees and other specials etc. The cement concrete block should be casted in situ to resist the thrust designed taking into account the maximum pressure the main is to carry in service or on test and the safe bearing pressure of the surrounding soil.

4.2.2 Cutting and Chamfering to C.I./D.I. Pipes :-

This item shall be executed for use of cut pipes in required length only when directed by Engineer in charge and after obtaining the permission from him. The burn left after cutting should be trimmed off by light grinding or by filing method. The chamfering of pipes shall conform to IS 12288 — 1987.

The chamfering shall be suitable for push on joints / mechanical joint without damaging the rubber gasket. The pipe after chamfering should be so smooth that enables to pushed in gasket for push on jointing. This item includes cost of all labour and tools required for executing the complete item.

4.2.3 Jointing of Pipes :-

The CI/DI pipes should be jointed either with flexible joints / SBR rubber gasket joints or by rigid flanged joints. The pipes shall be jointed by the rubber gaskets (SBR) except where there are specials / valves to be jointed to the pipeline. The SBR rubber gasket of suitable size required for laying of CI pipes shall have to be procured by the Concessionaire at his own cost. The SBR ring should confirm to IS 12820/1989.

Before assembling the joint the spigot of one pipe and the interior of the socket of the. adjacent pipe should be thoroughly cleaned. The insertion of the gasket can be facilitated by the prior application of a thin film of lubricant to the bulb seating the inside the socket.

The rubber gasket should be wiped clean, flexed and then placed in the socket with the bulb towards the back of the socket. The groove in the gasket must be located in the retaining heel in the socket and the retaining heel of the gasket firmly embedded in its seating:

It is necessary to ensure that the SBR gasket fits evenly around the whole circumferences removing any bulges which prevent the proper entry of the spigot end. In the larger diameter this operation may be assisted by forming a second loop in the gasket opposite the first then pressing the loop flat one after the other.

A thin film of lubricant should be applied to the inside surface of the gasket which will be in contact with the entering spigot. In addition a thin film of lubricant may be applied to the outside surface of the entering spigot for a distance of 25 cms from the spigot end.

The pipe to be jointed should be supported centrally by the tackle used for laying and balance just clear of the trench bottom. The spigot of the pipe must be aligned and entered carefully into the adjacent socket until it makes contact with the gasket. Finally assembly of the joint is completed from this position.

Joint assembly is completed by forcing the spigot end of the entering pipe through the gasket, which is thus compressed until the spigot end reached the total depth of the socket, if the assembly is not completed with the application of reasonable force, the spigot should be removed and the position of the gasket examined.

For joints 200 mm and above rack and level tackle may be used for completing assembly wherever found necessary at the cost of Concessionaire.

The rack is placed on the socket with the hooked end of the rack extending over the spigot of the entering pipe. The tumble on the end of the 3.2 mtrs. Long socket rope is placed over the hook bolt on the rack, which should be in its lowest position, with nut of the top of the thread. The plain end of the rope is passed round the body of the pipe looped through the rope adjuster on the side of the rack housing, wedge inserted and the rope draw tight, this pulls the wedge home thus securing the rope. The tackle is then tamped firmly to the pipe by tightening the nut on the work bolt once the length of the rope is correctly set, it is not necessary to loosen the wedge adjuster for subsequent joints unless the diameter of pipes being jointed in change. The thimble secured to one end of 6.1 m. wire rope is not loosed over the hook at the end of rack and the free end carried to the socket end of the pipe to be jointed.

A special hook and rope adjuster is then fitted on to this rope and securely located in convenient position by means of the wedge. Once the position of the hook and rope adjuster has been thus set subsequent assembly of pipe of similar length should be subsequently jointed.

4.2.4 Hydraulic Test of CI / DI Pipeline :-

1. DI pipes and Fittings:

2. All the Pipes, specials and fitting of DI shall be supplied and tested as per relevant IS.

3. codes and specifications

4. The Following code shall be used for

   a. Factory Test Pressure: as per IS 8329

   b. Site Test Pressure: as per IS 8329

Suitable section as directed by the Engineer in charge shall be taken for

such testing from time to time during progress of the work and satisfactory test given for that section. All testing apparatus, gauges, connections, etc. and water required for testing shall be arranged by the Concessionaire at his cost. The CMWSSB does not undertake any responsibility to supply water for testing which the Concessionaire has to arrange by paying the required charges directly. The CMWSSB shall have the right to recover such charges from his bills if complaints are received that Concessionaire has not paid the charges thereof. If there is delay in testing, the Concessionaire shall refill the trenches for the time being and reopen them at time of testing at his own cost failure of which shall entitle the CMWSSB to do the refilling and reopening of trenches at the risk and cost to the Concessionaire. If the trenches are filled due to any reason whatsoever before testing, the Concessionaire shall have to open them for testing at no extra cost.

1.0 Satisfactory hydraulic test shall be recorded when the section under test shall withstand the pressure as specified by the Engineer in charge for about 15 minutes without operating the test pump. The test pressure being maintained at the specified figures during that 15 minutes interval.

1.2 The field test pressure to be imposed should be not less than the maximum of following.

a) 1.5 times the maximum sustained operating pressure.

b) 1.5 times the maximum static pressure in the pipe line

c) Sum of maximum sustained operating pressure and maximum surge pressure.

d) Sum of maximum pipe line static pressure and maximum surge pressure,

Subject to the maximum equal to the work test pressure to any pipe fitting incorporation.

During testing if any joints are found leaking they shall be repaired and / or redone by the Concessionaire at his cost till the test is found satisfactory. Similarly, any pipes collars, specials, show hair cracks, leaks etc. during testing the Concessionaire shall replace them with sound pipes and specials etc. free of cost. The hydraulic test shall be given in presence of the Engineer in Charge.

4.3 PROVIDING, MDPE PIPES :-

4.3.1 MDPE pipes

These specifications are for MDPE Blue PE 80 Pipes for House Service Connections.

4.3.2 Raw Material

Raw material used to Manufacture MDPE Blue Pipes shall be Virgin Natural Resin PE 80 containing those anti – oxidants, UV Stabilizers & Pigments necessary for Manufacturing of pipes. The Density of Pipes shall be in the Range 0.926 to 0.940 g/cm3 confirming to ISO 4984 & ISO 4427 Standard. The PE 80 Resin shall have MRS of 8 Mpa.

4.3.3 Effects on Water Quality :

The MDPE PE 80 Blue Pipes shall confirm to ISO 4984 & ISO 4427for conveyance of Water for Human Consumption. Also the pipes intended for conveyance of Potable water for Human consumption to be tested to comply with BS 6920 specifications in any of the laboratories like DVGM/KIWA/SPGN/WRc-NSF and certificate of compliance to be produced for the following parameters

a. Odour & Flavour of Water

b. Appearance of Water

c. Growth of Micro Organism

d. Extraction of substances that may be of concern to Public Health (Cyto Toxicity)

e. Extraction of Metals.

4.3.4 Pressure Rating:

The Pressure rating of MDPE Blue PE 80 Pipes shall be confirming to clause4.1 of ISO 4984 of ISO 4427 : 1996.

4.3.5 Colour of Pipes:

The Colour of MDPE PE 80 Pipes shall be BLUE confirming to clause 3.2 of ISO 4984 of ISO 4427 : 1996.

4.3.6 Dimensions:

The pipe dimensions shall be as per latest revisions clause 4.1 of ISO 4984 of ISO 4427 : 1996 and pipes up to diameters 32 mm shall be supplied in Coils of 300 mtrs. The internal diameter, wall thickness, length and other dimensions of pipes shall be as per relevant tables of ISO 4427:1996. Each pipe shall be of uniform thickness throughout its length.

The wall thickness of the PE 100 Pipes shall be as per the table given below:

Nominal Dia of MDPE Pipe (mm)	PR rating	Wall thickness	
		Minimum	Maximum
20	PN 16	2.3	2.8
25	PN 12.5	2.3	2.8
32	PN 12.5	3.0	3.5

The dimension tolerances shall be as per ISO 4427

4.3.7 Performance requirements

The Pipe supplied should have passed the acceptance test as per ISO 4427. The manufacturer should provide the test certificates for the following tests.

1. Melt Flow Rate
2. Density,
3. Oxidation and Induction test,
4. Hydrostatic Test ,
5. Pigment dispersion Test,
6. Longitudinal Reversion Test.

These tests should be performed in the in-house laboratory of the pipe manufacturer. The Employer will depute Third Party Inspection Agency to the pipe manufacturing facility of the manufacturer to inspect the pipes as per QAP approved by Engineer In charge.

4.4 DI pipes

4.4.1 These specifications are for distribution DI pipes .

Providing and supplying in standard length ISI mark Ductile Iron(DI) pipes suitable for potable water as per IS specification 1829-2000 including all local and central taxes, insurance, transportation, freight charges, octroi, inspection charges, loading& unloading, conveyance to departmental stores or site of work and including cost of jointing material etc., complete. The item shall be covering manufacturing, supplying and delivery of DI pipes having material grade DN80-DN1000 bearing IS 1829-2000 and its latest version or amendments. The DI pipes shall be supplied in standard length or as per CMWSSB requirements.

4.4.2 Grade of Raw material

Raw material used to manufacture the DI pipes shall be virgin

compounded or Natural K7, K9, K10 etc, resin confirming to IS 8329:2000. The resin proposed to be used for manufacturing of the pipes should also comply with the following norms as per ISO 9080:1992.

4.4.3 Quality assurance certificate

Quality assurance program of the manufacturer shall be enclosed with the Tender.

The bidder should submit the above raw material certificates along with his bid in the first cover.

4.4.4 Pressure Rating

The pressure rating of DI pipes and specials shall be of K7 confirming of IS 8329:2000.

4.4.5 Colour of pipes

The Colour of the DI pipe shall be confirming to IS 8329:2000.

4.4.6 Dimensions

The pipe dimensions shall be as per latest revisions and amendment of I S 8329:2000.

The internal diameter, wall thickness, length and other dimensions of pipes shall be as per relevant tables of IS: 8329 for different class of pipes. Each pipe shall be of uniform thickness throughout its length.

4.4.7 Performance requirements

The pipe supplied should have passed the acceptance tests as per of IS8329:2000. The manufacturer should provide the test certificates for the tests conducted, as required of IS8329:2000 along with the supply of pipes. These tests can be performed in the in- house laboratory of the pipe manufacturer or at an approved laboratory. The Employer will fix the third party for inspection of pipes at factory.

4.4.8 Marking

As per the provisions of IS 8329:2000, each straight length of the pipe shall be clearly marked in inedible ink/ paint on either end and for coils at every 5m the following information:

a. The manufacturer's name and/ trade mark

b. Designation of the pipe as per IS

c. Lot number/ Batch number

The words "CMWSSB – 24x7 WATER, Demo Project

4.4.9 BIS License

The pipe manufacturer who is going to supply the pipe for the project has to have a valid BIS license to do so for the kind of pipes required for this project. The bidders shall include this valid license along with their bid.

4.4.10 Third Party Inspection

The pipes shall be accepted successful after the third party inspection by the agency approved and authorized by CMWSSB, the charges for the same shall be borne by the Concessionaire

4.4.11 Fittings / Specials

All DI fittings/ specials shall be fabricated in accordance with IS: 9523 (2000). All fittings/specials shall be fabricated or injection moulded at factory only. No fabrication or moulding will be allowed at site, unless specifically permitted by the Engineer.

Fittings will be butt welded on to the pipes or other fittings by use of heat fusion.

a) Bends :- DI bends shall be conforming to IS: 9523 Specifications.

4.4.12 Welding Procedure

Jointing between DI pipes and specials shall be done as per the latest IS: 7634 part II. Method of jointing between the pipes to pipes and pipes to specials shall be with EF coupler up to 110mm dia. and for above by using automatic or semi automatic, hydraulically operated, superior quality butt fusion machines which will ensure good quality butt fusion welding of HDPE pipes. If approved by the concerned Engineer, jointing with PP compression fittings may be carried out for smaller diameters of PE pipes (up to 110mm). The bidder shall furnish along with his bid the detailed specifications, procedure, tools and equipment for butt / EF fusion welding.

4.4.13 Butt Jointing

Electro fusion butt joint can be provided during continuous laying of HDPE pipeline conforming to relevant IS Standards. The butt joint shall not be allowed in case of joining two ends already laid & in such case only electro fusion with fittings is allowed.

With a clean dry cloth wipe the inside and outside surfaces of the two pipe ends to be joined to remove dirt, moisture and foreign materials. It is important that the ends protruding past the clamp jaws be absolutely clean and free of any kind of contaminations.

Install pipe in the welding machine clamps. Ends should extend approximately one inch past alignment clamps for facing. Check

alignment and adjust as required to get perfect alignment of the meeting surfaces

Pipe ends should be perfectly faced by facer or square-cut with appropriate tools meant for the same. Remove any burr on the meeting faced / square-cut ends by a knife. Do not touch the meeting pipe ends by hand, which may contaminate the meeting surfaces due to dirt or perspiration or body oil.

Bring the two pipe ends together after facing, to see the alignment once again and ensure the alignment is perfect.

Separate the two pipe ends and insert the heater plate between the two pipe ends. Bring the movable pipe section against the heater plate until both pipe-ends are in full and firm contact with the heater plate.

As soon as the pipe ends are firmly in contact with the heater plate, immediately remove the pressure given to the clamp to remove the pressure on pipe ends on heater plate. If the pressure on the pipe is maintained during heating, the melt will be squeezed away from the pipe ends and create a concave effect in the pipe ends and this will weaken the joint.

Heat the pipe ends until properly sized melt bead is formed on both pipe ends. As the pipe ends melt against the heater plate during the heating period, the molten plastic will swell and form melt beads around the pipe ends. The melt beads should be the same size on both ends and uniformly sized all the way around.

The butt fusion temperature is normally situated between 200^0C to 235^0C depending on the variable factors.

Pipe size	**Approximate one side melt bead width**
160 mm OD to 180 mm OD pipes	3.20 mm
200 mm to 250 mm OD pipes	4.75 mm
280 mm to 630 mm OD pipes	6.25 mm

Please note the meld bead width values given above are indicative only and depending on wall thickness of the pipe, the material grade, production type, temperature of the heater plate and the applied fusion-cycle, the melt swell bead width may vary.

After melting has been completed as described above, separate the pipe ends, just enough to remove the heater. Quickly observe the parts to be joined to ensure sufficient and uniform melting patterns. Then quickly

bring the pipe ends together with the fusion jointing pressure. Join the pipe ends within a time of (3+0.0dn) seconds with a maximum 6 seconds for diameters up to & including dn 250 mm and a maximum of 12 seconds for diameters above dn 250 mm.

To ensure a good quality joint, it should have a smooth symmetrical bead shape around the entire pipe circumference and the bead depression shall not extend below the pipe surface.

If the molten plastic sticks to the heater, do not continue with jointing. Allow the pipe ends to cool and start all over again from the beginning with refacing / square cutting.

Fusion jointing pressure would vary with pipe size, wall thickness and material grade. The force applied will cause each bead to roll back on to the pipe. Insufficient or excessive roll back is one indication of a faulty joint.

While maintaining the pressure used in making joints, allow the joints to cool naturally for 30 to 90 seconds per inch of pipe diameter before removing from the clamps. Heavier walled (lower SDR) pipes require longer cooling time. However, the cooling time will vary depending on the prevailing climatic / environmental conditions.

On examining if the joint appears faulty, cut open the joint and start all over again from the beginning.

On satisfactory appearance, remove fused pipe from the welding clams. Allow the joint to cool under no pressure at least for 20 minutes after removal from welding clamps before subjecting the joint to testing, bending or backfilling stresses.

4.4.14 Workshop

The Concessionaire has to establish a workshop for jointing group of HDPE specials by means of electro fusion welding. Two or more PE specials coming at one place (like HDPE Tee, Reducer, Flanged end etc.,) shall be jointed at workshop and transported to the site of works for final installation with proposed PE pipelines. In no case, jointing of two or more PE specials in one place, at site will be allowed.

4.4.15 On Field Works

After visual inspection and approval of the welded PE specials assembly by the Engineer, the group of PE specials welded at workshop shall be transported to site of works for installation with the proposed PE pipes or valves etc., by means of electro fusion or slip- on flanged joints.

The Concessionaire shall supply the required dia & length of pipe of ISI mark at his cost. **The pipes shall be accepted after the third-party inspection by** the agency approved and **authorized by CMWSSB,** the

charges for the same shall be **borne** by the Concessionaire.

4.5 Lowering , Laying DI pipes

4.5.1 Installation and Commissioning of DI pipes

Installation

a. Supplying, laying, jointing, testing and commissioning of pipes used for Water Supply shall conform to relevant IS codes, as applicable. Any additions and/or modifications specified in this Section shall also be followed.

b. The alignment of water pipelines shall be prepared by the Concessionaire and the respective drawings shall be furnished to Independent Engineer / PMC as and when sought for and any changes proposed by the Independent Engineer / PMC shall be incorporated and the final drawings released for construction.

c. The water supply pipelines shall be of MS, DI, GI, HDPE and MDPE as specified elsewhere. Pipes shall be laid underground with a minimum earth cover of 1m above the crown of the pipe, unless otherwise specified. All pipes, fittings and material shall be inspected and approved by the Independent Engineer / PMC before being laid. Any pipes, fittings or material placed before they are inspected and approved shall be removed and replaced with approved material. Before laying the pipe, necessary bedding shall be provided to the pipes, wherever specified.

d. Wherever Jointing Material like Bolts and Nuts are required for fixing valves or any other appurtenances, stainless steel/carbon steel Bolts and Nuts shall be used.

e. The DI Pipes shall be laid in accordance with IS 12288 (1987).

4.5.2 Depth and size of trench:

a. Depth and size of trench mentioned in this clause are Standardized measurement and applicable to normal site condition where surface is generally uniform. Site Engineer shall be the authority to decide the depth of trench.

b. When trenches are excavated in slopes, uneven ground, inclined portion, the lower edge shall be treated as top surface of land and depth of trench measured accordingly.

c. In a certain location, such as uneven ground, hilly areas and all other places due to any reason whatsoever it can be ordered to excavate beyond specified depth. to keep the bed of the trench as smooth as possible. Near the culverts, both ends of the culverts shall be excavated more to suit the gradient.

d. If excavation is not possible to the minimum specified depth as detailed

in sub clauses above, full fact shall be brought to the notice of the Engineer-in- charge in writing giving details of location & reason for not able to excavate that particular portion. Approval may be granted by Engineer-in-charge in writing under certain genuine circumstances only. The decision of Executive Engineer shall be final and binding on Concessionaire.

4.5.3 Trenching:

a. Trenching shall as far as possible be kept ahead of laying of pipes. Concessionaire shall exercise due care that soil from trenching intended to be loose for back filling is not mixed with loose debris. While trenching, Concessionaire should not cause damage to any underground installations belonging to other agencies and any damage caused should be made good at his own cost and expense.

b. The Concessionaire should provide sufficient width in the trench at all such places, where it is likely to cave in due to soil conditions without any extra payment.

c. A minimum free clearance of 15 cm. should be maintained above or below any existing underground installations. No extra payment will be made towards this.

d. In order to prevent damage to DI Pipe, due to the growth of trees, roots, bushes, etc., the Concessionaire shall cut them if encountered in the path of alignment of trench without any additional charges.

e. In large borrow pits, excavation shall be done not less than 165 cms. in depth and both sides of borrow pit shall be excavated more than 165 cms in depth to keep gradient of bed less than 15 degree with horizontal.

f. If not possible as stated in sub clause above, alignment of trench shall be changed to avoid borrow pit completely.

4.5.4 Location and augmentation of trench:

a. In city areas the trench will normally follow the foot path of the road except where it may have to come to the edge of the carriage way when cutting across road with specific permissions from the authorities responsible for maintenance of that road (such permissions will be obtained by the CMWSSB). Outside the City limits trench will normally follow the boundary of the roadside land. However, where the road side land is full of borrow pits or a forestation or when the cable has to cross culverts, bridges or streams, the trench may be closer to the road edge or in some cases, over the embankment or shoulder of the road (Permissions for such deviations for cutting the embankment as well as shoulder of the road will be obtained by the CMWSSB).

b. The alignment of the trench will be decided by a responsible CMWSSB Engineer-in- charge,. While marking the alignment only the centreline

will be marked, and the Concessionaire shall set out all other work to ensure that, the excavated trench is as straight as possible. Concessionaire shall remove all bushes, undergrowth, stumps, rocks and other obstacles to facilitate marking the centreline without any extra charges.

4.5.5 Dewatering

The Concessionaire shall be responsible for all necessary arrangements to remove or pump out water from trench. The Concessionaire should survey the soil condition encountering the section and make his own assessment about dewatering arrangements that may be necessary. No extra payment shall be admissible for this and the tendered rate may take care of this aspect. The extra payment will be operative only in case specially permitted by the competent authority as per site condition.

4.5.6 Line-Up:

The line up of the trench must be such that HDPE Pipe shall be laid in a straight line except at locations where it has to necessarily take a bend because of change in the alignment or gradient of the trench, subject to the restrictions mentioned elsewhere.

4.5.7 Laying of DI Pipes:

After trench is excavated to the specified depth the bottom of the trench has to be cleared of all stones or pieces of rock & levelled up properly. A layer of ordinary soil of not less than 5 cm. is to be used for levelling the trench to ensure that cable when laid will follow a straight alignment

When trenches are excavated up to specified depth, properly dressed and levelled, joint measurement of trench shall be taken by representative of Concessionaire and Site Engineer. Measurement shall be recorded in measurement book with their signature. Trenches for which measurements are recorded in measurement book shall be considered as approved trenches.

DI Pipe/RCC/GI pipes shall be laid only in approved trenches. The Concessionaire shall exercise due care to ensure that the DI Pipe/ is not subjected to any damage or strain.

Water present in the trench at the time of laying the DI Pipe shall be pumped out by the Concessionaire before lowering in the pipes to ensure that no mud or water gets into the pipes.

In case of nallahs, which are dry for nine months in a year, the DI Pipe shall be laid beyond the bed of nallah on either side.

For PLB Pipes blowing practice to lay the pipe, place jack stand along the side of trench and mount the coil with the help of strong iron shaft

passing through the collapsible reel. Drive the reel slowly to avoid over spinning of reel while pulling; unrolled pipe can be laid to the trench by placing worker after every 15-20 meter. The arrangement for horizontal Jack and associated other accessories should be arranged by Concessionaire at his cost.

4.5.8 Backfilling and Dressing the Trench:

a) Provided that the DI Pipe have been properly laid in the trench at the specified depth, the back filling operation shall follow as closely as practicable. The back filling operation shall be performed in such a manner as to provide firm support under & above the pipes and avoid bend or deformation of the DI Pipe / PLB Blowing Type/Pre-installed ropes when the DI Pipe/PLB Blowing Type / Pre-installed ropes get loaded with the back filled earth. In locations where the back filling is not done properly by the Concessionaire or done unevenly it shall be redressed and back filled properly by the Concessionaire's expense. No debris shall be allowed in the back fill at any time.

b) At locations where the back filled material contains hard clods, rock fragments and other materials which may cause injury to DI Pipe where excavated or rock fragment are intended to refill the trench in whole or in part, the trench should be initially filled, with a layer of ordinary soil or derocked loose earth of not less than 10 cms. above pipes, without any extra cost.

c) Back filling on public, private roads, railway crossings, and footpaths in city areas shall be performed immediately after laying the DI Pipe. Back filling at such locations shall be thoroughly rammed, to ensure original condition & made safe to traffic. All excess soil/ material left out on road/footpath/railway crossing shall be removed without any extra cost.

4.5.9 Field Hydraulic Test

a) The Sectional Hydraulic Test shall be carried out after the pipeline section to be tested has been laid jointed and backfilled to a depth sufficient to prevent floatation, but leaving the joints exposed which are to be tested. The sections to be tested shall be to the approval of the Independent Engineer / PMC and shall not be longer than 2000 m or 500 m when either the pipeline is laid adjacent to or underneath the carriageway or when section includes an air valve chamber. The joints between each tested section shall be left exposed until the pipeline has passed the test on completion.

b) Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted when the test pressure is applied. Air valves already fitted shall be permitted to function during the test

c) Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be with the prior approval of the Independent Engineer / PMC.

d) The length under test shall be filled making certain that all air is displaced through an air valve or any other appropriate mechanism. The test length shall then remain under constant moderate pressure, 10 to 20m head of water, for a period of several hours until the pressure can be maintained without additional pumping.

e) The pressure shall then be slowly increased at a maximum rate of 1 bar per minute to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure, which is called make up water, shall be the measure of thermal expansion or leakage from discontinuation of pumping until its resumption. The makeup water shall be as below:

OD of pipeline (mm)	Litres per 1000 m of the pipe length tested		
	One hour test	Two hour test	Three hour test
63	9	14	24
110	16	31	50
160	37	74	112
200	50	87	124
315	136	285	422
400	174	347	521

f) The maximum allowable test pressure shall be 1.5 times the system design pressure or pipe rating whichever is higher

g) Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint, the Concessionaire shall, at his own cost, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test with cost including the cost of water. Water used for hydrostatic test shall be clean and potable.

h) Pipelines shall be tested as above except where the Independent Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

i) Test pressures are to be measured in kg/cm2 at the centre of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified the test pressure shall be as stated below.

4.5.10 DI pipes and Fittings

All the Pipes, specials and fitting of DI shall be supplied and tested as per relevant IS codes and specifications

The Following code shall be used for

a. Factory Test Pressure: as per IS 8329

b. Site Test Pressure: as per IS 9523

4.5.11 Commissioning

After satisfactory installation and testing of the entire pipelines including fittings shall be disinfected before commissioning of pipeline and fittings for operation and to be certified by the Independent Engineer / PMC.

4.6 PROVIDING AND FABRICATING OF MILD STEEL PIPES :-

4.6.1 Quality of Steel :-

The pipes shall be manufacture from tested mild steel of 10.00 mm thick plate conforming to IS:2062-1999. The manufacturer's test certificate regarding chemical analysis and physical tests for the steel plates shall be supplied by the Concessionaire. Steel plates shall be procured by the Concessionaire from the reputed manufacturer.

4.6.2 Fabrication of Steel Shells :-

The pipes shall be fabricated as per actual requirement, diameter and lengthwise, for each zone, required mainly for road crossings etc. as directed by Engineer-in-charge.

4.6.3 Cutting :-

The plates shall be cut to the exact dimensions required for bending. The cutting shall be done by machine shearing or by gas, the latter type to be adopted only, if specifically approved by the Engineer-in-charge.

The plates after being cut, shall have their edges machined to conform to the shapes, angles etc. and to the specified welding requirements. In the cases of plates cut by gas, such portion of the metal next to the cut as may be approved or directed by the Engineer-in-charge shall be removed by the machining.

All edges of plates to be welded in the shops shall be machined to take a single 'V' butt joint. Since the pipes and specials are to be jointed in the field, by welding the edge of the lap shall be machined at an angle of 45^0 on the outside.

4.6.4 Joints :-

The plates shall be bent cold. The plates shall be bent with maximum possible width so as to have minimum number of circumferential joints and in any case not more than four joints in a section of 6 m. length will be permitted. The pipes / specials shall have only longitudinal weld duly staggered. The tenderer shall comply with the directions that the Engineer-in-charge may issue regarding the minimum length of pipe that may be welded in the shop.

4.6.5 Welding :-

All welding shall be done by submerged electric arc process. All welding work in shop shall be done by specifically qualified welders. The work of each welders shall be tested thoroughly by individual identification mark. Welders whose work is found defective shall not be allowed to work on the job.

If the test pieces are found unsatisfactory; the welders concerned shall not be permitted to weld any more pipes.

The defects, if any, shall be set right to the satisfaction of the Engineer-in-charge. All such check tests and rectifications of defects shall be entirely at the cost of Concessionaire.

All welding shall be done by a method which will exclude the atmosphere from the molten metal. The surface to be welded shall be clean and free from paint, scales, rust and other foreign matter.

Each layer of the weld metal shall be thoroughly cleaned, and if necessary shall be pealed before the succeeding layer is laid. Any portion or joint found defective shall be cut out, re-welded and tested again. Only those shells whose joints are found to be perfect shall be accepted.

All welding work shall be generally in accordance with the I.S.I. The longitudinal joints in continuous plates or pipes shall be staggered. Welding rods shall be selected with due regard to the quality of steel plates. The selection of these rods shall be the sole responsibility of the Concessionaire to ensure that the welds satisfy all the tests prescribed in these specifications. All welds shall be ground smooth so as to be substantially flush with the plate surface at the junction of the weld.

The finished pipes shall be loaded safely transported and unloaded at the site of laying.

4.6.6 GAS CUTTING OF PIPE PLATES ETC. :-

In course of work the Concessionaire may be required to carryout gas cutting of pipes, sections of various thickness.

The cut shall be 'V' or square as directed by Engineer-in-charge. After cutting the edges shall be made smooth (Even by use of grinders, pneumatic / electrical) during cutting it shall be ensured that shape of the material cut is not deformed.

4.6.7 FIELD WELDING :-

In all positions with required number of runs etc.

General :-

a. Before aligning, assembling and welding, the special's, faces shall be cleaned by scrapping with wire brushes or by any other method approved by the Engineer-in-charge.

b. Welding on field shall conform to IS:816 (Code of practice for use of metal arc welding for general construction hereunder shall have precedence).

c. Welders shall be experienced and approved to do the welding at all locations. Welding shall not be done by helpers, Concessionaires shall remove such welders from the job whose work is not found to be satisfactory. The Engineer-in- charge may ask them to do test welding before approving their employment on the job.

4.6.8 Gousing :-

a. M.S. Pipes of 700mm & above & specials of diameter larger than 500 mm shall be welded with required number of runs from inside and a sealing run from outside. External sealing run shall be done only after internal welding is completed. Before starting the external welding the weld material in the joint shall be cleaned by gousing with gas flame. Gousing shall be done before rectification of any defective welding wherever necessary and as directed by the Engineer-in-charge.

b. Gousing shall not be paid for separately and the rate for welding includes the cost of gousing.

4.6.9 Electrodes :-

Welding electrodes to be used for welding in this contract shall conform to the Indian Standard Specifications IS:814 (Part-II) latest (Specifications for covered electrodes for metal arc welding of mild steel) The Concessionaire shall use standard electrodes depending on

the thickness of the plates to be welded and the type of joint. The Concessionaire shall also use standard current and A.C. voltage required for the machine as per manufacturer directions.

4.6.10 Types of Welded Joints :-

a. The circumferential joints of the pipes shall be butt welded with required number of runs externally and internally. Pipes below 500 mm dia shall be welded only externally.

b. All fillet welds shall have a throat thickness not less than 0.7 times the thickness of the pipes to be welded.

4.6.11 Welding Procedure :-

a. All parts of pipes, specials shall be free from all loose scale, slag, rust, paint and any other foreign materials,, it shall be removed with wire brush and left clean and dry. All scale and slag shall be removed from each run of weld when that run is completed.

4.7 PROVIDING AND APPLYING EPOXY PAINTING TO M.S. PIPES AND SPECIALS :-

The sand blasting should be done with the help of compressor unit at pressure of 2.8 kg to 3.0 kg/sqm. to clear the inside/outside surface from rust and dust etc. to the required satisfaction of the Engineer-in-charge. After this epoxy paint of approved quality and make should be applied in 2 coats including applying specials primer as required.

4.7.1 LOWERING, LAYING, JOINTING M.S. PIPES :-

The MS pipes will be transported to the site of work where actually they are to be laid and jointed. All necessary steps shall be taken to prevent damage to pipes during transport, loading, unloading, operations etc. such as crane, winch and chain pulley block tripod, etc. may be adopted. While laying the pipes already stop along the trances are lower down into the trenches with help of crane/pulley. The formation of bed should be uniform. The pipes are laid true to the alignment and gradient before jointing. The ends of this pipe are butted against each other, welded and coat of cement is mortar is applied after welding. Steel pipes may be jointed with flexible joints of by welding but lead or other filler joints, hot or cold, are not recommended.

When welding is adopted, plain-ended pipes may be jointed by butt welds or sleeved pipes by means of fillet welds. For laying long strength length of pipelines butt joints technique may be employed. The steel pipes used for water supply include hydraulic lap welded electric fusion welded submerged arc welded and spiral welded pipes. The latter are being made from steel strip. For laying of welded steel pipe I.S. 5822-1986 may be referred to.

4.7.2 Field Hydraulic Test

MS pipes and Fittings:

All the Pipes, specials and fitting of MS shall be supplied and tested as per relevant IS codes and specifications.

The Following code shall be used for:

a. Factory Test Pressure: as per IS 3589

b. Site Test Pressure: as per IS 5822

4.8 DISMANTELLING DEAD PIPELINES OF ALL TYPES & DIA.:-

This item include cost of all labour required for breaking joints cutting of existing MS/CI/DI/GI pipe. Dismantling the existing pipe with minimum breakages as directed by the Engineer in Charge. Material obtained from dismantling shall remain the property of CMWSSB.

4.9 PROVIDING AND MAKING LEAD JOINTS :-

The material i.e. pig lead, spun yard etc. shall be of standard quality. The pipe joint shall be caulked with spun yarn to the satisfaction of Engineer in charge. The molten lead then be casted over the joint by use of conventional practice. The lead should be properly caulked and packed in the socket T-joint by use of caulking tools. The joint so caulked should be water tight and should be hydraulically tested to the required pressure at the time of hydraulic testing of pipe line and specials.

4.10 PROVIDING AND MAKING FLANGED JOINT :-

The suitable C.I. / M.S. specials required for making flanged connection shall be procured by the Concessionaire including all required jointing material i.e. nut bolt and rubber sheet of required thickness etc. The Concessionaire shall have to fix these specials at required places as directed by CMWSSB / Engineer in charge. The Concessionaire shall have to employ a fitter for making these flanged joints. The nut bolts shall be tightened enough to make the joint watertight. The satisfactory hydraulic testing shall have to be given by the Concessionaire for these joints. Any leakages if found during testing will have to be rectified by the Concessionaire at his cost. This item shall be carried out as described in Section Ba-V3 of PWD standard book of specifications (Red Book).

This includes the Cost of all jointing materials such as rubber packing of approved quality nut bolts of required size and length as approved by Engineer in charge and cost of all labour for Jointing in required position and alignment. No material shall be supplied by the CMWSSB.

4.11 General building works

4.11.1 Applicable Codes and Specifications

The following codes and standards are included in this section

IS:110	Ready mixed paint, brushing, grey filler, for enamels for use over primers
IS:269	Specification for 33 grade ordinary Portland cement
IS:280	Specification for mild steel wire for general Engineering purposes
IS:287	Recommendations for maximum permissible moisture content of timber used for different purposes
IS:304	High Tensile Brass Ingots and Castings.
IS:337	Varnish, finishing interior
IS:348	French polish
IS:383	Specification for coarse and fine aggregates from natural sources for concrete
IS:412	Expanded metal steel sheets for general purposes
IS:419	Specification for putty for use on window frames
IS:428	Distemper, oil emulsion, colour as required
IS:459	Specification for un-enforced corrugated and semi-corrugated asbestos cement sheets
IS:702	Specification for industrial bitumen
IS:710	Specification for marine plywood
IS:712	Specification for building limes
IS:730	Specification for hook bolts for corrugated sheet roofing
IS:733	Wrought aluminum and aluminum alloys, bars, rods and sections for general Engineering purposes
IS:777	Specification for glazed earthenware tiles

IS:1003	Specification for timber paneled and glazed shutters (Parts 1 & 2)
IS:1038	Specification for steel doors, windows and ventilators
IS:1077	Specification for common burnt clay building bricks
IS:1081	Code of practice for fixing and glazing of metal (steel & aluminum) doors,
	windows and ventilators
IS:1124	Method of test for determination of water absorption, apparent specific
	gravity and porosity of natural building stones
IS:1237	Specification for cement concrete flooring tiles
IS:1322	Bitumen felts for water proofing and damp proofing
IS:1346	Code of practice for water proofing of roofs with bitumen felts
IS:1361	Specification for steel windows for industrial buildings
IS:1397	Specification for kraft paper
IS:1398	Specification for packing paper, waterproof, bitumen laminated
IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles
IS:1477	Code of practice for painting of ferrous metals in buildings (Parts 1 & 2)
IS:1542	Specification for sand for plaster
IS:1580	Specification for bituminous compounds for water-proofing and caulking purposes
IS:1597	Code of practice for construction of stone masonry: Part 1 Rubble stone masonry
IS:1659	Specification for block boards
IS:1661	Code of practice for application of cement and cement-lime plaster finishes
IS:1834	Specification for hot applied sealing compound for joint in concrete
IS:1838	Specification for preformed fillers for expansion joint in concrete pavements and structures (non extruding and resilient type) : Part 1

	Bitumen impregnated fiber
IS:1948	Specification for aluminum doors, windows and ventilators
IS:1949	Specification for aluminum windows for industrial buildings
IS:2074	Ready mixed paint, air drying, red oxide- zinc chrome, priming
IS:2098	Asbestos cement building boards
IS:2114	Code of practice for laying in-situ terrazzo floor finish
IS:2116	Specification for sand for masonry mortars
IS:2185	Specification for concrete masonry units (Parts 1,2 & 3)
IS:2202	Specification for wooden flush door shutters (Solid core type): Parts 1 & 2
IS:2212	Code of practice for brickwork
IS:2250	Code of practice for preparation and use of masonry mortars
IS:2338	Code of practice for finishing of wood and wood based materials (Parts 1 & 2)
IS:2339	Aluminums paint for general purposes, in dual container
IS:2394	Code of practice for application of lime plaster finish
IS:2395 -	Code of practice for painting concrete, masonry and plaster surfaces (Parts 1 & 2)
IS:2402	Code of practice for external rendered finishes
IS:2571	Code of practice for laying in-situ cement concrete flooring
IS:2572	Code of practice for construction of hollow concrete block masonry
IS:2645	Specification of integral cement waterproofing compounds
IS:2690	Specification for burnt clay flat terracing tiles: Part 1 Machine made
IS:2691	Specification for burnt clay facing bricks
IS:2750	Specification for steel scaffoldings
IS:2835	Flat transparent sheet glass

IS:2932	Specification for enamel, synthetic, exterior type (a) undercoating, (b) finishing
IS:3007	Code of practice for laying of asbestos cement sheets - corrugated and (Part 1 & 2) semi-corrugated sheets
IS:3036	Code of practice for laying lime concrete for a water-proofed roof finish
IS:3067	Code of practice of general design details and preparatory work for damp-proofing and water- proofing of buildings
IS:3068	Specification for broken brick (burnt clay) coarse aggregates for use in lime concrete
IS:3384	Specification for bitumen primer for use in water-proofing and damp proofing
IS:3461	Specification for PVC-asbestos floor tiles
IS:3462	Specification for unbacked flexible PVC flooring
IS:3495	Method of test for burnt clay building bricks: Part 1 to 4
IS:3536	Specification for ready mixed paint, brushing, wood primer, pink
IS:3564	Specification for door closers (hydraulically regulated)
IS:3614	Specification for fire checks doors : Part-I Plate metal covered and rolling
IS:3614	Specification for metallic and non-metallic fire check doors: Part-2
IS:3696	Safety code of scaffolds and ladders (Parts 1 & 2)
IS:3935	Code of practice for composite construction
IS:4020	Methods of test for wooden flush door: Type test
IS:4021	Specification for timber door, window and ventilator frames
IS:4351	Specification for steel door frames
IS:4443	Code of practice for use of resin type chemical resistant mortars
IS:4457	Specification for ceramic unglazed vitreous acid resisting tile
IS:4631	Code of practice for laying epoxy resin floor toppings

IS:4832	Specification for chemical resistant mortars (Part II)
IS:4860	Specification for acid resistant bricks
IS:4948	Specification for welded steel wire fabric for general use
IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring
IS:5410	Cement paint, colour as required
IS:5411	Specification for plastic emulsion paint (Parts 1 & 2)
IS:5437	Wired and figured glass
IS:5491	Code of practice for laying of in-situ granolithic concrete floor topping
IS:6041	Code of practice construction of autoclaved cellular concrete block masonry
IS:6042	Code of practice for construction of light weight concrete block masonry
IS:6248	Specification for metal rolling shutters and rolling grilles
IS:7193	Specification for glass fiber base coal tar pitch and bitumen felts
IS:7452	Specification for hot rolled steel sections for doors, windows and ventilators
IS.8042	Specification for white Portland cement
IS:8543	Methods of testing plastics
IS:8869	Specification for washers for corrugated sheet roofing
IS:9197	Specification for epoxy resin, hardeners and epoxy resin composites for floor topping
IS:9862	Specification for ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and chlorine resisting
IS:10005	SI units and recommendations for the use of their multiples and of certain other units.
IS:12200	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams
BS:476	Methods for determination of the fire resistance of elements (Part-20) of

	construction (General Principles)
BS:476	Methods for determination of the fire resistance of load (Part-21) bearing elements of construction
BS:476	Methods for determination of the fire resistance of non-load (Part-22) bearing elements of construction

5.1 SPECIFIC TECHNICAL SPECIFICATIONS

5.1.1 Provision of DI K7 Pipe for Sub DMA headers

1. **ITEM No. 1&2:-** Cutting bituminous & concrete road and taking out soling, metaling including sorting, screening and stacking with in a lead of 50m.

   Item includes:-

   a) Cutting of bituminous & Concrete Road

   b) Taking out soling, metaling including sorting, screening and stacking with in a lead of 50 as directed by Engineer-in-charge.

   Specifications :-

   The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

2. **ITEM No.3,4 :- Laying of pipes, Excavation in trenches for pipes and refilling Item includes :-**

1.0] Laying of distribution pipe

2.0] Excavation for Pipe Trenches in all types of soils & surfaces in all types of site conditions including drainage, dewatering, refilling etc

3.0] Refilling of trenches

Specifications: -

The different activities under this item shall be executed as per the corresponding specifications detailed in general specifications above.

D.I Pipe shall be supplied from the CMWSSB approved list of the firms after third party inspection by the agency approved and authorized by CMWSSB. Inspection charges shall be borne by the Concessionaire.

3. **ITEM No. 5 & 6 :-** Providing Ductile iron socket / spigot pipes including testing of joints and including the cost of rubber gasket

   Item includes :-

a) Providing, laying & jointing DI pipes either for replacement of damaged/ bursted pipes or for laying new / parallel pipe line. (cost of specials shall be paid separately under relevant item), giving satisfactory hydraulic test.

b) Rubber Gaskets shall be as per IS specifications mentioned in the schedule.

Specifications :-

The different activities under this item shall be executed as per the corresponding specifications detailed in general specifications above & CPWD specification.

D.I Pipe shall be supplied from the CMWSSB approved list of the firms after third party inspection by any agency approved by CMWSSB. inspection charges shall be borne by the Concessionaire.

4. ITEM No. 7 :- Providing DI Specials :- Item includes:-

1. Providing DI I Mechanical Specials.
2. Providing DI Conventional , Specials
3. Providing DI Flanged Specials.
4. Carting the specials to site of work.

Specifications:-

D.I. Specials shall confirm to relevant IS codes of latest edition. Material should be procured from approved manufacturer with manufacturers test certificate. At least 50% of the D.I specials should be inspected by the agency approved and authorized by the CMWSSB. Inspection charges shall be borne by the Concessionaire.

Mechanical jiffy collar coupling should be of exact size, dia. and to the specifications and these jiffy fittings should be of standard quality and confirming to IS standards (preferably be purchased from authorized dealer)

Synthetic rubber ring dimension should be as per IS 12820 / 89 and quality should be as per I.S. 5382/1985 and suitable for jointing of D.I. pipes as per I.S. 8329-2000 or C.I. pipes as per I.S. 1536-2001. Mechanical joint Bends, Tees, Reducer, Adopter etc. shall be of exact size, dia degree and as per standard specifications.

The special shall be coated or protected from rusting and shall be suitable for D.I. pipes (as per IS 8329/2000) or C.I. pipes (as per IS 1536-2001).

Mechanical compression sealing flanged socket tail piece (Jiffy flange adopter) shall be of exact size and dia. to match D.I. pipes (IS 8329-2000). Mechanical Joint double socket reducer shall be as per IS 13382-1992 and

suitable to D.I. pipes (IS 8329-2000) sealing gaskets of S.B.R. shall be as per IS 12820-1989.

This item includes providing of special, transporting the special to site and testing. It also include cost of entire jointing material, cost of specials, and nut-bolts etc. Only labour charges required for jointing shall be paid separately under relevant items of this tender.

5. **ITEM No. 8:-** Providing, Lowering, laying & jointing MS pipe lines of different dia & Providing & Fabricating MS Specials

Item includes :-

a) Providing, laying & jointing MS pipes either for replacement of damaged/ bursted pipes or for laying new / parallel pipe line. (cost of specials shall be paid separately under relevant item)), giving satisfactory hydraulic test.

b) Providing and applying epoxy painting.

c) Providing and fabricating MS Specials.

Specifications:-

The different activities under this item shall be executed as per the corresponding specifications detailed in general specifications above. The MS specials shall be fabricated out of MS plate as per the corresponding specifications detailed in General Specifications above. The dimensions shall confirm to IS standards

6. **ITEM No. 9 & 14:-**

Providing, lowering , laying & fixing of EPDM Sluice Valves:-

The item includes – manually operated glandless, sluice valves, resilient seated with straight pocket less body passage with inside stem screw. Inside & outside epoxy powder coated (EP-P) with minimum thickness of 20µm.

a) Providing of sluice valve with EPDM rubber. The sluice valves shall confirm to ISO-7005-2 Series.

b) Fixing of sluice valve at the location as decided by the Engineer-in-charge during the execution.

c) Testing of sluice valve for water tightness in the same manner as described for mains.

d) Before fixing the valves, the base of the valve chamber/surface box shall be completed, though these chambers/ surface are covered under separate items.

Specifications :-

Material-

Body & Bonnet : Ductile Iron to IS 1865 Gr. 400/12 (GGG-40)

Wedge : Ductile Iron to IS 1865 Gr. 400/12 (GGG-40) fully vulcanized with EPDM Rubber GR W 270

Wedge : NBR 'O' rings in bronze Bush Stem : Stainless steel to 1.4021

Stem nut : Brass Body, bonnet Gasket: EPDM

The different activities under this item shall be executed as per the manufacturing specifications details.

Valve shall be supplied from the CMWSSB approved list (VAG, IVC) of the firms after third party inspection by the agency approved and authorized by CMWSSB. inspection charges shall be borne by the Concessionaire

7. **ITEM No. 10,11,12 &13:-**Providing, lowering , laying & fixing of Air Valves

Providing and fixing valve and giving satisfactory hydraulic test.

Specifications:-

Product features

- Single chamber, double orifice triple function air valve
- Operated by the flow medium
- Triple function
- Larger orifice for release of big air volumes
- Large orifice for intake of big air volumes
- Small orifice for release of small air volumes during operation under full operation pressure
- High discharge capacity up to sonic velocity by means of stabilized float
- Final Inspection Test acc. to EN 12266 (DIN 3230, Part 4)

Materials and corrosion protection

- Body and bonnet of ductile cast iron EN - JS 1030 (GGG-40)
- All inner parts and bonnet screws of stainless steel (expect float for DN 50

which is of Polypropylene)

- Gaskets and seal of EPDM
- Inside and outside epoxy coated

Valve shall be supplied from the CMWSSB approved list (VAG, IVC) of the firms after third party inspection by the agency approved and authorized by CMWSSB. Inspection charges shall be borne by the Concessionaire

8. **ITEM No. 15 :-** Constructing Masonry Chamber for 100 to 250 dia. Sluice valve including providing and fixing FRC cover and frame of size 60x60 cm for size 1.35x1.2x1.55 m, including cost of materials, labour, T&P etc. all complete.

   The different activities under this item shall be executed as per the corresponding specifications detailed in **CPWD**

9. **ITEM No. 16 :-** Constructing Masonry Chamber for 300 to 400 dia. Sluice valve including providing and fixing FRC cover and frame of size 60x60 cm for size 1.35x1.35x1.95 m, including cost of materials, labour, T&P etc. all complete.

   The different activities under this item shall be executed as per the corresponding specifications detailed in **CPWD**

10. **ITEM No. 17 :-** Constructing Masonry Chamber for 50 dia. air valve including cost of materials, labour, T&P etc. all complete.

    The different activities under this item shall be executed as per the corresponding specifications detailed in **CPWD**

11. **ITEM No. 18 :-** Constructing Masonry Chamber for 80 dia. Double air valve for 100 to 350 dia. Pipe line including providing and fixing FRC cover and frame of size 60x60 cm for size 1.2x0.9x1.8 m including cost of materials, labour, T&P etc. all complete.

    The different activities under this item shall be executed as per the corresponding specifications detailed in **CPWD**

12. **ITEM No. 19 :-** Constructing Masonry Chamber for 100 dia. Double air valve for 400 to 500 dia. Pipe line including providing and fixing FRC cover and frame of size 60x60 cm for size 1.5x1.2x2.3 m including cost of materials, labour, T&P etc. all complete.

    The different activities under this item shall be executed as per the corresponding specifications detailed in **CPWD**

13. **ITEM No. 20 :-** Constructing Masonry Chamber for 150 dia. Double air valve above 600 dia. Pipe line including providing and fixing FRC cover and frame of size 60x60 cm for size 1.5x1.2x2.3 m including cost of materials, labour, T&P etc. all complete.

    The different activities under this item shall be executed as per the corresponding specifications detailed in **CPWD**

14. **ITEM No. 21:-** Hire charges of pump set of capacity 10 hp

    The item includes dewatering during excavation for the work under water other than specified in Item No: 1 excavation for pipeline, wherever necessary. All machinery, piping, fuel, lubricating oil, electrical connection charges etc. required for pumping machinery including labour and running charges are to be born by the Concessionaire.

    This item is operative only when dewatering operations are actually required to be done during execution of construction work at Nallah, river crossing. Necessary written permission from the competent authority is necessary before starting of work.

    Specifications:-

    The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

5.1.2 Provision of House Connection with AMI enabled Smart Water Meters

1. **ITEM No. 1 & 2(B) :-** Providing, Lowering, Laying MDPE pipe lines of different dia. as replacement of existing/new service connection. (For Service Connections) including earth work excavation, refilling the trenches and disposal of surplus earth.

   Item includes:-

   1.0] Excavation for Pipe Trenches in all types of soils & surfaces in all types of site conditionsincluding drainage, dewatering etc.

   2.0] Providing, laying & jointing MDPE (Medium Class) pipes for replacement of service connections (including cost of pipes & specials)

   3.0] Refilling of trenches

   4.0] Dismantling & Shifting of dead pipes (if any) from site.

   Specifications :-

   The different activities under this item shall be executed as per the corresponding specifications detailed in general specifications above.

Specification for COMPRESSION FITTINGS (Factory tests):

Compression fittings used for House service connection comply as per ISO 14236

A. Material of Construction

Compression fittings material shall confirm to ISO14236.Clause -5.

a) A Body-Polypropylene

b) Nut / Cap –Polypropylene.

c) Clip Ring-POM (Acetylic resin)

d) Packing bush- Polypropylene

e) "O" ring – NBR

f) Threaded metal inserts –SS 304 with BSP Threads

B. Pressure testing

The pressure rating of compression fittings as per clause 8 of ISO 14236 which shall be PN16

C. Dimensions:

The Dimension of compression fittings shall be as per clause 7.1 of ISO 14236

D. Performance requirements

The compression fittings shall be tested as per ISO 14236. Following Test methods shall be performed.

Leak tightness under internal pressure.
Resistance to Pull out.
Leak tightness under Internal Vacuum.
Long term Pressure Test for Leak tightness for assembled Joint
MRS Value as per ISO 9080
Resistance to Internal pressure.

E. Effects on Quality of Water

The Compression fittings for intended for conveyance of Potable water for Human consumption to be tested to comply with BS 6920 specifications

in any of the laboratories like DVGM / KIWA / SPGN / WRc –NSF and certificate of compliance to be produced for the following parameters:

a. Odour & Flavour of Water.

b. Appearance of Water.

c. Growth of Micro Organism

d. Extraction of substances that may be of concern to Public Health (Cyto Toxicity)

e. Extraction of Metals.

For clear identification of the water services, the nuts of the fittings should be colored blue while the body to be black. All fittings with threaded ends should be with BSP threads.

F. Specifications:-

The different activities under this item shall be executed as per the corresponding specifications detailed in general specifications above.

Pipe shall be supplied from the CMWSSB approved list of the firms after third party inspection by the agency approved and authorized by CMWSSB. Inspection charges shall be borne by the Concessionaire.

2. **<u>ITEM No. 3:-</u>** Providing & Installing Bulk & Domestic Water Meters with Strainers Item includes:-

1.0] Excavation for fixing meters in all types of soils & surfaces in all types of site conditions including drainage, dewatering, etc.

2.0] Dismantling existing meter if any.

3.0] Providing installing Bulk / Domestic Meters with cost of jointing materials.

1] Technical Specifications for Consumer Water Meters

Installation of Smart Water Meter (AMI water electromagnetic / Ultrasonic meters DN15 / 20 to DN40 having no moving parts and confirming to ISO 4064) and MID approved, Reading of meters every month with Automatic metering Infrastructure AMI and integration of the read data with the Authority software for generating bills automatically.

Technical Requirements	Details

Technical Standards	a) IS 779:1994 (reaffirmed 2015) - Specification for water meters (domestic type) b) IS 6784:1996 – method of performance testing of water meters c) ISO 4064-1:2014 - water meters for cold potable water and hot water - metrological and technical requirements d) ISO 4064-2:2014 - water meters for cold potable water and hot water - test methods e) ISO 4064-3:2014 (Reviewed and Confirmed in 2019) – water meters for cold potable water and hot water – test report format f) ISO 4064-4:2014 - (Reviewed and Confirmed in 2019) – Non metrological requirements not covered in ISO 4064-1. g) ISO 4064-5:2014 - (Reviewed and Confirmed in 2019) Installation requirements		
Required Certificates	IS 779: 1994 (reaffirmed 2015) and IS 6784:1996, IS 2373: 1981 (reaffirmed 2017), ISO 4064 (1 to 5):2014 The Meter should be MID certified. In addition, endurance test report in accordance with ISO4064:2014 from FCRI should be provided.		
	Manufacturer's authorization		
Class of Water Meter	Class 2 Water meters in accordance with ISO4064:2014. Operating range ratio (Q3/Q1) = R500.		
Sizing of Water Meter	The size of meter shall be arrived based on the dwelling units of the premises:		
	Equivalent Dwelling Units	Size of Meter (mm)	Recommended range of monthly consumption (m3)
	Up to 6	15	0-100
	7 to 20	20	101-170
	21 to 40	25	171-260
	41 to 70	32	261-420
	Above 70	100	420-550
Material requirements	The water meter body shall be made of Corrosion resistant material like, Engineering Plastic, brass, Bronze, Stainless steel, Carbon steel. The same will be reviewed time to time by the Technical Committee.		
Tamper protection seals	A water Meter shall include protection devices which can be sealed so as to prevent, both before and after correct installation of the water Meter, dismantling or modification of the Meter, its		

	adjustment device or its correction device, without damaging these devices. This can be done by sealing with a corrosive resistant wire or specially made plastic ribbon inserted through 2.5 mm diameter holes in the halves of the body, and secured by a circular sheet metal seal impressed by a device which provides a unique imprint on the seal.
Meter Accuracy Testing	A water Meter shall be designated as accuracy class 2. This requires the Maximum Permissible Error (MPE) to be $\pm$*2 %* (for temperatures from 0.1 °C to 30 °C and $\pm$*3 %* for temperatures greater than 30 °C) for the upper flow rate zone (Q3 & Q4). The MPE for the lower flow rate zone (Q1andQT) shall be $\pm$*5%*. During procurement, two Meter samples from each Tender shall be tested in an accredited facility. Any Meter that shall fail the accredited test shall be considered technically non responsive in the tendering process.

5.1.3 Technical Specification for Bulk Potable Water Meters :-

50 mm, 80 mm, 100 mm, 150 mm, 200 mm, 250 mm & 300 mm dia Bulk Cold-Water Meters

1] Type of Meters:-

The meters offered should be Woltman type cold water meter and a range of meters should be available to measure maximum flow rates between 90 and 1000m^3/hour

All meters offered under the terms of the tender and specification must be Woltman type meter and be fitted with a low mass rotor which is parallel to the direction of water flow and exhibits dynamic thrust relief.

The meter bodies will be flanged for connection and be drilled in accordance with DIN2532/3 or BS4622, NP10/16

The meter will have a magnetic coupling between the meter mechanism and the register. This must be fully tamperproof and prevent the meter reading being affected by any non-destructive external methods.

The register mechanism will be mounted within a non-plastic housing preferably made from copper and should be fitted with a mineral glass window. Engineering plastic window are allowed subject to clear visibility The register will be submersible to 2m depth of water and will remain condensation fee.

The register mechanism will be pre equipped to receive a pulse output unit in the future which can be added to the meter onsite without breaking the meter seal and without removing the meter mechanism.

The meter must offer the facility for both optical and reed switch outputs

which can be used at the same time. The meter shall offer the facility for pulse outputs ranging shall be from 10 litres Pulse to 10,00 liters pulse dependent upon meter size and specification.

The complete measuring mechanism of the meter shall be removable and interchangeable with a replacement pre calibrated mechanism. Changing the mechanism will not have an effect larger than +/- 0.5% on the accuracy of the complete meter within the EEC limits for the Class B standard. The rates for inter changeable mechanism shall be quoted separately.

The meter should be capable of installation in any plane with no change in accuracy of reading. The meter should also be able to function in reverse flow .The meter shall confirm to ISO 4064 standard with EEC certification.

2] Size and Length :-

The size and lengths of the meters offered should be in accordance with the table shown below. For future use meters must be available in the all of the sizes specified in the same model type.

Meter Size	**Length**
50 mm	300
80 mm	350
100 mm	350
150 mm	500
200 mm	500

3] Material and Workmanship :-

The meter shall be guaranteed against defects in material and workmanship for a minimum period of one year from date of delivery. Parts to replace those in which a defect may develop within such period shall be supplied without charge, piece, upon the return of such defective parts to the supplier thereof or upon proof of such defects.

All parts of the meters shall be finished to ensure interchangeability which is to be guaranteed. The materials for the various parts of the meter shall be as follows.

a] Main Casting :-

The meter body shall be manufactured of cast iron and shall be coated with a high quality fusion bonded powder coating inside and outside the meter body.

b] Strainers :-

A full range of strainers will be available in sizes compatible with the metersand will have the same general specification as the water meter.

c] Flange Connections :

The meters will be supplied complete with connecting gaskets to provide a working seal between the meter and the adjoining pipe work.

4] Marking :-

Each water meter shall be marked with the following information

a. Direction of flow of water on both sides of the meter.

b. Maximum flow rate.

c. Serial number.

d. Manufactures name.

e. Year of manufacture.

5] Registers :-

The register shall consist of both a direct straight reading numeric display and two dial displays with sweep hands. The main dial display will show the lowest unit of registration and the second dial display will show the tens of units Registers will be available in both cubic meters and gallons.

6] Accuracy :-

The meters performance specifications shall be to ISO 4064 or BS 5728 part 7 Class B performance or to equivalent internationally recognized Standard for forward flow. The meter offered will be able to meet the performance specifications laid out in the following table.

50 mm	Qmax	90
	Qn	50
	Qt	1
	Qmin	0.35

	Approval	Class B/0.1 bar
80 mm	Qmax	200
	Qn	120
	Qt	2
	Qmin	0.5
	Approval	Class B/0.1 bar
100 mm	Qmax	250
	Qn	180
	Qt	2
	Qmin	0.6
	Approval	Class B/0.1 bar
150 mm	Qmax	600
	Qn	450
	Qt	4
	Qmin	1.8
	Approval	Class B/0.1 bar
200 mm	Qmax	1000
	Qn	700
	Qt	6
	Qmin	4
	Approval	Class B/0.1 bar
250 mm	Qmax	1600 / 0.36 bar
	Qn	1000
	Qt	11
	Qmin	6
	Approval	Class-B / 0.1 bar
300 mm	Qmax	2000 / 0.58 bar

	Qn	1500
	Qt	15
	Qmin	12
	Approval	Class B / 0.1 bar

Note :- Q in m^3/hr., Qn – Normal flow, Qmax – Maximum Flow, Qt – Transitional flow.

7] Approbation Certificates :-

Copies of the relevant Approbation Certificates are to be provided by the Tenderer.

8] Headloss :-

Meters shall show a loss of head not exceeding 0.1 Bar at Qn in accordance with ISO 4064 or BS5728 Part 7.

9] Working Pressure :-

The meters working pressure shall be 16 Bar with test pressure of 25 Bar.

10] Working Temperature :-

The meter must be able to withstand a maximum working temperature of 50 Deg C (warm water meter type)

11] Seals :-

All meters shall be sealed with approved type of seals and seal wires. The seals and seal wires shall be provided by the Supplier.

12] Meters should be designed for easy disassembly and re-assembly without the use of special tools or equipment and should be easy to maintain and repair. Meters designed to resist vandalism will be preferred.

Technical Specification of Dirt Box with S. S. Strainer :-

The Dirt box shall be made of materials , which are not susceptible to electrolysis , corrosion and non-toxic . The body shall be of stream flow design with closed grain cast iron material to suit a working pressure of 6 Kg/cm Subject to a test pressure of 9Kg /cm during shop test inspection

The cover shall be fixed with the help of hinged bolts, nuts with rubber gaskets/packing for easy removal of the strainer basket and quick cleaning of dirt . The dirt box shall be of sufficient size and design to trap the silt and foreign materials so that the frequency of cleaning the strainer and dirt box is minimum optimal.

The strainer basket shall be of rigid special web design made of *stainless steel* with perforated punched opening which provided largest possible area of filter element with minimum head loss and the pressure rating test pressure shall be same as mentioned in above.

The head loss to the strainer basket shall be minimum and shall confirm to the relevant standard depending on the diameter of the strainer. As the strainer shall be placed up – stream of the meter the profile of the same shall be such that the turbulence caused by it shall be arrested within Day of the strainer.

The strainer with dirt box shall be of doubled flanged flat machined faced type and details of the flanged shall be similar to that of water meter type WOLTMAN. The internal diameter of the strainer shall be same that of the corresponding meter.

Material :-

- Body: C.I. IS:210 FG 200
- Strainer Frame : SS Perforated Sheet, SS 304
- Mesh (30) : SS Perforated Sheet, SS 304
- Gasket : Rubber
- Cover : C.I. IS:210 FG 200
- Stud / Bolts / Nut : IS:1363CL4.6 & CL4.0
- Eye Bolt : IS:1363CL4.6 & CL4.0
- Plug : 13% CR. SS (AISI 410)
- Flange Dimensions as per IS:1538 table 6/BS-4504 PN16

Installing and giving satisfactory field test for flanged and Bulk Type Water Meter :-

The size and specifications shall conform to those stated under relevant item in BOQ. The installation and giving satisfactory field test of the meter shall be carried out as per the directives of Engineer-in-charge.

3. ITEM No. 4(b): Providing PP Water Meter Enclosure

Specifications:

PP Water Meter Enclosure Insulated, Impact Resistant With Acrylic View Top, Retrofit Type with Watco Printed Logo Size 450mmLength x 155mmWidth x 478mm Height with necessary inlet outlet Astral make

Upvc connecting fittings (appox 8 feet from Ground to meter and to consumer connection with necessary valves Elbow Socket Mta Union Fta(brass) all complete as per direction of engineer in charge

4. **ITEM No. 6(b):-**

Supply and delivery of DI D/F PICO Diaphragm Pressure relief valve (Type-3) of PN12 Class Item includes:-

Supply delivery & fixing of DI D/F PICO Diaphragm Pressure relief valve (Type-3) of PN12 Class, Hydraulically operated main valve in control circuit, high capacity filter with inspection glass and ball valve for manual drain, separate controller for adjustment of opening and closing speed, visual position indicator with seat and control insert made of stainless steel. All parts inside and outside epoxy coating. Material of construction include, Body with Ductile iron to EN-JS 1030 (GGG-40), stainless steel seat & control insert, EPDM rubber sealings and membrane and surface protection of inside and outside epoxy coating with minimum thickness of 250 microns (Singer make)., and giving required trial & run etc. complete the Job in all manner (including all necessary accessories required to finish the job).

Coupler shall be supplied after third party inspection by the agency approved and authorized by CMWSSB. Inspection charges shall be borne by the Concessionaire.

5.1.4 Control Unit at DMA entry- Automation With Control Valves and Communication Cable

1. **ITEM No. 1**

Single phase Power Supply (0.5 Kw) with energy meter cable security deposit for commercial use from distribution company

2. **ITEM No. 2**

Supply, Installation, Testing, Programming, Wiring & Commissioning of street site double encloser PLC panel

Specifications:

Supply, Installation, Testing, Programming, Wiring & Commissioning of street site double encloser PLC panel Made out of 2 MM C.R sheet, PLC Pannel with encloser size 800x700x2100mm Duel Powder coated, Floor standing, Front operated, complete with interconnection with copper wire and lugs having 24 V DC dual power supply, 10 inch HMI, Din Rail mount LIU,1 Port SAP 4 port Lane Ethernet Giga bite Switch . Having Type 2-1P+N 15kA Surge protection device- 1Nos ,32A 15KA MCB - 1 nos, DC powered with isolation Transformer, Transistor / Relay based 16DI, 20DO, 20 AI, 8 AO & Modbus chennal-10. Ambient air temperature upto 55 'C.10'' W touch Panel display having 2 ethernet,

USB host device 24VDC type- 1 Nos, 1 KVA online UPS with 3x65 AH battery bank (Make- Siemens, Schneider, Allen Bradly / Phoenix contact).

3. ITEM No. 3:- Providing Full Bore Electromagnetic Flow Meters.

Item includes:-

i. Excavation for fixing Flow meters in all types of soils & surfaces in all types of site conditions including drainage, dewatering, etc.

ii. Providing installing Electromagnetic Flow Meters with cost of accessories required. (Flow Meter are to be fixed for measurement of water flowing in & out of the distribution.

5.1.5 General Technical Specification & Conditions for Electromagnetic (Full bore) :-

1.1] CMWSSB has provided the size of pipe is indicative. The actual size, O.D.I.D., thickness shall be measured by Manufacture before supply of meter, any deviation and delay or damage cost due to non-fitting of meter shall be borne by Manufacture. The liquidity damage due to delay in fitting for wrong selection of fittings and accessories lies with Manufacture, It shall given pressure & flow.

1.2] If there is any problem with ovality of pipes after the pipes are cut, the Concessionaire as per the relevant standards shall jack up the pipes and the jointing work shall be carried out.

1.3] The Manufacture will have a full system of local offices in India and full service capability in the Metro-cities throughout the country. Full contact details for key personnel, both national and local shall be furnished on request. The supplier shall provide evidence of at least five years involvement in the manufacturing of meters worldwide.

1.4] The sensor / transmitter cables shall be capable of withstanding the climatic condition as applicable at site and should be weatherproof. The cable shall be installed in a suitable uPVC duct to minimize the risk of damage during excavations for other works. All the cable laid at a minimum depth of 0.5 m below the ground. Maximum length between the sensor & the transmitter shall not be more than that recommended by the meter Manufacture.

1.5] The transmitter shall operate so as to avoid loss of data in the event of temporary loss of electrical power supply and Concessionaire shall include of provision of maintenance free battery back up facility (8 hours duration) to cater for temporary loss of such power supply. The Concessionaire must allow for normal variations in mains electrical power parameters to be expected at site.

1.6] All the data loggers should be of the same type & make. i.e. they should

be compatible for all the meters supplied as part of this bid. The logger should be suitable for local conditions. Each signal transmitter should be provided with a appropriate dual channel flow & pressure logger of type approved by the client, with a data storage capacity of 120 days at 5 minutes logging interval. Logger shall be supplied with compatible communication leads from transmitters to loggers & loggers to portable download devices (hand held units / laptops) & GSM / WAP Mobile phone.

1.7] The loggers shall receive a compatible pulse or continuous output as appropriate from the transmitter. Appropriate software, of Windows type or similar software approved shall be included for downloading the flow on to a portable download device. The loggers shall have integral maintenance free batteries with a minimum of 10 years life, on continuous operation and rated not worse than IP68 protection. Pressure transducer should be of appropriate type with a pressure range of 5 m to 150 m with an accuracy of not less than + 1%. The logging interval should have a range of 1 second to 24 hrs.

1.8] The portable devices shall be compatible to the logger & flow meters for the purpose of retrieving data and resetting the data loggers / meter as part of this contract. The portable download devices should be simple to operate, robust in construction. The portable download devices should be compatible for downloading the data to a desktop or laptop computers. Supply of portable download devices also includes supply of necessary programming and communication leads for connection with data logger and desktop / laptop computers. All the necessary software for downloading of data from logger to portable devices & software for download of data from portable devices to laptop/ desktop computers to be provided by the Concessionaire.

1.9] The flow meter shall be supplied with compatible features for "Gateway for Remote Monitoring of flow meter via Web Browsers". The system should enable remote monitoring, remote diagnosis and remote configuration of connected HART sensors/actuators, either via telephone lines (analogue and ISDN), Ethernet TCP/IP and mobile communications (GSM). The measured data shall be web-compatible

1.10] All safety precaution with lighting protection shall be provided to all the flow meters, the failure / damage to flow meter for any reason for the warranty and period of annual maintenance contract shall be with Manufacture, hence, cost of insurance against all failure / damage (if any) shall be borne by Manufacture no additional payment will be made.

1.11] The sensor / transmitter of flow meter shall be capable of transmitting flow and pressure parameters. Display unit should be compatible to give flow and pressure data both.

1.12] The Electromagnetic meter shall be of with 10 years battery back-up. with data loger in built in it.

4. ITEM No. 4 : Providing Electric Operated Solenoid Valve Pilot Actuated

Specifications: Supplying, Fitting, fixing & Commissioning, of double chamber DI control valve of PN 1.6 ,hydraulic operated 24 V DC, solenoid control,IP68, integrated with PLC panel for operation (local / remote and web enabled with command and control) of make CLA/DOROT-300/Bermad-700 to control water supply including the cost of valve cutting the pipeline & making good to the damages including cost of all labours, T&P etc. all complete as per the direction of Engineer-in-charge.

5. ITEM No. 5 & 6:-

Providing, lowering , laying & fixing of EPDM Sluice Valves:-

The item includes – manually operated glandless, sluice valves, resilient seated with straight pocket less body passage with inside stem screw. Inside & outside epoxy powder coated (EP-P) with minimum thickness of 20µm.

1. Providing of sluice valve with EPDM rubber. The sluice valves shall confirm to ISO-7005-2 Series.

2. Fixing of sluice valve at the location as decided by the Engineer-in-charge during the execution.

3. Testing of sluice valve for water tightness in the same manner as described for mains.

4. Before fixing the valves, the base of the valve chamber/surface box shall be completed, though these chambers / surfaces are covered under separate items.

Specifications :-

Material

Body & Bonnet: Ductile Iron to IS 1865 Gr. 400/12 (GGG-40)

Wedge : Ductile Iron to IS 1865 Gr. 400/12 (GGG-40) fully vulcanized with EPDM Rubber GR W 270

Wedge : NBR 'O' rings in bronze

Bush Stem : Stainless steel to 1.4021

Stem nut : Brass Body, bonnet Gasket: EPDM

6. ITEM No. 7 & 8:- Pressure Gauge

Item includes:-

Providing & fixing pressure gauge at required point as directed by engineer-in-charge

Specifications :-

The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

7. ITEM No. 9 & 10:-

Pressure Transmitter for pure water pumping station

Item includes:-

Designing, Supplying, Installing, commissioning & testing of pressure transmitter pin type CE marked with following technical parameters at Raw Water Pump House and Interfacing with PLC panel including mounting arrangement.

Output 4-20 mA / HART, Power supply - 24V DC ext., Accuracy - +/- 0.1 % of full scale or better, Enclosure- IP 68 of Make (Krone/Force Marshal/Honey well/E&H/ Rose Mount/Danfoss/Wika)

IP 68 enclosure for Pressure Transmitter with tubing from the distribution system.

Specifications:

The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

8. ITEM No. 11

Communication data Transmission

Item includes:-

1. CABLE TRENCH: Excavation in unpaved areas of earth in work sites for conventional cable trenches for a depth upto 0.9 metres or bellow to the water Pipeline including backfilling the trench, job complete in all respects, including all labour and materials complete as per specification and directions of Site Engineer /Engineer-in-Charge.
2. Labour for cutting open road for laying 50mm HDPE pipe duct for FO cable/screen cable, including T&P - Concrete Roads
3. Labour for cutting open road for laying of 50mm HDPE pipe duct for FO cable/screen cable, including T&P - Bituminous Roads
4. HDPE PIPE: - PE 100 AS PER IS 4984/2016 / PN6 SDR-21, Supply and

Laying of 50MM dia HDPE pipe (Make: Supreme / equivalent) in cable trench as per specification and directions of Site Engineer / Engineer-in-Charge.

5. OFC: Supply and Laying of 12core unarmoured Optical fibre cable (OFC : fiber glass with F-G 62.5/125micron, 2.6DB/KM F600) to various sites through HDPE pipe, relaying testing of each cable drum for each fibre and taking the OTDR traces, submission of OTDR traces (in hard as well as soft copy) to Engineer-in-charge/ Site Engineer, blowing of OFC through previously laid HDPE, jointing / splicing of OFC, post installation testing of OFC for each fibre for each drum laid & taking OTDR traces, submission of OTDR traces (in hard as well as soft copy) to Engineer-in-charge/ Site Engineer as per the scope, specifications and directions of Engineer-in-charge/ Site Engineer.
6. Supply and Installation of OFC jointing kits as per drawings, specifications and directions of Engineer-in-charge/Site Engineer.
7. Supply and laying of pre-cast RCC Joint Box 600mm dia, depth 600 with Iid as per specification and directions of Site Engineer / Engineer-in Charge.
8. Supply, Installation and commissioning of copper Data cable system includes cables to be laid in soil, in trenches, cables to be laid in racks, cleated on walls, cable lugs, cables glands, conduits, cable joints etc.as per specification.2C x 1 sq.mm Make-(Lapp India)
   4C x 1 sq.mm Make-(Lapp India)

   6C x 1 sq.mm Make-(Lapp India)

   12C x 1 sq.mm Make-(Lapp India)

   24C x 1 sq.mm Make-(Lapp India)

   48C x 1 sq.mm Make-(Lapp India)

   Specifications: The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

5.1.6 Control Unit At Lane Sub Lane Entry- Automation With Control Valves and Communication Cable

1. Item No. 1& 2:- Communication interfaces RTUs

Item includes:-

RTU system shall have been neatly wired inside wall / pole mounted CRCA powder coated suitable for outdoor mounting. RTU system shall be protected from all ind of possible surges and must have required surge protection devices. RTU must be fully programmable as per IEC 61131-3 and it shall have MQTT or DNP3 built-in protocol support, RTU IO count shall have DI-8, DO-4, AI-4, RTU shall have capability of reading fast

digital pulses from flow meters. Ambient working temperature shall be 55 deg C for RTU & other components. System shall work under relative humidity upto 95% (Non-condensing). All required networking accessories must be included in the RTU system for LIVE data communication between the RTU panel and existing Linux kernel supported NIC Server via OFC. The data should be stored through an application in the server for monitoring and analysis of entire water network from various remote places. In case of OFC breakage, all data shall be recovered upon restoring of OFC.

Approved make:

- RTU-Phoenix/Schneider/Siemens,
- SPD-Phoenix/Dehn/Mersen
- Media Converter-Syrotech/Dlink/TP-Link
- Panel-Rittal/AEC/Werner
- Approved system provider:
- Dynamic Technologies / Automatech Electric Co / Visnave Automation

Installation, testing & commissioning for the RTU system at lane level, including cost of all labour, T&P etc., all complete.

Specifications:

The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

2. Item No. 3:- Installation of Globe valve, Mechanical flow meter and basket Strainer

Item includes:-

MS piping for installation of Globe valve, mechanical flow meter and basket strainer and fibre cover over the arrangement including cost of all materials, labour for fitting fixing T&P etc., all complete.

Specifications:

The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

3. Item No. 4&5 : Pressure Transmitter for pure water pumping station

Item includes:-

Designing, Supplying, Installing, commissioning & testing of pressure

transmitter pin type CE marked with following technical parameters at Raw Water Pump House and Interfacing with PLC panel including mounting arrangement.

Output 4-20 mA / HART, Power supply - 24V DC ext., Accuracy - +/- 0.1 % of full scale or better, Enclosure- IP 68 of Make (Krone/Force Marshal/Honey well/E&H/ Rose Mount/Danfoss/Wika)

IP 68 enclosure for Pressure Transmitter with tubing from the distribution system.

Specifications:

The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

5.1.7 Communication data Transmission

1. Item No. 1:. Valve Actuators Interfacing

ELECTRIC ACTUATOR FOR MOTORISED SLUICE VALVES

Concessionaire shall be responsible for supply, delivery, erection, installation, testing, trial for interfacing to valve actuators required for automatic control of existing sluice valves. It is responsibility of the Concessionaire to integrate these actuators with SCADA system by installing suitable PLC/DCS, transmitters, sensors etc for automatic control of Valves and as directed by engineer in charge.

Required transmitters, cables, hand wheels for emergency manual operation, wired on terminal blocks and including repairs and reconditioning the existing sluice valves etc. is the responsibility of Concessionaire. The existing Sluice valves are to be repaired / reconditioned and made fit for Electronic Actuators. The existing conditions may be verified in the field before tendering.

Local controls shall comprise push buttons for open close and stop operations

2. ITEM No. 2:- Pressure Gauge

Item includes:-

Providing & fixing pressure gauge at required point as directed by engineer-in-charge

Specifications :-

The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

3. **ITEM No.5**

Supply, Installation, Testing, Programming, Wiring & Commissioning of street site double encloser PLC panel

Specifications:

Supply, Installation, Testing, Programming, Wiring & Commissioning of street site double encloser PLC panel Made out of 2 MM C.R sheet, PLC Pannel with encloser size 800x700x2100mm Duely Powder coated, Floor standing, Front operated, complete with interconnection with copper wire and lugs having 24 V DC dual power supply, 10 inch HMI, Din Rail mount LIU,1 Port SAP 4 port Lane Ethernet Giga bite Switch . Having Type 2-1P+N 15kA Surge protection device- 1Nos ,32A 15KA MCB - 1 nos, DC powered with isolation Transformer, Transistor / Relay based 16DI, 20DO, 20 AI, 8 AO & Modbus chennal-10. Ambient air temperature upto 55 'C.10" W touch Panel display having 2 ethernet, Usb host & device 24VDC type- 1 Nos, 1 KVA online UPS with 3x65 AH battery bank (Make- Siemens, Schneider, Allen Bradly / Phoenix contact).

4. **Item No. 8 : Pressure Transmitter**

Item includes:-

Designing, Supplying, Installing, commissioning & testing of pressure transmitter pin type CE marked with following technical parameters at Raw Water Pump House and Interfacing with PLC panel including mounting arrangement.

Output 4-20 mA / HART, Power supply - 24V DC ext., Accuracy - +/- 0.1 % of full scale or better, Enclosure- IP 68 of Make (Krone/Force Marshal/Honey well/E&H/ Rose Mount/Danfoss/Wika)

IP 68 enclosure for Pressure Transmitter with tubing from the distribution system.

Specifications:

The different activities under this item shall be executed as per the corresponding specifications details in general specifications above.

5.1.8 Provision of MOV In pumping main, NRV.

1. **Item No. 1:. Valve Actuators Interfacing**

ELECTRIC ACTUATOR FOR MOTORISED SLUICE VALVES

Concessionaire shall be responsible for supply, delivery, erection, installation, testing, trial for interfacing to valve actuators required for automatic control of existing sluice valves. It is the responsibility of the Concessionaire to integrate these actuators with SCADA system by installing suitable PLC/DCS, transmitters, sensors etc for automatic

control of Valves and as directed by engineer in charge.

Required transmitters, cables, hand wheels for emergency manual operation, wired on terminal blocks and including repairs and reconditioning the existing sluice valves etc. is the responsibility of the Concessionaire. The existing Sluice valves are to be repaired / reconditioned and made fit for Electronic Actuators. The existing conditions may be verified in the field before tendering.

Local controls shall comprise push buttons for open close and stop operations

2. Item No. 2:. DI D/F Slanted seat Swing Check Valve

Supplying all materials, labour, t&p and fixing DI D/F Slanted seat Swing Check Valve in single piece body and body of ductile cast iron GGG-40 and dish of ductile cast iron GGG-40 with fully encapsulated and EPDM rubber where both faces can be used Electrostatic epoxy powder/ liquid coating (E.P-P) inside and outside colour blue RAL 5005 with minimum coating thickness of 250 microns. The EPDM rubber & epoxy powder should be approved for drinking water application, applied through fusion bonding process by dipping the shot-blasted casted components heated up to 200degree (face to face dimensions as per EN558-1, series 48 and flange connection as per EN 1092-2/2/15 1538**.**

3. ITEM No. 3 :-Laying of M.S. Cover Pipes below IRDP, Cement Concrete and Major Roads by Push on / HDD Method (Trenchless Technology) :-

The item includes

- Excavation for pit required at ends of push on pipe in all type of strata.
- Providing of M.S. casing pipe of required diameter and thickness.
- The cost involved for machineries of tools, tackles, fuels, lubricants, all labour charges and running expenses of machineries including thrust wall.
- Pushing through of casing and carrier pipe with cost of separator.

Specifications :-

Push through technique for crossing of pipeline across Railway track, Concrete roads, highway to be used shall be as follows as well as follow the latest technique prescribed by INDSTT (Indian society for trenchless Technology)

A. THRUST PIT :-

- An excavation pit of suitable size is excavated on any one

side of the proposed crossing.

- The Depth of excavation is kept according to the level of pipe required.
- P.C.C. is laid at the bottom of the thrust pit.

B. THRUST WALLS :-

- R. C.C. Thrust wall is designed to take the thrust during pushing.
- Jacks of suitable capacity are installed on the thrust wall.

C. LOWERING OF PIPES :-

- M.S. Pipes are now lowered on the thrust bed with required alignment and level. (First capsule)
- The length of pipe is kept according to the availability of working space.

D. PUSHING OF PIPE :-

- Pipe is pushed with the help of Jacks in the embankment. In one stroke usually the pipe is pushed for about 0.30 m depending upon strata of soil available.

E. MUCKING OF SOIL :-

- Once the pipe is pushed in the embankment the soil collected inside the pipe is manually collected and brought outside the thrust pit.

F. WELDING OF NEXT PIPT :-

- Once the pipe is pushed inside embankment (ie. First capsule) second pipe pieces is welded to the first pipe
- In this way one after the pipes are added and pushed in side.

G. RECEPTION PIT:-

- After completing the pushing of desired length, reception pit of required size is excavated at the other end of pipe to locate the pushed pipe. Necessary separator is to be provided between casing and carrier pipe

H. LAYING OF CARRIER PIPE :-

Once both ends of the casing pipe are opened then carrier pipe is laid inside the casing pipe by either pushing or pulling the pipes.

I. COMPLETATION OF JOB :-

The trust walls etc. constructed are dismantled before bank filling the thrust pit and the reception pit.

The work shall be carried out as per the direction of Engineer-in-charge. The M.S. pipes shall be laid minimum 2.00 m below the road surface. The pipes shall be water tight for the designed water pressure. One size bigger M.S. pipe shall be used as casing pipe, the minimum thick. of casing pipe should not be less than 12 mm. Necessary precautions shall be taken to avoid any damages to the public utility services. No damages to carriageway of IRDP, cement concrete and major road is allowed. Adequate precautions shall be taken to avoid any accident.

The rate is for the completion of item in all respect including cost of cover pipe but excluding carrier pipe, which will be paid in the respective item in BOQ.

5.1.9 Control Unit At WDS-SCADA & Automation With Control Valves and Communication Cable Including Server

1. Item no1 :- Supply, Installation & Commissioning of SCADA software

Supply, Installation & Commissioning of SCADA software with unlimited I/O (Make-Schiender / Simens / Fox) with Graphical processor visualization Advanced alarm management, historical and Real time trending, Built-in-reporting, Statical process control, Multithreaded citect VBA and Cicode programming language including supply, installations of Industrial PC with 500 GB SSD & 8 GB RAM (1 No. for Engineering station+ 1No. for operation station), UPS etc all complete Including license Key.

2. Item no2 :- Supply, Installation of PLC Pannel

Supply, Installation, Testing, Programming, Wiring & Commissioning of PLC panel Made out of 2 MM C.R sheet, PLC Pannel with encloser size 800x700x2100mm dual Powder coated, Floor standing, Front operated, complete with interconnection with copper wire and lugs having 24 V DC dual power supply, 10 inch HMI, Din Rail mount LIU,1 Port SAP 4 port Lane Ethernet Giga bite Switch. Having Type 2-1P+N 15kA Surge protection device- 1Nos ,32A 15KA MCB - 1 nos, DC powered with isolation Transformer, Transistor /Relay based 16DI, 20DO, 20 AI, 8 AO & Modbus chennal-10. Ambient air temperature upto 55 'C.10'' W touch Panel display having 2 ethernet, USB host device 24VDC type- 1 Nos (Make- Siemens, Schneider, Allen Bradly / Phoenix contact).

3. Item no3 :- Electromagnetic Flow Meter

Electromagnetic Flow Meter shall be a velocity sensing Electromagnetic type, microprocessor based signal converter, sealed housing, flanged tube meter for 1.0 Mpa working pressure, manufactured to highest standard available for mag-meters, equipped with minimum six digit digital totalizers,

reading indifferent units (Kilolitres / Cubic meter)and shall be accurate within 0.5% of Measured value, shall operate within a range of 0.3m/sec to 4m/sec and be constructed as follows: Meter tube(Sensor) shall be fabricated from stainless steel tube and use class PN10 flat face carbon steel flanges in accordance with IS 1538. These flanges shall be welded to the flow tube. The internal and external of the meter tube shall be blasted to near white and lined with hard rubber / Polyurethrene / PTFE preferably by SBR or EPDM. Meter tube shall have a constant nominal inside diameter offering no obstruction to the flow. The accuracy should be inclusive of linearity, hysteresis, repeatability, temperature and pressure effects. Coil Housing shall be fabricated from stainless steel (SS304) /Die cast Aluminium/Carbon steel with anticorrosive paint for corrosion resistance and welded to the tube providing a completely sealed environment for all coils, electrode connections and wiring harness capable of submerged or buried operation with IP68 Protection. Signal Converter shall be pulsed DC coil excitation type with auto zeroing. The signal converter shall be remotely mounted away from the meter. The converter shall indicate direction of flow and provide a flow rate indication and a total of flow volume for both forward and reverse directions. The converter shall provide an isolated 4-20mA out put into minimum 500-ohm load and a frequency output of a maximum of 0-10KHZ and a scaled pulse output. The micro processor based signal converter shall have a self-diagnostic test mode and a backlit display that continuously displays “Rate of Flow” and “Total Volume”. Converter shall be supplied with a programable low flow drop out, higher flow and empty pipe zero return. The signal converter housing should be die-cast aluminium with glass window. The converter cum transmitter should be fully programable from the front facia. The programming should be user friendly, self-prompting menu driven. Flow meter test calibration certificate from FCRI, flow test lab / NABL accredited lab to be furnished.

4. ITEM No. 4 : Providing Electric Operated Solenoid Valve Pilot Actuated

Specifications: Supplying, Fitting, fixing & Commissioning, of double chamber DI control valve of PN 1.6 ,hydraulic operated 24 V DC, solenoid control,IP68, integrated with PLC panel for operation (local / remote and web enabled with command and control) of make CLA/DOROT-300/Bermad-700 to control water supply including the cost of valve cutting the pipeline & making good to the damages including cost of all labours, T&P etc. all complete as per the direction of Engineer-in-charge.

5. ITEM No. 5:- Providing, lowering , laying & fixing of EPDM Sluice Valves:-

The item includes – manually operated glandless, sluice valves, resilient seated with straight pocket less body passage with inside stem screw. Inside & outside epoxy powder coated (EP-P) with minimum thickness of 20µm.

1. Providing of sluice valve with EPDM rubber. The sluice valves shall

confirm to ISO-7005-2 Series.

2. Fixing of sluice valve at the location as decided by the Engineer-in-charge during the execution.

3. Testing of sluice valve for water tightness in the same manner as described for mains.

4. Before fixing the valves, the base of the valve chamber/surface box shall be completed, though these chambers / surface are covered under separate items.

Specifications:-

Material-

Body & Bonnet : Ductile Iron to IS 1865 Gr. 400/12 (GGG-40)

Wedge : Ductile Iron to IS 1865 Gr. 400/12 (GGG-40) fully vulcanized with EPDM Rubber GR W 270

Wedge : NBR 'O' rings in bronze

Bush Stem : Stainless steel to 1.4021

Stem nut : Brass Body, bonnet Gasket: EPDM

The different activities under this item shall be executed as per the manufacturing specifications details.

Valve shall be supplied from the CMWSSB approved list (VAG, IVC) of the firms after third party inspection by the agency approved and authorized by CMWSSB inspection charges shall be borne by the Concessionaire

Provision for Transformer, Pump set as per OZ, VFD, MCC Pannel & DG set

1. Item No.1 :

Transformers of required configuration/ capacity as per BOQ dry type3 phase, outdoor distribution transformer with off load top changer as per IS 2026 (with all standard fitting and bi-directional rollers and accessories as per I.E. rules) and as per other detailed specification. The transformer shall be fixed on suitable plinth as per I.E. rules.

Power Transformers as per BOQ, dry type3 phase, 50 Hz, Natural self-cooled type Onan, core type with class "A" insulation, double wound with off load tape changer outdoor distribution transformer with accessories designed and manufactured with particular reference to tropical condition conforming to IS 1026: 1981 as per IE rules and as per detailed specification.

2. Item No.2: Pump Set

The pumps shall be high head single stage horizontally split casing type to facilitate easy inspection & maintenance. The pumps shall be designed to operate satisfactorily while handling a minimum suction lift of 4.0m from all causes. 3 Nos. of pump sets of required capacity at each location as mentioned in BOQ.

The pump shall be horizontally split with the suction and delivery branches cast INLINE on the bottom half of the casing. The top half should be constructed to allow easy dismantling. There by providing the facility of inspection and repair to the equipment without any difficulty.

The rotating elements of pumps will be dynamically balanced and over stressing should not occur due to sudden failure of power, Reverse rotation should not damage the pumps.

The pumps shall be so designed as to have a maximum flow capacity of not less than 110% of the rated flow capacity.

The pumps shall be designed for continuous operation at any point of head capacity curve between 50% & 110% of pump rates flow without under vibration or overheating.

The pumps shall be so designed as to have a stable non overloading characteristics, capacity head curve shall be continuously from shut-off point to operating point and shall be suitable for parallel operation of pumps without any haunting possibility. The shut-off head should not exceed 120% of duty point head.

The impeller adjustment shall be designed in such a way that impellers run free in any installed condition.

The pump shall be complete with suction pipe, foundation plate/sole plate and all other necessary accessories.

The pumps should generally comply with the requirement of following standard.

a. IS 1520-1980 : Horizontal Centrifugal Pumps for clear, cold and fresh water.

b. IS 5120-1977 : Technical requirement of Rotor Dynamic special purpose pumps.

SCHEDULE E: APPLICABLE PERMITS

Indicative list of approval is mentioned below, Concessionaire shall have to make assessment of applicable permits, approvals, clearances:

Applicable Permits

Both the Concessionaire and CMWSSB shall be individually responsible for obtaining various permits, authorizations and consents to enable them to carry out their duties.

Indicative list of such Applicable permits to be procured in respect of the Project would include the following:

a. Planning permissions
b. Public way-leaves that may be required from time to time
c. Building permits
d. Permission from Roads and Traffic departments
e. Permissions to enter public and industrial properties of end consumers (Resident Welfare Associations/ Society)
f. Right to use Electrical power
g. Vehicle and equipment licenses
h. Licenses to work during other than normal working hours
i. Licenses if any to operate water supply facilities
j. Health and Safety certificates
k. Fire certificate, if required
l. Approval from Labour Department

The permits stated at b, d, e, out of applicable permits shall be arranged by the CMWSSB.

Apart from the licenses and approvals stated above the Concessionaire shall be responsible to procure and maintain all such licenses as may be required from time to time during the execution of the works under this Agreement.

SCHEDULE F: 1. CONSTRUCTION PERIOD PERFORMANCE SECURITY

WHEREAS:

A. …… (the "**Concessionaire**") and …… (the "**Authority**") have entered into a Concession Agreement dated …….. (the "**Agreement**") whereby the Authority has agreed to the Concessionaire undertaking the development of ……basis (the "**Project**"), subject to and in accordance with the provisions of the Agreement.

B. The Agreement requires the Concessionaire to furnish a Performance Security to the Authority in a sum of Rs……. (Rupees …… crore) (the "**Guarantee Amount**") as security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the Construction Period (as defined in the Agreement).

C. We, …….. through our Branch at.....(the "**Bank**") have agreed to furnish this Bank Guarantee by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due performance of the concessionaire's obligations during the Construction period, under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon occurrence of any failure or default in due and faithful performance of all or any of the Concessionaire's obligations, under and in accordance with the provisions of the Agreement, on its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Concessionaire, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

2. A letter from the Authority, under the hand of an Officer not below the rank of Executive Director in the Authority, that the Concessionaire has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Concessionaire is in default in due and faithful performance of its obligations during the Construction Period under the Agreement and its decision that the Concessionaire is in default shall be final, and binding on the Bank, notwithstanding any differences between the Authority and the Concessionaire, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of

the Concessionaire for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Concessionaire and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Concessionaire before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfilment and/or performance of all or any of the obligations of the Concessionaire contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Concessionaire, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Concessionaire or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Agreement or for the fulfilment, compliance and/or performance of all or any of the obligations of the Concessionaire under the Agreement.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force in accordance with Article 9 of the Agreement.

8. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

9. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred Branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in

due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

10. This guarantee shall also be operational at our branch at _____, from whom, confirmation regarding the issue of this guarantee or extension/renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

11. This Guarantee shall come into force with immediate effect and shall remain in force and effect for a period of two years from the date hereof or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

Signed and sealed this …… day of …….., 20…… at ……..

SIGNED, SEALED AND DELIVERED
For and on behalf of the BANK by:

(Signature)
(Name) (Designation) (Code Number)
(Address)

NOTES:

(i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.

(ii) The address, telephone number and other details of the Head Office of the Bank as well as of issuing Branch should be mentioned on the covering letter of issuing Branch.

SCHEDULE F: 2. OPERATION PERIOD PERFORMANCE SECURITY

WHEREAS:

A. ……. (the "**Concessionaire**") and …… (the "**Authority**") have entered into a Concession Agreement dated …….. (the "**Agreement**") whereby the Authority has agreed to the Concessionaire undertaking the development of ……basis (the "**Project**"), subject to and in accordance with the provisions of the Agreement.

B. The Agreement requires the Concessionaire to furnish a Performance Security to the Authority in a sum of Rs……. (Rupees …… crore) (the "**Guarantee Amount**") as security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the Construction Period (as defined in the Agreement).

C. We, …….. through our Branch at.....(the "**Bank**") have agreed to furnish this Bank Guarantee by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due performance of the concessionaire's obligations during the Initial Operation period/Operation Period, under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon occurrence of any failure or default in due and faithful performance of all or any of the Concessionaire's obligations, under and in accordance with the provisions of the Agreement, on its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Concessionaire, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

2. A letter from the Authority, under the hand of an Officer not below the rank of Executive Director in the Authority, that the Concessionaire has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Concessionaire is in default in due and faithful performance of its obligations during the Construction Period under the Agreement and its decision that the Concessionaire is in default shall be final, and binding on the Bank, notwithstanding any differences between the Authority and the Concessionaire, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of

the Concessionaire for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Concessionaire and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Concessionaire before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfilment and/or performance of all or any of the obligations of the Concessionaire contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Concessionaire, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Concessionaire or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Agreement or for the fulfilment, compliance and/or performance of all or any of the obligations of the Concessionaire under the Agreement.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force in accordance with Article 9 of the Agreement.

8. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

9. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred Branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in

due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

10. This guarantee shall also be operational at our branch at _____, from whom, confirmation regarding the issue of this guarantee or extension/renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

11. This Guarantee shall come into force with immediate effect and shall remain in force and effect for a period of two years from the date hereof or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

Signed and sealed this …… day of …….., 20…… at ……..

SIGNED, SEALED AND DELIVERED
For and on behalf of the BANK by:

(Signature)
(Name) (Designation) (Code Number)
(Address)

NOTES:

(i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.

(ii) The address, telephone number and other details of the Head Office of the Bank as well as of issuing Branch should be mentioned on the covering letter of issuing Branch.

SCHEDULE G: PROJECT COMPLETION SCHEDULE

To be added

SCHEDULE H: DRAWINGS

1. **Drawings**
   In compliance of the obligations set forth in Article 12.2 of this Agreement, the Concessionaire shall furnish to the Independent Engineer, free of cost, all Drawings listed in Para 3 of this Schedule-H.

2. **Additional drawings**
   If the Independent Engineer determines that for discharging its duties and functions under this Agreement, it requires any drawings other than those listed in Para, it may by notice require the Concessionaire to prepare and furnish such drawings forthwith. Upon receiving a requisition to this effect, the Concessionaire shall promptly prepare and furnish such drawings to the Independent Engineer, as if such drawings formed part of Para 3 of this Schedule-H.

3. **List of Drawings**

   a. Project Area Map (Palipattu & Thiruvanmiyur WDS)

   b. Palipattu WDS Map

   c. Thiruvanmiyur WDS Map

   d. Network Drawing / Map of Operational Zones / Depots

(Schedule-H)

ANNEXURE 1: TABLE OF CONTENTS FOR DETAILED PROJECT REPORT (DPR)

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ANNEXURE 20 – NETWORK DRAWING OF OZ/DEPOTS

SCHEDULE I: TESTS

1. Schedule of Tests

1.1. The Concessionaire shall, no later than 30 (thirty) days prior to the likely completion of the Project, notify the Independent Engineer and the Authority of its intent to subject the Project to Tests, and no later than 7 (seven) days prior to the actual date of Tests, furnish to the Independent Engineer and the Authority detailed inventory and particulars of all works and equipment forming part of the Project.

1.2. The Concessionaire shall notify the Independent Engineer of its readiness to subject the Project to Tests at any time after 7 (seven) days from the date of such notice, and upon receipt of such notice, the Independent Engineer shall, in consultation with the Concessionaire, determine the date and time for each Test and notify the same to the Authority who may designate its representative to witness the Tests. The Independent Engineer shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with Article 14 and this Schedule-I.

2. Tests

2.1. In pursuance of the provisions of Article 14.1.2 of this Agreement, the Independent Engineer shall conduct, or cause to be conducted, the Tests specified in this Paragraph 2.

2.2. Visual and physical Test: The Independent Engineer shall conduct a visual and physical check of the Project to determine that all works and equipment forming part thereof conform to the provisions of this Agreement.

2.3. Asset or Equipment Specific Tests: The Independent Engineer may require the Concessionaire to carry out or cause to be carried additional Tests, in accordance with Good Industry Practice, for determining the compliance of the Project with Specifications and Standards.

3. Agency for conducting Tests

All Tests set forth in this Schedule-I shall be conducted by the Independent Engineer or such other agency or person as it may specify in consultation with the Authority.

4. Completion/Provisional Certificate

Upon successful completion of Tests, the Independent Engineer shall issue the Completion Certificate or the Provisional Certificate, as the case may be, in accordance with the provisions of Article 14.

5. Tests during construction

Without prejudice to the provisions of this Schedule-I, tests during construction shall be conducted In accordance with the provisions of Article 13.3.1.

SCHEDULE J: COMPLETION CERTIFICATE

FORMAT OF COMPLETION CERTIFICATE

1 I/We,…….. (Name of the Independent Engineer), acting as Independent Engineer, under and in accordance with the Concession Agreement dated ……..(the "Agreement"), for _____ on Hybrid Annuity Model Project (the "Project") on design, build, operate and transfer (the "DBFOT Annuity or Hybrid Annuity") basis, through……(Name of Concessionaire), hereby certify that the Tests specified in Article 14 and Schedule I of the Agreement have been successfully undertaken to determine compliance of the Project with the provisions of the Agreement, and I/We am/are satisfied that the Project can be safely and reliably placed in commercial service of the Users thereof.

2 It is certified that, in terms of the aforesaid Agreement, all works forming part of the Project have been completed, and the Project is hereby declared fit for entry into commercial operation on this the day of _____

SIGNED, SEALED AND DELIVERED
For and on behalf of
INDEPENDENT ENGINEER by:

(Signature)
(Name)
(Designation)
(Address)

FORMAT OF PROVISIONAL CERTIFICATE

1 I/We,…… (Name of the Independent Engineer), acting as Independent Engineer, under and in accordance with the Concession Agreement Dated…… (the "Agreement"), for development and operation of the _____ on Hybrid Annuity Mode (the "Project") on design, build, operate and transfer (the "DBFOT Annuity or Hybrid Annuity") basis through……(Name of Concessionaire), hereby certify that the Tests specified in Article 14 and Schedule-I of the Agreement have been undertaken for the Project/section…….. of the Project to determine compliance thereof with the provisions of the Agreement.

2 Construction Works forming part of the Project/section of the Project that were found to be incomplete and/or deficient have been specified in the Punch List appended hereto, and the Concessionaire has agreed and accepted that it shall complete and/or rectify all such works in the time and manner set forth in the Agreement. Some of the incomplete works have been delayed as a result of reasons attributable to the Authority or due to Force Majeure and the Provisional Certificate cannot be withheld on this account. Though the remaining incomplete works have been delayed as a result of reasons attributable to the Concessionaire,[1] I/We am/are satisfied that having regard to the nature and extent of such incomplete works, it would not be prudent to withhold commercial operation of the Project/section…….. of the Project, pending completion thereof.

3 In view of the foregoing, I/We am/are satisfied that the Project/section of the Project can be safely and reliably placed in commercial service of the Users thereof, and in terms of the Agreement, the Project/section of the Project is hereby provisionally declared fit for entry into commercial operation on this the …… day of…… 20

ACCEPTED, SIGNED, SEALED AND DELIVERED	**SIGNED, SEALED AND DELIVERED**
FOR AND ON BEHALF OF	FOR AND ON BEHALF OF
CONCESSIONAIRE by:	**INDEPENDENT ENGINEER by:**
(Signature)	(Signature)
(Name and Designation)	(Name and Signature)
(Address)	(Address)

[1] May be struck out if not applicable. Also strike out other parts which are not applicable.

SCHEDULE K: MAINTENANCE REQUIREMENTS

The Concessionaire shall perform all the obligations under the Agreement with utmost care, effective and efficient and adapt the best practices in all operations and maintenance activities in accordance to the industry standards and in confirmation to the guidelines provided in the Manual on Water Supply and Treatment and the Manual on Operations and Maintenance of Water Supply Schemes published and amended from time to time by CPHEEO, Government of India.

The Concessionaire shall undertake the operations and maintenance activities including but not limited to the tasks detailed herein as General O & M requirements & Specific O & M requirements.

1. **General requirements:-**

- **Operating Functions**

Basic Operating Functions

Area of Operations	**Key Operating Functions**
Pumping Systems & BPS	▪ Conduct routine O&M ▪ Facility management ▪ Asset maintenance ▪ Flow and pressure monitoring
Storage and Distribution	▪ Conduct routine O&M ▪ Valve inspection ▪ Compliance monitoring for pressure and quality ▪ Flow monitoring ▪ Leak detection and repair ▪ Storage tank inspection ▪ Repairs, rehabilitation, expansion of networks ▪ Replacement of assets as per maintenance schedule

Consumer services	▪ Install new connections ▪ Conduct meter installations ▪ Meter reading ▪ Billing and collection ▪ Consumer complaints redressal, and monitor Consumer satisfaction ▪ Debt management
Water Safety	▪ Water safety plan ▪ Monitoring water quality
Administration	▪ Planning and coordination with other authorities ▪ Procurement of materials, works and services ▪ Project Management and supervision ▪ Accounts and financial management, and training ▪ Information recording and management ▪ Regulatory reporting ▪ Water Meter Test Bench ▪ Stores and Inventory Management

In the above table, the key basic operating functions are only listed and there are many more routine O&M functions which the Concessionaire has to undertake at different time frequencies.

Asset Replacement

The general asset replacement schedule is shown in the following Table. **Asset Replacement Schedule**

Item	**Scheduled Replacement**
Painting of Buildings and OHTs, Pumping Machinery	Once in [3] years
Electrical Motors	Once in [15] years or as and when required

Chlorination Equipment	Once in [5] years or as and when required
Instruments	Once in [5] years or as and when required
Pipe lines	As and when required
Valves	As and when required
Bulk Meters and Pressure Loggers	Once in [5] years or as and when required
Consumer Meters	Once in [4] years or as and when required
Computers Hard Wares and Software	Once in [3] years or as and when required

Preventive Maintenance

The preventive maintenance tasks generally required in O&M of distribution systems are given in the following Table. Chart Indicating Preventive Maintenance Schedule

Component	**Daily Maintenance Tasks**
Chlorination	Routine Maintenance ▪ Check leakage of Chlorine ▪ Cleaning of chemical deposits ▪ Check fuses and contacts ▪ Check dosing pumps ▪ Check condition of safety equipment
Pipelines	Routine Maintenance Check residual chlorine - weekly Surveillance for leakage – pipe breaks and leaks - Daily Pipe flushing once in 6 months Swabbing and scraping once in three years

Valves	Routine Maintenance (C) Sluice valve and Knife gate valve ▪ Check gland packing of the valve at least once in a month. ▪ Ensure that packings inside the stuffing box are in good trim and impregnated with grease.
	▪ If necessary, change the packing as often as necessary to ensure that the leakage is within limit. ▪ Grease should be applied to reduction gears and grease lubricated thrust bearing once in three months. ▪ Check tight closure of the valve once in 3 months. ▪ A valve normally kept open or closed should be operated once every three months to full travel of gate and any jamming developed due to long disuse shall be freed. ▪ Inspect the valve thoroughly for flaws in guide channel, guide lugs, spindle, spindle nut, stuffing box etc. once in a year. ▪ Do not operate with oversize hand wheel or cap or spanner. ▪ Do not operate under throttled i.e. partially open condition (B) Reflux (non-return) valve

	▪ Check proper operation of hinged door and tight closure under no-flow condition once in 3 months. ▪ The valve shall be thoroughly inspected annually. ▪ Condition of dampening arrangement should be thoroughly examined once in year ▪ In case of dampening arrangement, check for oil leakage and replace oil once in a year. (D) Butterfly Valve ▪ Check seal ring and tight shut-off once in 3 months. ▪ Lubricate gearing arrangement and bearing once in 3 months. ▪ Inspect the valve thoroughly including complete operations once in a year. ▪ Change oil or grease in gearing arrangement once in a year.
Connections	Routine Maintenance
Water Meters & Test Bench	Routine Maintenance ▪ Check for meter accuracy – once in 6 months or as per requirement ▪ Replace Consumer meters – once in 5 years ▪ Replace bulk meters – once in 5 years

2. Specific O & M Requirements

Specific O & M requirements to be performed by the Concessionaire are described as following: -

2.1 General Provisions

The Schedule 1 incorporates the mandatory requirements of CMWSSB regarding Operation & maintenance of distribution system of the project area (Pallipattu WDS & Thiruvanmiyiur WDS). O & M will be carried out by the Concessionaire as per General Conditions of contract or Concessionaire's O & M manual as approved by CMWSSB.

O & M plan which shall meet the CMWSSB requirements as stipulated in Schedule 1 as General and specific O & M requirements. The detailed O

& M manual improved over the requirements given in Schedule 1 shall be prepared by Concessionaire within 3 months from the date of handing over of the distribution system.

4.2 Concessionaire's obligation

4.2.1 General Obligations

The Concessionaire shall have the following general obligations as they may be applicable during the term of the Contract .

(i) The Concessionaire shall perform the Services in accordance with this Contract, and carry out its obligations with all due diligence, efficiency, and economy, in accordance with generally accepted professional techniques and international best practices, and shall observe sound management principles, and employ appropriate advanced technology and safe methods. The Concessionaire shall always act in good faith, in respect of any matter relating to this Contract ' or to the Services, to the CMWSSB and shall at all times support and safeguard the CMWSSB's legitimate interest in any dealings with the Customers, sub-Concessionaires or third parties;

(ii) The Concessionaire shall ensure that all materials and workmanship used in the course of the Contract shall be in accordance with the standard specifications. In absence of and appropriate specification, in accordance with the Indian National Standards or the International Standards Organisation as the case may be.

(iii) The Concessionaire shall develop, install, commission and maintain efficient and effective Integrated Information' Management System (IIMS) comprising of all management needs including customer contact management, commercial services including billing, collection, debt management, new connections, disconnections, reconnections, consumption and flow monitoring, demand management, financial management, asset management, inventory management, human resources management, monitoring .of operating efficiency etc complete as' required for efficient and effective operations and management of the water supply services.

(iv) Pursuant to Clause 27.1 of General Conditions , the Concessionaire shall establish and operate a 24-hour customer service centre to carry out the functions of customer relations, support and complaints in terms of this Contract including but not limited to response and redressal of complaints concerning leakages in the distribution system, water reduction, water quality, low

pressure, and provide assistance in imparting education concerning use of water supply, installation of new connection, water usage and plumbing. The customer service centre should be operational during all times of year round the clock with appropriate staff.

Open House Quarterly Meeting: -

i. Public Grievances Redressal / Open House Quarterly Meetings shall be conducted by the Concessionaire for public to discuss the water related issues and to aware about water conservation..

ii. Public, all Voluntary Organisations, Consumer Action Groups, Residents Associations & Representatives of all other concerned Interested Groups working in the city shall be invited for the meeting through press release.

iii. Open House Meeting shall enable the participant public/ customers to interact with the Concessionaire to present their grievances as well as sharing and contributing in the decision making by offering opinion/advice and suggestions for system improvement wherever necessary.

iv. Minutes for the Open House Meetings shall be prepared and redressal of petitions / complaints received in the Open House Meeting shall be registered & monitored.

v. The Concessionaire shall install Customer metering on all points of Customer supply and randomly check the calibration of meters installed for accurate reading to establish accurate water balance and monitor water losses;

vi. The Concessionaire shall supply water to CMWSSB properties with metered connection

vii. The Concessionaire shall permit the persons appointed and / or authorised by the CMWSSB to conduct. time to time audit of accounts and records of the Concessionaire relating to performance of the Concessionaire under the Contract after the Appointed Date subject to receipt of prior written intimation from the CMWSSB in this regard and shall fully co-operate with such auditors in the conduct of audit and review exercises and checks and shall provide all requested information to the auditors;

viii. The Concessionaire shall on a periodical basis update the record of Facilities.

ix. Neither the Concessionaire nor its employees shall indulge, either directly or indirectly, in any of the following activities:

(i) during the term of this Contract, any business or professional which would conflict with the activities

assigned to them under this Contract;

(ii) NA

(g) The Concessionaire shall undertake the measures as agreed under the Emergency Procedures as per para 5.1 herein in times of operational exigencies.

i. Any complaints received from the consumer/ CMWSSB shall be recorded and the appropriate remedial measures shall be effectively implemented to the satisfaction of the CMWSSB duly documented.

ii. Any leakages observed in the distribution line, rising main and feeder main shall be attended immediately and water supply restored within 12 Hours of the receipt of complaint for leakage.

iii. The billing and collection of water revenue shall be ensured as per the performance targets during the entire term of contract.

iv. The Concessionaire shall be responsible to maintain required quantities of spares for preventive maintenance, periodical maintenance and breakdown maintenance as enlisted hereafter in this document. The Concessionaire must also keep the minimum stock of spares for emergency repairs as required for prudent operational practices.

2.2.2 Specific Obligations of the Concessionaire for Operations & Maintenance

The Concessionaire shall have the following obligations:

a) Review of operating and maintenance manuals if any, prepared by the Original Construction Concessionaire (OCC), spare parts lists, recommended spares , warranty period from equipment suppliers and connected matters;

b) identifying and procuring laboratory and workshop equipment and capital spares as may be required, at his cost.

c) select suitably qualified Suppliers of Spares, Consumables, Chemicals and the external Concessionaires required during Operations.

d) Set up a fully functional office with computers, personnel, equipment, furniture and communications and 24-hour customer service desk at convenient locations as per the General Conditions of the Contract.

e) The Concessionaire shall assist the CMWSSB in evaluating and verifying the reasonableness of the Operations and Maintenance Plan and answer all queries, explain the assumptions, projections, calculations etc. and shall make available all the concerned staff who had prepared the respective plans.

f) Notwithstanding the above obligations the Concessionaire shall have the following obligations during Operation & Maintenance

g) Provide prudent management, operation and maintenance services as per the prescribed-standards of performance;

h) Undertake efficient demand management and meet the entire demand for water as required during the time of operation;

i) Comply with Performance Standards at all times, in accordance with the terms of the Contract;

j) Undertake customer commercial services including reading meters, raising invoices for services, giving water connections, disconnecting defaulters, reconnecting as per the general conditions of contract.

k) Manage and maintain the Integrated Management Information System (IMIS) to ensure efficient and transparent information, record keeping, financial management and accounting and decision making. Under IMIS, set up a robust integrated information system comprising of the following areas:

- technical services such as service levels of water quality, consumption, pressure, losses, monthly real time water balance;
- commercial services such as customer contact, complaint redressal, customer consumption, billing, revenue collection, debt management;
- business services comprising accounts, financial management, procurement, inventory management and human resource management;
- Hydraulic network Modeling:- A hydraulic network model representing the WDS wise water supply system shall be developed using suitable software such as Water GEMS. The model shall be calibrated, reconciled and established and fully functional for continuous updating for management of the system;
- Asset Management Program including covering each type and category of asset, its servicing schedule, replacement frequency, etc. for all assets in water system including but not limited to:-

    (A) Valve inspections

    (B) Tank inspections

    (C) Pipeline inspections

    (D) Leak detection process

    (E) Preventive maintenance of all mechanical,

electrical and instrumentation equipment

(vii) Set up operating and maintenance procedures for each of the unit operation including Standard Operating Procedures, Standard Maintenance Procedures, Emergency Procedures, Health and Safety Procedures etc incorporating Original Construction Concessionaire's Operating and Maintenance Manuals;

l) Maintain effective and efficient customer complaints redressal system, at the prescribed performance standards;

m) Undertake timely and cost effective asset management program;

n) Maintain the automated water quality surveillance system;

o) Operate and maintain all mechanical, electrical, instrumentation and information technology installations, equipment, machinery etc as per the respective standard operating and maintenance procedures;

p) Undertake preventive and breakdown maintenance for all pipelines, appurtenances, mechanical, electrical and instrumentation equipment in relation to the above referred Facilities, along with appropriate documentation to facilitate warranty and insurance claims, if required;

q) Ensure effective and efficient planning, procurement and inventory management for all spares, chemicals, consumables etc;

r) Provide robust security arrangements for all the facilities within the scope of this project, including restriction of entry of unauthorised persons;

s) To organize for monthly reading of customer meters, consumption, updating the records, preparing a bill based on the water tariff fixed by CMWSSB from time to time and issuance of bill to the customers in the prescribed time;

t) To collect the revenue through cash, cheques, demand drafts, electronic clearing services etc and issue receipts of acknowledgement for payment to the customers on behalf of CMWSSB;

u) To remit cash, cheques and all other forms of payment collected into the designated accounts of CMWSSB within 12:00 hours of the next business day with appropriate reconciliation accounting system;

v) To prepare monthly accounts of demand, collection and balance and report to CMWSSB on the revenue management;

w) Manage and maintain the water distribution management

system (WDMS) for the entire water supply in the project area, including all pumping stations, water and storage facilities, flow measurement and quality surveillance systems etc. complete;

x) Comply with all relevant local laws including environmental, industrial and labour laws;

y) Maintain healthy working relations with all stakeholders including the customers, Water resources department, Chennai Metro Water Supply & Sewerage Board, Greater Municipal Corporation of Chennai (GCC), State Pollution Control Board, and power utilities; etc.

z) Maintain detailed documentation and prepare periodical reports including monthly, quarterly and yearly reports for submission to CMWSSB including data on quality of raw and treated water, leakage levels, flow and pressure of water at designated check points, service level, billing, collection, debt management etc. complete as set out in.

aa) Submit Monthly invoices to CMWSSB including accounts receivable, adjustment for errors in billing, accounting for realization and generation of overdue receivables;

bb) Training of the operating personnel from CMWSSB or any other designated authority for taking over the system at the end of Contract Term;

cc) To undertake emergency chlorination measures at times of outbreak of epidemics and any such emergency situations;

dd) Rectify all defects attributable to the Concessionaire and notify the CMWSSB of defects, developed within defect liability period of the commissioned components of Water supply system;

ee) Follow all reporting requirements;

ff) Maintain the Performance Indicators, Quality Assurance, Safe Operation Procedures (SOP_S);

gg) To summarize, the services provided by the Concessionaire shall include the following:

- Operation of all Facilities;
- Provision for 24 hours a day operation and emergency cover;
- Maintenance of all the Facilities;
- Ground and buildings maintenance;
- Unscheduled and emergency maintenance;
- Responding to customer enquiries;
- New service connection surveys and estimates;

- Making new service connections;
- Investigation of illegal connections and disconnections;
- Responding to requests from utilities and others for water supply lines;
- Quality control and assurance;
- Data collection and reporting;
- Holding emergency exercises;
- Incident management;
- Safety inspections;
- Supervision of sub-contractors, enforcement of specifications;
- Operational liaison;
- Updating of the IMIS;
- Preparation of all plans, procedures and budgets relating to operational matters, as required within the Contract.
- Any other work necessary to ensure the continued operation and availability of the system.

hh) Maintenance Work for the pumping stations/ BPS is divided into four categories Preventive, Corrective, Replacement, Minimal Maintenance;

ii) Preventative maintenance (PM) is defined as those maintenance procedures that are implemented repetitively at regular interval. The works carried out shall consist but not be limited to:

- Greasing, oil changing, provide fuel, distilled water, recharging gas;
- Cleaning from dust, mud and sediments, testing, calibrating, checking of tightness of all connections, general cleaning for the body, charging, cleaning filters;
- Check gauges, adjust gland-packing and repair or replace if required;
- Replace worn-out drain lines, fittings replace fuses, bulbs and similar, if required;
- Inspecting all fans, compressors, motors wiring, switches, controls, protection devices;
- Check for correct operation;

Any other related works in accordance with manufacturer specifications and instructions.

jj) Corrective Maintenance is defined as those maintenance works performed to repair parts to correct the situations. The works carried shall include but not be limited to:

- Dismantle the unit;
- Check the body (casing) and covers and clean it. If the casing is corroded, the Concessionaire shall submit the filling material, coat it with suitable paint to the CMWSSB's approval;
- Check all connections and fittings and repair the corroded and closed fitting wherever needed;
- Clearance work should be to the manufacturer instructions and specifications. If the clearance is above the range, the Concessionaire shall replace wearing and any other fittings or materials to keep the unit in its range;
- All wearable parts such as gland packing, packing bushes, oil seals, O-rings, gaskets, rubber parts, fuses, bulbs shall be replaced;
- Repair the part which is needed to be repaired according to the work orders;
- Assemble the unit and check for proper operation;
- Any other related works in accordance with the manufacturer specifications and instructions.

kk) Replacement Maintenance is defined as those maintenance works applied in response to situation that cause equipment to be out of service and beyond repair.

ll) Minimal Maintenance comprises a suitably qualified person visiting a pumping station and carrying out an inspection possibly with basic items of maintenance such as greasing and bulb changing. Such work can be expected to be completed by one person, within an hour.

mm)All instruments shall be maintained, checked, calibrated and serviced periodically and will always be kept in operating condition. The calibration shall be checked whenever necessary and corrected. Calibration data shall be submitted to the CMWSSB for approval. As a minimum, all instruments shall be calibrated once per year.

nn) For the purpose of complying with the requirements of this contract, the Concessionaire will need to provide.:

i) An adequate and skilled workforce, supervisors, managers and

technical support staff;

ii) Administrative and financial support staff and computer and business support systems;

iii) All necessary mobile plant and equipment, vehicles and incidental equipment;

iv) Health and Safety equipment and staff protective clothing as well as traffic and footpath barriers and signs;

v) Necessary chemicals and fuel;

vi) Stores suitably stocked with adequate spare parts and replenished within a store policy that recognizes frequency of use and delivery periods;

vii) Suitable depot and office premises.

oo) The Concessionaire shall carry out the complete cleaning & disinfection of ground service reservoirs, master balancing reservoirs etc. once in a year.

pp) The Concessionaire shall carry out operation and maintenance of meter testing facilities.

2.2.3 Standard Operating Procedures (SOP)

Operating Instructions and Safe Operating Procedures (SOP) shall be formulated for each Site comprising of process equipment schedules, operation & maintenance data, sampling and analysis with frequencies etc. The operating parameters shall be optimized based on the data collected on commissioning of the facilities. All the activities in the preventive maintenance schedule shall be followed without any lapse. Indicative functions that are expected to be performed at each site are given below:

Water Supply:

Water pumping stations/ BPS and transmission main

(l) Check operation of all pumps

(m) Take all relevant meter readings

(n) To ensure compliance with agreed withdrawals and to bring to notice of the CMWSSB any excess or short withdrawal

(o) Check operation of all valves along the transmission main

(p) Flow and pressure measurement

(q) Checking operations of electrical & mechanical equipment

(r) Check the power factor and power consumption

Feeder main pumping Stations

(a) Inspect the overflow devices

(b) Check operation of all pumps

(c) Take all meter readings at such times of the day, as agreed with the CMWSSB

(d) Check distribution of flows **to** feeder mains

(e) Checking operations of electrical & mechanical equipment

Supply Network

(a) Take all relevant meter, flow and pressure readings

(b) Check operation of all equipment

(c) Periodically check water meters, test bench and take readings

(d) Check for Chlorine residual, flow and pressure at the Critical Measurement Points (CMPs)

(e) Checking operations of electrical & mechanical equipment

3 Maintenance and Repairs (Mechanical, Electrical and Instrumentation)

3.1 Management and Maintenance Plan

A properly designed water system shall be capable of delivering desired output at all times. Considering that every mechanical system shall have to be given a downtime for maintenance purposes, the Concessionaire shall schedule a plant downtime of one hundred twenty hours, on a cumulative basis in a year for the facilities in consultation with the CMWSSB so as to minimize disruption in services.

(A) Routine inspection and maintenance of all equipment;

(B) Planned and scheduled maintenance (preventive);

(C) Unscheduled maintenance (breakdown);

(D) Cost and budget planning.

3.2 Routine Inspection and Maintenance of Equipment

The Concessionaire shall carry out routine monitoring of the equipment and ensure that the equipment is properly maintained to meet the desired output. Typical tasks that shall be undertaken are :

(A) Mechanical

(a) Checking the lubrication and necessary follow-up

(b) Replacing of glands that are leaking

(c) Servicing as per supplier's instructions

(d) Stripping down of pumps to observe clogging if any

(e) Checking for unusual vibrations and noise

(B) Electrical

(a) Checking electrical contacts and wiring

(b) Checking motor heating and noise level

(c) Assessing efficiency of electrical equipment

(C) Instrumentation

(a) Cleaning and calibration of probe **/** sensors

(b) Fault diagnosis

These maintenance tasks shall be issued on a weekly basis through computer aided management system and the Concessionaire shall incorporate it in operating work schedule. All observations shall be recorded in the properly designed record system and would be analyzed for initiating corrective actions, if any.

3.3 Planned and Scheduled Maintenance (Preventive)

A work schedule chart listing identification of critical equipment, work assignment, timing shall be prepared. Critical equipment is defined as those items where failure would adversely affect the quality and quantity of output or those that risk the safety of employees or customers. The schedule shall identify the responsible person / agency who shall be intended to complete the task e.g. in - house technician or specialist Concessionaire etc.

The overall yearly plan schedule shall be issued to all parties to enable forward planning of anticipated manpower requirement and equipment down time. The indicative maintenance schedule is provided further in the following table. This shall be finalised during the preparation of the Operation and Maintenance Plan.

3.4 Breakdown Maintenance

The aim of routine and preventive maintenance is to keep breakdown to minimum for items of critical equipment which shall directly affect the performance of treatment processes. However certain breakdown may occur in spite of proper maintenance. The Concessionaire shall take the

breakdown maintenance on top priority to keep disruption to the systems at a minimum level.

The Concessionaire shall have an option to call other available staff and also the services of the local skilled Concessionaires should the breakdown occur.

3.5 Spare Parts

The Concessionaire shall store spares of all the critical equipment on respective sites and the inventory shall be assessed according to anticipated usage and in conformity with Annual Operating and Maintenance Plan and Annual Budget.

The Concessionaire shall obtain consumable items required for maintenance e.g. grease, gaskets etc. from local suppliers, as and when required.

Annual reports on the cost of replacement spare/million litre of water supplied shall be provided to the CMWSSB, for the purpose of monitoring usage and cost control.

3.6 Maintenance Report

To assist the Concessionaire in the management of the maintenance activities, a Computer Aided Maintenance Management (CAMM) shall be implemented by the Concessionaire which shall be integrated with the IMIS system. Appropriate proprietary CAMM packages shall be utilized by the Concessionaire for maintenance purposes. This package shall incorporate features such as Facility details, maintenance history records, and scheduling of maintenance activities. The use of such package shall allow the Concessionaire to predict when the maintenance activities need to be carried out.

Record of maintenance jobs carried out shall be reported in the record system, which shall provide the CMWSSB the past history, time and cost involved for each category. The report shall include:

(a) Details of number of jobs completed

(b) Frequency of breakdown, time required repairing and costs involved.

(c) Personnel involved / Concessionaires used

Input data along with the base data and license, if assignable, would be made available to the CMWSSB.

4 Emergency Action Plan

4.1 Emergency Action Plan

The Concessionaire shall provide the Emergency Plan of Action , as per the following:

(i) The CMWSSB may, at its election, intercede and take, or direct the Concessionaire to take, any and all actions reasonably necessary to respond to an Emergency.

(ii) The Concessionaire shall, upon learning of an Emergency or the probable occurrence of an Emergency, (1) immediately provide oral notice to the CMWSSB or its Authorized Representative of the same and (2) as soon as possible, but no later than twelve (12) hours, provide Notice to the CMWSSB or its Authorized Representative of such event or probable event; provided however, if Applicable Law shall provide for a more expeditious oral or written notice of any Emergency to the CMWSSB, the Concessionaire shall so comply by providing such notice to the CMWSSB or its Authorized Representative.

(iii) The CMWSSB and Concessionaire or their Authorized Representatives shall coordinate with each another prior to, during and after the occurrence of an Emergency including 1) the planning and implementation of actions designed to prevent or mitigate damage to the System and the environment and (2) the attendance of all meetings related to such planning and implementation.

(iv) The Concessionaire shall interact and cooperate with appropriate departments of the public entities comprising the CMWSSB and other jurisdictions.

(v) The Concessionaire shall supply standby employees from normal system staff ready to address an Emergency in an expeditious manner.

(vi) Response Times and Emergencies: -

The Concessionaire commits itself to a high standard of effective response. To indicate commitment, the Concessionaire shall establish 'Standards of Service' which shall define the Concessionaire's response to any emergency with the intention of minimizing the possible impact of an emergency or failure on the output of the Facilities. These standards shall be agreed with the CMWSSB and would typically include:

Situation	**Response**	**Target Time**
To any alarm or non-conformity during normal work time, or when the Facilities are being manned.	Any threat to public or personal health.	Immediate

	To attend to and assess the required action and the resources needed to effect remedial action. Effect first call repairs where possible	Immediate
	If the problem requires further resources, to have remedial work on site rectifying the problem	2 Hours
To any alarm or non-conformity occurring outside normal Operating hours or when Facilities are unmanned	Any threat to public or personal health.	Immediate
	To attend to and assess the required action and the resources needed to	1 Hours
	effect remedial action. Effect first call repairs where possible	
	If the problem requires further resources, to have remedial work on site rectifying the problem	2 Hours

A dedicated problem solving team shall be appointed by the Concessionaire and this team shall have the responsibility of tracking problems through to a satisfactory outcome.

Major events that threaten public, employee or process safety or security shall be managed directly by the Concessionaire's Representative, who shall have full authority to utilize whatever resources he considers fit to rectify any emergency situations. In performing these duties, this manager shall have full responsibility for ensuring proper and adequate communications with the CMWSSB and other relevant bodies.

5 Permits

1. Both the CMWSSB and the Concessionaire will be responsible for obtaining various permits, authorizations and consents to enable them to carry out their duties. These will include, but not be limited to the following:

2. Permits to be obtained by CMWSSB

a) Abstraction licences from various departments

b) Planning permissions

c) Public way-leaves that may be required from time to time

d) Building permits

e) Discharge consents

f) Disposal licenses for sludge

g) Permissions to enter public and industrial properties

3. Permits to be obtained by the Concessionaire

a) Vehicle and plant licenses

b) Licenses to store and use chemicals

c) Licenses to use machinery

d) Waste management licenses

e) Health and Safety certificates

f) Fire certificate

g) Approval from Labour Inspector

h) Approval from District Health Officer

i) Insurance as appropriate

j) Licenses to carry out water operations

k) Right to use Electrical power

6 Sampling, Testing, Reporting Requirements

6.1 Meter Testing Bench & Workshop

The Concessionaire shall construct building for water meter test bench as per the specifications provided in Schedule 14 for works contract. Concessionaire shall perform water meters testing at test bench as per the requirement or as directed by CMWSSB. Space for the test bench shall be provided by CMWSSB.

All the equipment and necessary tools required for carrying out in house repairs and maintenance, troubleshooting, maintenance for smooth operations will be made available by the Concessionaire and stored in an area allocated by the CMWSSB for that purpose.

6.2 Sampling and Analysis

The Concessionaire shall collect all water samples related to the system required by Applicable Law and provide and submit in a timely manner all such samples to the CMWSSB for analysis unless otherwise directed by CMWSSB or its Authorized Representative. All results of analysis shall be certified and provided to the CMWSSB Authorities (and to the applicable Governmental Authorities) if required by Applicable Law) in a timely manner and in accordance with the requirements of this Agreement.

It should be noted that the measures referred to above are to ensure that the quality of supplied water from UGR/BPS and in the distribution network are within standard norms. Other parameters will be monitored on a regular basis to determine performance against a number of determinants to determine whether the Concessionaire is liable to pay Liquidated Damages.

6.3 Reporting Problems

The Concessionaire shall immediately notify and provide the CMWSSB or its Authorized Representative with any and all information as the same becomes available related to any activity, problem, event or circumstance that is an abnormal condition, including overflows and bypasses on the System, that threatens or may threaten compliance with the requirements of this Agreement, the public health, safety or welfare of the residents of the CMWSSB's service area as identified in Schedule 2 or disrupts System operations or requires notifications to Governmental Authorities. To the extent the Concessionaire, is required by Applicable Law to notify the applicable Governmental Authorities, it shall do so in compliance with the timeframe required by Applicable Law provided, however, the Concessionaire shall always endeavor to notify the CMWSSB or its Authorized Representative of such abnormal condition before it notifies the applicable Governmental Authorities, if required, of such condition. The Concessionaire shall continue to update and provide any and all information regarding such act or event to the CMWSSB's Authorized Representative and, to the extent required of the Concessionaire by Applicable Law, to the applicable Government Authorities, as such information becomes available. The Concessionaire shall take all reasonable steps necessary under the circumstances to develop and provide to the CMWSSB's Authorized Representative within four (4) hours after becoming aware of the abnormal condition, the reasons or events giving rise to the abnormal condition, a full and complete assessment of the situation based on such available information, provide recommendations as to

the responses that are and should be undertaken by the Concessionaire to address and cure the abnormal condition and continuously update the CMWSSB or its Authorized Representative of the same as information becomes available. Further, the Concessionaire shall immediately, but in no event later than period of time prescribed, as applicable, above, commence (1) all necessary investigative, corrective and mitigative actions required by Applicable Law, (2) implementation of the Emergency

plans as required, to the extent it is applicable to the situation, (3) implementation of the activities required by this Agreement, (4) implementation of Capital Repairs or Replacements, Material Capital Repairs or Replacements and Emergency repairs and (5) physical inspection and gathering of information and other data from field locations as may be necessary and appropriate to assess the range of responses that may be available and appropriate to the situation, including that information and data as may be requested by the CMWSSB or its Authorized Representative.

6.4 Failure to Comply

Failure of the Concessionaire to comply with the requirements shall lead to withholding the performance fee due to the Concessionaire.

6.5 Service indicators

Level of service (LOS) Indicators which measure the effectiveness of service and operation levels will be developed and monitored as per following Table.

Level of Service Indicators			
No.	Level of Service Indicators	Frequency of Monitoring	Response Repair Time
1	Bursts in the transmission mains and-feeder mains of water supply system. -	Weekly	Response time within 6 hrs
2	Bursts in the distribution network pipelines	Weekly	Response time within 4 hrs
3	Billing complaint	Monthly	Response time within 3 days
4	Downtime of pumps/ T/w at all pumping stations.	Monthly	Repair time within one day except for major repairs and replacement which shall be within 7

			days

7 SMART WATER Management System (SWMS)

The Concessionaire shall establish, develop and maintain Smart water management System (SWMS). The SWMS shall have capabilities for receiving data of flow, pressure and quality from strategic locations of the network at 5 second intervals for real time monitoring of the operation. The system shall be capable of facility management, inventory management, billing and collection management, operational job management and records and data management as well as all capabilities necessary for safe and efficient management, operation and maintenance of the Facilities.

7.1 The Concessionaire's and the CMWSSB Responsibilities.

(a) The Concessionaire shall be establishing, keeping and maintaining the SWMS in consultation with the CMWSSB. The Concessionaire shall collect and keep up to date information on the facilities, both above and below ground.

(b) All Facilities taken over by the Concessionaire shall be entered into the IMIS.

(c) The Concessionaire shall verify all information in accordance with procedures agreed with the CMWSSB.

(d) The Facility Register shall be supported by operational information on compliance with Performance Standards, part wise.

(e) The Concessionaire shall be responsible for operating the Facilities and the Conveyance System in the correct manner and for maintaining them in a professional manner.

(f) The Concessionaire shall use the data to plan the Annual O&M Plan in consultation with the CMWSSB.

(h) CMWSSB may use the information to gain an overall view of the Facility's value, performance and condition.

7.2 Facility Register

The Facility Register shall be a schedule (a computerized database, but also available on prayer for ease of inspection) of all the Facilities and the Conveyance System to be maintained under the responsibility of the Concessionaire as agreed with the CMWSSB. The Facility Register shall be used to perform, or support, the Services carried out by the

Concessionaire

The format of the Facility Register shall be designed in consultation with the CMWSSB.

The CMWSSB shall have the right to verify the Facility Register and Concessionaire's procedures for keeping it up to date.

7.3 Facility Numbering

Each above ground Facility shall be given a unique number within the Facility register. Numbering system shall be designed in consultation with the CMWSSB. The number shall refer to the site and the type of Facility.

7.4 Performance and Condition Grades

Performance grades shall define whether the Facility is meeting the required quality standards or levels of service standards or is suitable for its function. Condition grades shall define the structural condition of the Facility. This may be from an assessment of the structural condition or from recording of the frequency of failures of the Facility.

Following Table describes the meaning of some of the Grades of the Facilities. Detailed definition of these Facilities shall be formed within six months of appointed date of Operations Period, for each Part, in consultation with the CMWSSB.

Definition of Facilities		
Grade	Description	General Meaning
1	Good	Of sound structure with components that are operable and well maintained.
2	Fair	As 1, but showing some minor signs of deterioration Routine repair, refurbishment and maintenance required with review of condition in the medium term
3	Adequate	Functionally sound, but affected by minor cracking, staining or minor leakage. Some reduced efficiency and minor failures. Review of condition required in the medium term with action likely to be needed in the medium term to prevent deterioration to Grade 4
4	Poor	Condition has a significant effect on performance of the Facility with components requiring significant repair or maintenance to remain operational. Shall require major

		overhaul/replacement with in the medium term.
5	Bad	Condition of the Facility has a serious effect on its performance. Effective life of mechanical and electrical plant and other components is exceeded and incurring excessive repair and maintenance costs due to unreliability. Shall require major overhaul/replacement in the short term.

7.5 Timing Definitions and Differentiation between Facility Types

a) Performance Aspects

The Concessionaire shall develop a clear understanding of the exact meaning of the phrases 'Immediately', 'Short Term' and 'Medium Term' used in association with the performance Grades with the CMWSSB, within six months of appointed date of the Operating Period.

b) Condition Aspects

Different Facilities shall have different expected life span. Buildings or Civil (usually reinforced concrete structures) Facilities are expected to have a Facility life of 30 years. Electrical and Mechanical Facilities are expected to have a Facility life of 15 years. Bulk water mains would be expected to have Facility life in excess of 30 years, or may be taken as having an indefinite life.

The terms 'immediate', 'short term', 'medium term' need to describe approximately when major work shall be required related to the Facility's normal life.

7.6 Records to be Produced and Maintained

The scope of the Facilities to be included are summarized in following Table

Scope of the Facilities	
Type	Facilities
Management and General	Workshops Stocks Computers and associated equipment

	Land Vehicles Plant & machinery PS UGR etc.

7.7 Operational Job Management

The Concessionaire shall establish and maintain a suitable job management system, in consultation with the CMWSSB. This job management system shall provide detailed information on Facilities such as the type and make of motors, maintenance schedules etc.

7.8 Record Drawings

Data on Facilities shall be mentioned on Record Drawings.

The CMWSSB shall ensure that the Concessionaire is given available Drawings of all Facilities. The Concessionaire shall accept the As-Built Drawings as per the scales and standards utilized by the Original Construction Concessionaire(s). The data can then be extracted and summarized on the IMIS. The Concessionaire shall establish and maintain up to date Record Drawings for both above ground and below ground Facilities.

The Concessionaire shall update the Record Drawings and Facility Register to include the Facilities taken over , together with any works that are subsequently undertaken. The Record Drawings shall be updated by the Concessionaire within 3 months of any modifications being carried out in the Facilities.

7.9 Accuracy of Data.

The Concessionaire shall assign 'Confidence Grades' to the data to validate its accuracy. The Concessionaire shall develop the definitions of these grades and how they are to be used in consultation with the CMWSSB.

7.10 Inventory Management

The Concessionaire shall operationalize a computer-based inventory management system to enable effective control of spares and consumables on the commencement of the Operations Period. This system shall use standard proprietary software and shall be linked by the Concessionaire to IMIS. The Concessionaire shall provide monthly

reports from this system to the CMWSSB in support of the expenses incurred.

7.11 Customer Service Management System

Customer service encompasses a broad range of activities. The Customer Service Management System shall have an interface with the Customer's premises to ensure required performance parameters are met (e.g. water pressure and flow) and proper responses are given to customer enquiries. The following provisions shall be integrated into the customer service management system:

i. At least 24 hours advance warning of planned supply shut off for repairs and renewals

ii. Advice Customers during emergencies

iii. Recording and Responding to Customer Complaints.

iv. The Concessionaire shall develop a Customer management strategy with a view to establish world class quality of Customer Services.

v. The strategy prepared by the Concessionaire shall include, but not be limited to, a comprehensive strategy to establish a Customer Service Centre.

vi. The Concessionaire shall receive and handle all customer queries and complaints, including, but not limited to, queries and complaints related to

- Water bills;
- Malfunctioning or inaccurate meters;
- Meter readings;
- Water quality;
- Water pressure;
- Leakage and damaged pipes;
- Change in meter location;
- Changes in customer names; .
- Cancellation of connection by the customer

7.12 Systems and Procedures for Creating and Updating Customer Database

Pursuant to Clause 7.4 (b) of agreement , the Concessionaire shall operationalize a Customer Database, with which all customer contacts with respect to billing and provision of services can be controlled.

Information held shall include the Customer name, reference number,

mailing address, telephone number and account history information. The supporting data shall be made available by the CMWSSB sufficiently in advance. The Concessionaire will update the database from time to time.

7.13 Meters and Meter Reading

The Concessionaire shall establish a fixed area network based data collection and install the automatic data collection gateways at appropriate locations established through a RF study of the project area and ensure automatic meter reading.

The Concessionaire's personnel shall read the gap data of bulk water supply meters and the end use meters on a periodic basis. The Concessionaire shall enter the meter readings into hand-held data entry machine (ITRON or PSION or similar) provided by him. The individual readings shall be downloaded at a central terminal at regular intervals to create a billing schedule.

The Concessionaire shall:

i) read all Customer Meters in accordance with the general instructions of the CMWSSB;

ii) register all Customer Revenue Meters readings in the appropriate computer data base;

(iii) develop a monitoring program of random spot-checks to ensure the accuracy of the -meter calibration and the meter reading process and provide written reports to the CMWSSB on the results of the monitoring programme;

(iv) develop and implement a plan the intent of which is to ensure that:

- all Customer Meters are accurate;
- all Customer Meters are read;
- all Customer Meters are in suitable locations;
- problems related to unprotected and unsealed Customer Meters are resolved;

(v) provide advice as to methods to improve the meter reading process to ensure greater accuracy;

(vi) convert all Customer Meters readings to billings to Customers;

(vii) identify Customer Meters which have not been read; and

(viii) respond to reports of malfunctioning Customer Meters from Customers.

7.14 Meter Replacements / Refurbishment / Calibration by Concessionaire

As per contract and Schedule B as may be applicable

7.15 Customer Service

A 24 hour customer service desk shall be established by the Concessionaire. The customer service desk will be integrated with the IMIS. All enquiries and customer complaints shall be recorded into the system along with resolution mechanism, time of resolution, action taken and feedback procedures.

8 Financial Management and Customer Services

8.1 Financial Management

The Concessionaire shall prepare a comprehensive Financial Management Plan in respect of all matters including but not limited to:

(i) financial management, including accounting systems;

(ii) the billing and collection systems;

(iii) Customer Services, including data bases relating to complaints and questions and response times with respect to complaints and questions;

(iv) information systems; and

(v) asset registers from the perspective of maintaining a prudent asset management system and accounts.

8.2 Billing and Revenues Collection

8.2.1 Billing & Collection system

The Concessionaire shall develop a robust billing, collection and revenue management system with facility for easy upgradation and improvement. This shall include but not be limited to;

(i) Effective water billing practices and procedures;

(ii) Effective revenue collection practices and procedures; and

(iii) a simple and efficient connection, disconnection, and re-connection procedure.

8.2.2 Billings and Collection of Revenues

The Concessionaire further acknowledges that it will take over full responsibility for billings and collection in the Service Area for and on behalf of the CMWSSB.

The revenue collection system shall support all CMWSSB standard payment methods at a minimum and would be designed to incorporate additions. In addition, it will cover the following:

(a) Preparation and issue of a debtor statement

(b) Timetable for the issue of reminders and recovery notices shall be established and issued to consumers at the regular intervals based on the inputs.

(c) Intimation to the CMWSSB of continued debtors for the CMWSSB's action like disconnection etc.

(d) Additional charges such as disconnection/reconnection fees , damage cost and late payment penalties shall be billed.

8.2.3 The Concessionaire shall:

a) Collect all amounts due to the CMWSSB as Revenues related to the Services.

b) Through the Concessionaire's billing offices;

c) Through banks, electronic transfer;

d) By other means as may be agreed to by the CMWSSB.

e) Identify and record all outstanding accounts and take all necessary measures to collect outstanding accounts;

f) Submit to the CMWSSB summary and analysis of unpaid accounts (every month);

Manage all aspects of customer services with the Customers.

9 Environmental Management Plan

Environmental Management Plan for the Project Area in Chennai

Project Activity	Environmental Impacts	Mitigation Measures	Primary Responsibility
Bursts	Flooding and leakage of water in the influence Area during implementation	Appropriate shut off or bypass and leak control arrangements shall be ensured	Concessionaire
Replacing the valves	Temporary disruption of water supply to	Alternative supply arrangements such as supply through	Concessionaire

Project Activity	Environmental Impacts	Mitigation Measures	Primary Responsibility
	the consumer	tankers shall be provided.	
Leak repair and replacement of mains	Disruption of water supply to the consumers during execution	-Alternative supply arrangements such as supply through tankers shall be provided.	Concessionaire
New pipelines or extensions	Disruption of traffic during execution	-Appropriate traffic diversion plans shall be prepared and implemented during construction	Concessionaire
Working in roads or restrictive places	Safety hazards to labour	-Adequate safety precautions such as helmets, safety shoes, gloves, etc. shall be provided to the labours	Concessionaire
Repair of pipelines	Disturbance to other utilities such as telephone cables and sewer lines etc.	-Scheduling activities in consultation with the other utility agencies and ensuring minimum disturbance to the utilities	Concessionaire
Construction or installation of new structures or equipment	Increased noise levels during construction	-Use of low noise generating equipment for all the activities, provision of personal protective equipment, ear muffs, etc. for the construction labour and avoiding construction activities during nights	Concessionaire
Replacement of service connection	Temporary disruption of water supply	Alternative supply arrangements such as supply through tankers shall be Provided.	Concessionaire
Provision of appropriate water meters & taps	Temporary disruption of water supply	Alternative supply arrangements such as supply through tankers shall be Provided.	Concessionaire

SCHEDULE L: POPULATION & BULK WATER DEMAND PROJECTIONS

PROJECTED WATER DEMAND	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
No.s of Years	0 (base year)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Domestic Population	260957	262732	264518	266317	268128	269951	271787	273635	275496	277369	279255	281154	283066	284991	286929	283066
Domestic Demand MLD	50.00	50.34	50.68	51.02	51.37	51.72	52.07	52.43	52.78	53.14	53.50	53.87	54.23	54.60	54.97	55.56

SCHEDULE M: LIST OF MAKES OF EQUIPMENT

S. No.	Equipment	Makes	Short Form
1	Pumps	Kirloskar Brothers Limited Mather & Platt (I) Ltd Jyoti Ltd Becon Wier Ltd Worthington India Ltd KSB Pumps Or any other approved vendors by CMWSSB	KBL MP JYOTI BEACON WORTHIN KSB
2	Motors	Kirloskar Electric Co. Ltd New Government Electric Factory Ltd Siemens India Limited Jyoti Ltd Crompton Greaves Ltd Or any other approved vendors by CMWSSB	KEC NGEF SIEMENS JYOTI CGL
3	Gate Valves	Kirloskar Brothers Ltd Indian Valve Company Upathyaya Valves Manufacturers P Ltd Or any other approved vendors by CMWSSB	KBL IVC UVML
4	Non-return Valves	Kirloskar Brothers Ltd Indian Valve Company Upathyaya Valves Manufacturers Pvt ltd	KBL IVC UVML
5	Sluice Gates	Jash Engineering P Ltd The Indian Valve Co. Oriental Castings Bharat Industrial Corporation Hydraulic & General Engineers Or any other approved vendors by CMWSSB	JASH IVC OC BIC SIWL HEG
6	Butterfly Valve	Audco, Kirloskar, IVI, IVC	
7	C I Sluice Valves	Kirloskar, IVI, Fouress,	
8	Differential float control valves	Bermad, Doret, VAG Or any other approved vendors by	

		CMWSSB	
9	Altitude pilot control valves	Bermad, Doret, VAG	
10	Actuator	Marsh L&T Rotork Auma Or any other approved vendors by CMWSSB	MARSH L&T ROTORK AUMA
11	G I Pipes	Tata, Jindal	
12	Ductile Iron Pipe & Fittings and Dismantling Joints	The Indian Iron & Steel Company Ltd Bharat Industrial Corporation Oriental Castings Upadhayay Castings, Calcutta Electric Steel Castings Tata Iron & Steel Co. Or any other approved vendors by CMWSSB	IISCO BIC OC UCL ESC TISCO
13	Crane	W H Brady & Co. Ltd Hercules Hoists Ltd Delta Engineering Works Sharps Engineering Pvt Ltd Reva Engineering Electrotechnics Avon Cranes Or any other approved vendors by CMWSSB	BRADY INDEF DELTA SHARPS REVA ELECTRO AVON
14	Chain Pulley Block	Reva Engineering Hercules Hoists Ltd W H Brady & Co.Ltd Or any other approved vendors by CMWSSB	REVA INDEF BRADY
15	Sump Pump Set	Kirloskar Brothers Ltd SU Motors Pvt Ltd Jyoti Ltd Flyght Or any other approved vendors by CMWSSB	KBL SU JYOTI

16	Dewatering Pump Set	Kirloskar Brothers Ltd Modi Industries (FC) Pvt Ltd SU Motors Pvt Ltd Kishore Pumps KSB Pumps Or any other approved vendors by CMWSSB	KBL MIPL SU KPL KSB
17	415 V Switchgear Control Gear components / Bus Duct	Larsen & Toubro Ltd Siemens India Limited Voltas Ltd English Electric Ltd Jyoti Ltd Control and Switchgear Bhartia Cutler Hammer Electrical Control Gear Ltd ASPL Or any other approved vendors by CMWSSB	L&T SIEMENS VOLTS EEL JYOTI C&S BCH ELCON ASPL
18	Power Transformer	Bharat Bijlee Ltd New Government Electric Factory Ltd Kirloskar Electric Co. Ltd VOLTAMP Or any other approved vendors by by CMWSSB	BBL NGEF KEC VOLTAMP
19	Motors contactors	Bhartia Cutler Hammer Larsen & Tubro Ltd Siemens GE Power Or any other approved vendors by CMWSSB	BCH L&T SIEMENS GE
20	11 KV / 3.3 KV Switchgear	Jyoti Ltd New Government Electric Factory Ltd Siemens India Limited Asian Brown Boveri ALSTOM Kirloskar Electric Ltd Bharat Heavy Electricals Ltd Crompton Greaves VOLTAS Ltd Or any other approved vendors by CMWSSB	JYOTI NGEF SIEMENS ABB ALSTOM KIRLOSKAR BHEL CGL VOLTAS
21	Cables	Indian Cables Ltd Fort Gloster Industries Ltd Cable Corpn. Of India Universal Cables Indian Cable Co. Asian Cables Corporation Ltd Gemscab Finolerx Cables Ltd Delton	ICL FGI CCI UNISTAR ICC ASIAN GEMSCAB FCL DELTON

		Cables Polyeab Or any other approved vendors by CMWSSB	
22	Instruments & Control Cables	Asian Cable Corporation Delton Cables LAPP Finolex Thermopads Udey Pyro Cables TCL cables, Elkay telelinks,	
23	Optic Fibre Cables	Delink Cords R R Cale Icon Aksh Or any other approved vendors by CMWSSB	DELINK CORDS RR ICON AKSH
24	Level Transmitters	M/s EMERSON M/s ABB, M/s Siemens M/s Endress+Hauser M/s Yokogawa	EMERSON ABB, Siemens Endress+Hauser Yokogawa
25	Flow meters/Flow Indicator/ Transmitter (Electromagnetic flow meter	M/s ABB M/s Siemens M/s Yokogawa M/s Endress+Hauser M/s Krohne Marshall	
26	Level/Float Switches	M/s EMERSON M/s ABB M/s SBEM M/s Endress+Hauser M/s Pune Techtrol	
27	Pressure Switches	M/S Warree M/S ABB, M/s Wika M/s Gen Inst Co M/s Switzer M/s Danfoss	Warree ABB, Wika Gen Inst Co Switzer Danfoss
28	Pressure Gauges	WAREE, WIKA, AN Instruments, Guru, Hitek, Electronet	

29	Pressure Indicator Transmitter	M/s EMERSON M/s ABB, M/s Siemens M/s Endress+Hauser M/s Wika	
30	pH/Turbidity/Online Residual Chlorine Analyzer	M/s Hach Company M/s Yokogawa M/s EMERSON M/s WTW	
31	Ultrasonic Type Level Measurement Device	Endress+Hauser / Krohne Marshall / Hycontrol UK, Electronet/ EIP Enviro Level Controls Pvt. Ltd./ SBEM Pvt.Ltd.	
32	Surge Protection Devices / Lightning Protection Units	M/s Hensel M/s Phoenix M/s Crompton Greaves M/s MTL Instruments M/s Pepper & Fuchs M/s Cirprotec M/s MH Instruments	
33	Flow Indicator and Totalizer, Alarm Annunciators	M/s Masibus M/s Alan M/s Omron M/s NISHKO	
34	Workstations, Servers	Dell, HP, Lenovo	
35	Programmable Logic Controllers	Siemens, Phoenix contact, Honywell, Schneider, confirming to IP-20 with ambient operational temperature 55oC.	
36	Analog Signal Multiplier	MASIBUS, Sai Tech, MTL INSTS, NISHKO	
37	SCADA Programming Software	Siemens, Phoenix contact, Honywell, Schneider, confirming to IP-20 with ambient operational temperature 55oC	
38	Control Panels / Enclosures	Rittal, Pyrotech,	

		Hoffmann	
39	VFD	Siemens, L&T, ABB, Schneider, Danfoss	
40	Mechanical Water Meter with pulse out put	Siemens Building Technologies DWYER INSTRUMENTS EnviroTech Alrams Ltd.	
41	AMR Water Meter	Xylem india IXOM Water care Zenner Water Meters · Toshniwal Water Meters Baylon DEIHL	
42	Billing Software	Xylem india Webnox Technologies PYRUMAS	
43	Diesel Generators	Kohler, caterpillar, Cumins, Jackson, Kirloskar	

SCHEDULE N: DELETED

SCHEDULE O: ENVIRONMENTAL & SOCIAL SCREENING

Environmental & Social Screening

Subproject Details

Name of Subproject:	Improvement of Water Distribution System Project in Area-X and Area-XIII of Chennai City – **Palipattu and Thiruvanmiyur WDS under Area XIII**
Subproject Components: (mention all sub project components including upgradation / improvements / new construction, construction site amenities and facilities. Support infrastructure proposed, Quarry sites if any, Disposal sites if any etc.)	Laying of distribution pipeline including replacement works, new pipeline works, Pump house upgradation, automation with House metering in the Project area in Area XIII (Palipattu & Thiruvanmiyur). The overall Project with network length of 377Kms, including distribution network of 326Kms and 51Kms of feeder mains are scoped. Out of the total of distribution network, new pipelines of 80.6kms, replacement of pipeline of 33.4Kms, having about 38668 no. of House Service Connection (HSC) and AMR meters. Out of the above, Palipattu WDS covers about 95Kms of pipeline work with 31481 House Service Connections and Thiruvanmiyur WDS covers about 18.7kms of pipeline work with 7187 House Service Connections.

Sub project Location (City/Town/Village with Ward numbers):	Area-X and Area XIII of Chennai City, Palipattu WDS Base year Population 2,60,957 and Thiruvanmiyur WDS Base year Population 67,215 are to be covered under Area XIII

Stage1: Exclusion List

Sl. No.	Non-permissible Activities	Yes/No	Description
1	Sub-projects(activities)in sites/locations which shall be excluded as per prevailing Rules/Laws on Environment, Natural Habitats and Forests or Archeologically Protected Monuments (National, State, Local): (i) any construction in demarcated Forest areas or protected natural areas or their buffers,(ii) any subproject that would impact critical natural habitat, (iii)any sub-project which shall be excluded as per AMASR Act,(iv)Any sub project or activity to be excluded as per CRZ Notification 2019,Or its amendments,(v) any subproject or activity to be excluded as per Tamil Nadu rosewood trees (conservation) Act 1994	No	No Sub project site or its construction activities/works, storage area, waste disposal site etc.; falls under demarcated forest area, near archaeologically protected monuments. (Note: Part of both the WDS falls under CRZ II, however as per CRZ Notification 2019, laying of pipelines for water supply and its allied activities are permitted and hence this activity does not fall under exclusion.)
2	Sub-projects in sites/locations which should be excluded as per applicable siting criteria prescribed by TNPCB, Master Plan, Excluded Disaster Zones, or other applicable criteria set out by National, State, Local Body.	No	None of the sub project locations excluded as per applicable siting criteria prescribed by TNPCB, Master Plan, Excluded Disaster Zones, or other applicable criteria set out by National, State, Local Body.

3	Sub-projects involving: (i)Activities that involve purchase, storage, and use of Banned Pesticides/ Insecticides/ chemicals/ Asbestos, (ii)Contaminated Areas, not conducive for the proposed activity or use, (iii)any impact on or due to Dams or barrages	No	Not Applicable in this project

Stage 2: Environmental Screening

Project Details		
Sl. No.	**Components**	**Details**
1	Location and details of the Sub Project Site.	Area XIII (Pallipattu and Thirvanmiyur WDS) of Chennai City
2	Quantity of Water Required for Construction and Annual Operations with Details of Source/s (Ground/ Surface)	Project does not involve major construction activities and Water requirement is very minimal. Secondary treated water shall be procured and used for construction activities.
3	Power Required and Source of Power.	This Project does not involve any major construction work which requires dedicated power. Whatever power required will be met through mobile DG sets.
4	Raw materials & any chemicals if any used (quantities)	Chlorine dosing shall be done during O & M period for disinfection of water in the pipeline.
5	Waste generation and disposal	Excavated soil shall be reused for filling the trench. Surplus soil excavated, shall be disposed of as per the standard guidelines. Construction and Demolition Waste Management Rules, 2016, shall be followed for disposal of construction waste.

6	Road network	The laying of pipeline will be done along different road (major/local) networks, mainly along existing utility corridor / existing alignment of water pipeline and other utilities along the road shoulders. Suitable temporary restoration of road network will be done immediately (within 3 to 4 days at max).
7	Labor Influx	As it is not a major construction activity, labourers will be mobilized locally on a daily basis. Applicable labour acts and regulations will be complied.

Base line Environmental Conditions			
I.	**Environmental Aspects**	**Yes/No**	**Details on its Importance with respect to proposed Sub project activities and possible impacts**
1	**Is the project site/proposed road located either on or adjacent to any of the?** **Following or possibly disturb any of these**		

(i)	Cultural Heritage site, protected monuments-listed by ASI/ State/ Local Body	No	All the construction activities will be carried out within the available RoW. Hence, no disturbances/damages to any heritage site/religious areas etc. are anticipated.
(ii)	Culturally – socially important paths, areas/religious occupancies, burial grounds, tourist or pilgrim congregation areas, borders etc.–locally important Cultural areas	No	No such major activities are anticipated during Project activity Period. (Project activity shall be scheduled to avoid such occurrences, if any)
(iii)	Possibility of Chance Finds	No	Proposed Project activities are along the existing roads and existing alignments and its not a green field activity.
(iv)	Eco-sensitive Areas (ESAs) or Critically Vulnerable Coastal Areas (CVCAs)	No	Both the WDS does not have ESAs or CVCAs.
(v)	Natural Forests/ Protected Areas/ Bio-Reserves. Is the subproject in an eco-sensitive or adjoining an eco-sensitive area, with any schedule 1 species? If yes, which is the area and species?	No	Both WDS are predominantly consists of residential, commercial, institutional and mix use land uses within well-developed urban area. Part of Depot 169 (which is 1 of the 6 depots under Palipattu WDS) abuts Guindy National Park. However, less than 1 Km of excavation work is expected within that area, hence there is no major construction / excavation activity in depot 169. Further applicable precautionary measures will be taken to avoid any impact.
(vi)	Other Wetlands/Mangrove/Estuarine/Coastal Zone Region	No	Not Applicable

(vii)	Natural Habitat areas, Ponds, Lakes, Rivers, Streams, Canals, roosting/ nesting areas, breeding areas; areas with natural features like waterfalls, Sacred groves etc.	No	4 out of 7 Depots are abutting Adyar River. However as stated above, the Project activity does not include any major construction work and about 90% of the waste generated through construction shall be used for refilling of trenches. The surplus construction waste will be disposed of as per applicable state and national regulations without impacting the water body.
(viii)	Drinking water source (Ground, Surface), upstream and downstream uses of rivers, etc	No	NA
(ix)	Sensitive Receptors – a) Habitations /Households / Hostels, Hospitals, other special areas etc. b) School c) Religious Places d) Tourist Areas	Yes	Appropriate dust, noise, air pollution, waste and wastewater pollution prevention mechanisms and safety measures shall be adopted so that there is no disturbance to communities or sensitive receptors such as schools, hospitals etc..
2	Is the site in Critical / Over Exploited Ground Water Block? Provide the level of the ground water table	Yes	This criteria is not applicable for this project, as the project itself aims to provide CMWSSB water supply with an objective to discourage ground water usage. Average level of water table within the project area is 4 mtrs.
3	Is the site vulnerable to major natural or induced hazards such as Earthquakes, Landslides, Flooding, Storm surge, Cyclone, Severe wind damage, Fire? Explosion, Other (specify)	Yes	Chennai Metropolitan Area falls under Seismic Zone – III. However, it may not have major impact for the sub-project.
4	Describe the type of soil and vegetation on site		As stated above, the project activities are along the RoW of existing Roads which is predominantly is of madeup soil and does not have any vegetation.

5	Is the site present in the flood plains as recorded in the last 100 years?	No	NA

Anticipated Environmental Impacts: Impacts on Air, Noise, Water and Soil

II.	**Impacts on Land/Soil Environment**	**Yes/No**	**Details (incl. chain age/site location/road stretch name)**
1	Extent of land expected to be under green Belt	No	NA
2	Will the proposed project cause the following? On Land/Soil		
(i)	Impact on Surrounding Environmental Conditions including Occupation on Low-lying lands/floodplains	No	--
(ii)	Substantial removal of Topsoil.	No	--
(iii)	Any degradation of land/eco-systems expected due to the project?	No	--
(iv)	Loss or impacts on Cultural/heritage areas/ properties	No	--
(v)	Does the project activity involve cutting and filling/blasting etc.?	Yes	Temporary trench will be open for laying of water supply pipelines and shall be filled and closed after laying is completed. No blasting involved.
(vi)	Will the project cause physical changes in the project area (e.g., changes to the topography) due to excavation, earth work or any other activity?	No	--
(vii)	Will the project involve any quarrying/mining?	No	--
(viii)	Will the project/any of its component contaminate or pollute the land?	No	--
(ix)	Will the project contribute to any long term significant adverse (negative), large scale, irreversible, sensitive impact at a regional	No	--

	scale or area broader than the project sites; in combination with other projects proposed/ existing?		

III.	Impacts on Air and Noise Environment	Yes/No	Details (including any Quantity Estimation)
1	Will the project cause or increase air pollution due to dust and/ or vehicle emissions?	Yes	Only during excavation for laying pipelines, necessary pollution control measures will be taken during the project cycle.
2	Will the project cause or increase pollution due to GHG emissions?	No	NA
3	Will the project cause or increase odor nuisance?	No	NA
4	Is there a potential for release of toxic gases or accident risks (e.g.: potential fire outbreaks)	No	NA
5	Will the project generate or increase noise levels or vibration which will impact surrounding biodiversity or communities?	Yes	Only during excavation for laying pipelines, necessary pollution control measures will be taken during the project cycle.

IV.	Impacts on Water Environment	Yes/No	Details (including any Quantity Estimation, Chain age /site/road stretch name)
1	Will the activities proposed at the site(s)impact water quality (surface or ground) or resource availability – extraction, leachate, run off, waste deposition, sediment load, spill, leakage, erosion, Effluent disposal?	No	NA
2	Chances of pollution of water bodies/ground water wells, nearby or downstream	No	NA
3	Will the activities have proposed at the	No	NA

	site(s) Hinder natural drainage		
4	Will the project affect the river flow pattern, stream pattern or any other Irrigation canal?	No	NA
5	Will the project result in Stagnation of Water flow or pond age or weed growth	No	NA

V.	**Impacts on Biodiversity and Host Communities**	**Yes/No**	**Details (including any Quantity Estimation, incl. chain age/site /road stretch name)**
1	Will the project necessitate:		
	(a)Cutting of Trees/Loss of Vegetation: (Mention species, no; of trees cut, under story type; any endangered species)	No	In case during construction, it is necessitated to cut down any number of trees, required approval shall be taken and plantation shall be done as per guidelines.
2	Will the project it at substantial removal of topsoil.	No	--
3	Any degradation of and/eco-systems expected due to the project?	No	--
4	Potential Noise, Light Pollution / movement causing disturbance to nearby habitats / communities mainly During night hours	No	NA
5	Potential disruption to common property, accessibility, traffic disruptions, conflicts, or disruption to the local community within the sub project area?	Yes	Brief disruption to traffic is expected especially along BRR Roads, which is only 8.4Kms in length. Necessary traffic management and safety measures will be taken during construction phase.
6	Potential risk of habitat fragmentation due to the clearing activities? (e.g. Hindrance to the local biodiversity like disturbing the migratory path of animals/birds etc.)	No	Not applicable
VI.	**Impacts due to Accidents, Storage and Wastes, Pollution and Hazards**	**Yes/ No**	**Details (including any Quantity Estimation incl. chainage / site / road stretch name)**

1	Will the project use or store dangerous substances (e.g., large quantities of machine oils, lubricants, hazardous chemical used fort treatment/ other uses; materials like Chlorine, Diesel, Petroleum products; any other?	Yes	Chlorine dosing shall be done for disinfection of water in the pipeline, during O & M period, which shall be safely stored at the designated location within the premises of CMWSSB Water Distribution Station (WDS).
2	Will the project produce solid or liquid wastes; including construction /demolition wastes (including dredging, de-weeding wastes, muck/silt, dust); Polluted liquids?	Yes	Excavated soil shall be reused for filling the trench. Surplus soil excavated, shall be disposed of as per the standard guideline. (Construction and Demolition Waste Management Rules, 2016)
3	Will the project cause or increase air pollution or odour nuisance?	No	NA
4	Will the project generate or increase noise or vibration level switch will impact surrounding biodiversity or communities?	No	NA.
5	Will the project generate or increase visual light or light pollution?	No	NA
6	Will the project involve dangerous construction activities or specialized equipment/machinery which may be a concern to workers/host/ communities	No	NA

Suggested Environmental Enhancement Measures

VII.	**Enhancement Measures**	**Yes/No**	**Details (incl. chain age/site /road stretch name)**
1	Has the subproject considered no disturbance to natural flora including Trees?	Yes	No impact anticipated on Natural flora.
2	Has the subproject considered waste minimization or waste reuse/recycle?	Yes	Will use C&D waste / recycled material as much as possible

	Options		during the project cycle.
3	Considerations for extreme events, drought, flood, other natural disasters	Yes	All workers will be trained for emergency related response measures including Fire Safety, during Project period.

Stage2: C. Social Screening		
Impact on Assets and People	**Yes/No**	**Details**
Location of sub-project		Area-XIII Paliapattu and Thiruvanmiyur WDS (Chennai City)
Is the sub-project located in settlement where majority belong to Scheduled Caste?	No	--
Is the sub-project located in settlement where majority belong to Other Backward Caste?	No	--
Is the sub-project located in settlement where majority belong to General Population?	Yes	--
Beneficiaries		
Population proposed to be benefitted by the proposed project	Present Population: 3,21,567	Palipattu WDS – 2,60,957 Thiruvanmiyur WDS – 67,215
No. of Families to be benefitted	Approx. no.: 66,617	Palipattu WDS – 52,054 Thiruvanmiyur WDS – 14,563

Clearances and Permits Required

III.	**Type**	**Yes/No**	**Details (incl. chain age/site /road stretch name, who has to procure, Status of these if initiated)**
i)	Environmental	No	--

	Clearance (mention State / Centre in case of any proposed facility attracting EC requirement)		
ii)	CRZ Clearance (mention State/Central level)	No	--
iii)	Consent from TNPCB for establishment and operation of any subproject Component if applicable (mention which components and details)	No	--
iv)	NOC Forest Department / ULB for tree-cutting	No	In case tree cutting is required during later stage, all necessary permissions will be obtained from concerned departments and authorities.
v)	NOC for establishment of water supply intake	No	For the proposed project, the entire freshwater requirement will be procured from CMWSSB and no ground water will be extracted.
vi)	NOC for water withdrawal from Surface water source	No	For the proposed project, the entire freshwater requirement will be procured from CMWSSB.
vii)	Labor License CAR Policy Workmen Compensation Policy	Yes	Labour license along with other insurance and policies to be obtained prior to commencement of work.

This Screening sheet must be completed for each of the proposed sites by respective Designated Nodal Officer on Environment in concerned Implementing Agency and forwarded to the Environment Specialist in the PMU/PMC along with the following enclosures.

Enclosures: WDS maps

Comments on Need for Instruments, Oversight

- EMP clauses to be included in Bid documents.
- Registers for Accidents including Severe, Serious, Indicative

Status	***Agency / Official***	***Name, Signature with Date and Seal***
Checked	CMWSSB - IA Environmental Expert / Nodal Officer	

SCHEDULE P: ENVIRONMENT SOCIAL HEALTH & SAFETY (ESHS) REQUIREMENTS

The project **Improvement of Water Distribution System Project in Area-X and Area-XIII of Chennai City – Palipattu and Thiruvanmiyur WDS under Area XIII** is part of Chennai City Partnership; the Chennai Sustainable Urban Services Program "C-SUSP" program which is being implemented as a Program-for-Results "P for R" operation of the World Bank. Hence all activities under the program needs to be comply with Environmental and Social Systems Assessment (ESSA) Report of the Program. In this regard, the following Environment Social Management Plan (ESMP) requirements have been formulated to comply with the ESSA and the same needs to be adhered by the Authority and the Concessionaire (as applicable) as part of the project during the currency of this agreement.

1. Excluded Locations for various activities:

1.1. Sites/ locations which should be excluded as per applicable siting criteria prescribed by TNPCB, Master plan, Excluded Disaster Zones, or other applicable criteria set out by National, State, Local Body will not be included in the Project.

1.2. Activities that involve (i) purchase, storage, and use of banned pesticides/ insecticides/chemicals/asbestos, (ii) Contaminated Areas, not conducive for the proposed activity or use, will not be allowed.

1.3. No pipeline laying activities, its operation & maintenance works, or disposal of wastes / wastewater or other activities shall affect demarcated forest area, natural habitats, archaeologically protected monuments/areas, cultural heritage areas, or area under Coastal Regulation Zone ("CRZ") notification or any other National / State / Local regulations or guidance. The Authority shall ascertain and take required permissions for any activity under the Program.

2. *(Note: Part of both the WDS falls under CRZ II, however the project involves laying of water pipeline along existing roads and existing utility network, hence it's not a greenfield project. Further, as per CRZ Notification 2011 and 2019, laying of pipelines for water supply and its allied activities are permitted and hence this activity does not fall under exclusion. However, the Concessionaire shall verify the same and take required permissions as per requirements/applicable regulations prior to the commencement of the work)*

2.1. Sites/ locations which should be excluded as per applicable siting criteria prescribed by TNPCB, master plan, excluded disaster zones, or other applicable criteria set out by National, State, Local Body will not be included in the Operation & Maintenance activity.

2.2. Activities that involve (i) purchase, storage, and use of banned pesticides/ insecticides/chemicals/asbestos, (ii) Contaminated Areas, not conducive for the proposed activity or use, will not be allowed.

2.3. Repairs/replacement and operation & maintenance of pipelines network shall be strictly in line with regulations, without any pollutants, waste, wastewater discharge or safety concerns affecting any cultural resources, religious activities or sensitive areas including waterbodies, nalas, canals.

3. Pre-Construction Stage

The Concessionaire study the DPR and carry out field visits & verifications along with the Authority/CMWSSB and verification of this ESMP and shall prepare a detailed ESMP for the project in compliance with this ESMP and submit it to the authority along with Capital Investment Plan (CIP). The authority shall review and approve the same along with approval of CIP.

- Stakeholder consultations: The Concessionaire along with the Authority conduct Stakeholder Consultations covering local representatives, neighbourhood society representatives, with all concerned line departments, Traffic Police, concerned GCC representatives etc, prior to grounding of the work and provide details about the project and its proposed construction activities. which will help laying out a plan for scheduling construction works to minimize disruption.

4. **Construction Stage**

Construction stage is the most crucial stage in terms of activities that require careful management to avoid environmental and social impacts.

Activities by the IE

The IE shall be involved in the smooth execution of the project and assisting the Authority towards monitoring the Concessionaire during this phase. Their work shall include but not limited to:

- Monitoring and guiding the concessionaire on adopting good environmental, Social, EHS/OHS and engineering practices.
- Monitoring of implementation of the approved Environment and Social Management Plan (ESMP) by the concessionaire.
- Towards Monitoring the stakeholders consultations processes carried out the Concessionaire arranging training to the concessionaire and other stakeholders according to the needs arising; and

5. **Mitigation Measures**

Project specific Environment and Social screening is undertaken for all activities belonging to the project and, a rapid assessment was undertaken for all activities. For each activity, an activity-specific mitigation/management plan is prepared. The activity-specific mitigation measures are provided in the following table.

Environment & Social Management Plan (ESMP)

PRE-CONSTRUCTION STAGE		
SL No	**Environment & Social Issues**	**Management Measures**
P1	NOC/Consents/License	Necessary permission/license/NoCs (if required) will be obtained by the concessionaire prior to commencement of work. Necessary NoCs/Work permission (if required) to be obtained from Guindy National Park Authority. Necessary NoCs/Work permission (if required) to be obtained from CRZ Authority.
P2	Labor Requirements	The concessionaire preferably will use unskilled labor from local communities to give the maximum benefit to the local community. Necessary license (Labor license/BoCW) shall be obtained by the concessionaire.
P3	Arrangement of water	To avoid disruption/disturbance to other water users, the concessionaire will arrange water from CMWSSB.
P4	Pollution Under Control (PUC) Certificate	The concessionaire will obtain the PUC certificates of vehicles, which will be used for construction purpose.
P5	Utility Shifting	As per the site investigation and surveys, no utilities found within the RoW. In case any utilities found during construction phase, will be shifted suitably as per the instructions of the concerned/owner department.
CONSTRUCTION STAGE		
SL No	**Environment & Social Issues**	**Management Measures**
C1	Traffic Management and Accessibility	• The concessionaire will provide safe and convenient passage for vehicles, pedestrians, and livestock. • The concessionaire will take care that schools and religious places are accessible to public.

		• The concessionaire will also ensure that the work on / at existing accesses will not be undertaken without providing adequate provisions. • The concessionaire shall take all necessary measures for the safety of public/pedestrian and vehicle/traffic during construction and provide, erect, and maintain such hard barricades with reflectors and good lighting, including signs, markings, flags, lights, and flagmen; and there shall be no possibility of communities or workers falling into pits/manholes etc. • All pits shall be closed safely on time immediately after work requirements, and/or before works at the location stops. • Appropriate barricades lighting shall be provided for pits / closed pits, so that there is no risk of fall or other hazards. • The concessionaire shall inform the local community of the changes to traffic routes, conditions, and pedestrian access arrangements in advance. • Traffic Management Plan shall be prepared and followed by the concessionaire during the project cycle after concurrence of the same by CMWSSB, GCC/Traffic Police and all the concerned stakeholders. • The concessionaire shall take care that residences, school, hospitals and religious places are accessible (safely without risk of hazards) for the occupiers and visitors. • The concessionaire shall also ensure that the work on / at existing accesses will not be undertaken without providing adequate provisions. • Necessary arrangements for vehicle movement, public accessibility and traffic control shall be ensured by the concessionaire during important local religious festivals where huge gatherings may happen. • The Concessionaire shall ensure to avoid construction activities at temple and church areas during festival time and will not disturb / obstruct the access of public to such places. Depot No. 180, Thiruvanmiyur, - Marundhishwarar

		koil festival – March 4th week to April 1st week – During this period, the construction work in nearby streets such as North Mada Street, East Mada Street and South Mada Street shall be avoided. Depot No. 179, Besant Nagar, 7th Avenue area - Velankanni Church Festival – End of August to early September – During this period, the construction work in nearby streets such as Annai Velankanni road, Mahatma Gandhi Road, Besant Nagar 2nd Avenue road, 3rd avenue road, 7th avenue road shall be avoided.
C2	Worker Facilities and Health & Safety	• All worker facilities shall be ensured as per regulations by the authority (for its employees employed for the project under this Agreement) & the concessionaire for its work force under the project. It is the obligation of the concessionaire to comply with Factories Act/ other National / State regulations throughout the project period. This includes (but not limited to) provision of clean and safe rest area, first aid kit, potable water, & toilets etc. and connected to sewer system or septic tanks with appropriate water supply etc. • The concessionaire shall provide appropriate PPEs to all the workers and replace the damaged ones on time as required. • The concessionaire ensures safety of women during construction stage. Appropriate training on Gender safety needs to be conducted for the worker to handle safety of public especially women, children, senior citizens and other vulnerable groups. • The concessionaire shall provide appropriate safety measures for women workers in the construction. • Concessionaire shall provide readily available first aid kit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone. • Necessary firefighting equipment (fire extinguishers/sand buckets) will be provided by

		the concessionaire and ensure firefighting trainings.
C3	Material Handling	• All vehicles delivering fine materials to the site shall be covered to avoid spillage of materials and dust.
C4	Waste Management	• Concessionaire shall use C&D waste / recycled material as much as possible in the project area, but strictly following regulations and without any harm to people or environment. • The waste and other disposable materials will be stored in a safe manner. • Asbestos waste (old pipes etc.) if any shall not be tampered. It shall be safely collected without breakage. Such wastes stored & transported in covered manner; & disposed at hazardous waste Treatment, Storage and Disposal Facilities (TSDF) in line with National State regulations & special Standard Operating Procedures (SOP)s. Solid waste (including dry & wet if any), Construction &

		Demolition (C&D) wastes, hazardous wastes (such as existing asbestos pipes if any), e-wastes, shall be segregated at source & stored in different color-coded bins, and treatment and disposed shall be arranged in municipal / other approved facilities as in corresponding rules. No dumping of waste around the project or any other area shall be permitted. • Scarified bitumen shall be stored properly and disposed of as per the rules or can be used to fill low lying areas or in construction of temporary roads with prior necessary permission from the concerned authority.
C5	Pollution Control and Management	• Appropriate dust, noise, water pollution (if any) prevention mechanisms shall be adopted so that there is no disturbance to communities or sensitive receptors such as schools, hospitals etc. nearby. • The concessionaire shall take all precautions to reduce the level of dust from construction sites involving earthwork by measures such as sprinkling of water, encapsulation of dust source and by erection of screen / net. • Concessionaire shall strictly conform to the CPCB noise standards for its construction activities, vehicle and machinery (if any). • No construction activities should be carried out in between 9.00 AM to 4.00 PM (working days) near to school /educational institution areas. • Activities during market days, festivals shall be scheduled in discussion with stakeholders and Traffic Police Department.
C6	Special Situations and Emergencies	• Chance finds procedures to be followed in line with applicable regulations. • All safety requirements shall be followed during emergencies. Hazards shall be identified & safety, emergency & fire response plans shall be prepared and followed during the project life cycle. • Emergency Response Plan will be prepared & followed by the concessionaire. All workers will be trained at intervals in emergency related response measures including fire safety.

C7	Water and Wastewater Management	• No groundwater exploitation/extraction is permitted. • The Concessionaire shall use construction water supplied by Chennai Metro Water Supply and Sewerage Board (CMWSSB) / other relevant local bodies. • No wastewater shall be discharged into the drains or waterbodies etc.
C8	Drainage	• Concessionaire will ensure that no construction materials like earth, stone or appendage is disposed of in a manner that blocks the flow of water of any water course and cross drainage channels. • Concessionaire will take all-necessary measures to prevent any blockage to water flow.
C9	Housekeeping and Cleanliness	• Good housekeeping shall be always maintained at construction zones; without posing hazards, pollution or safety issues to the environment or people.
C10	Excavation of Trench/Pit	• The concessionaire shall ensure that all the opened trenches must be closed immediately after works pertaining to that trench and/or before workers leaving the site; and during monsoon /heavy rains/cyclone etc. In case any open trenches are there, that must be hard barricaded along with provision of cautionary/warning boards at least 100 to 200 m ahead as per road disposition and adequate lighting for nighttime. • The concessionaire shall ensure the trenches must be closed immediately after the laying of pipelines. • Excavated materials shall not be piled up so close to the trench or pit with possibility of its slippage. All excavated material shall be transferred within 24 hours to C&D disposal facility or safe storage area. • Storage of excavated material or fine materials for works (at site or in disposal area) shall be with proper cover (to prevent dust), berm (to prevent erosion), lighting and barricading. • No material shall fall into waterbodies or forest areas, community owned/used areas or the like.

C11	Monitoring & Record Keeping	• The water used for consumption (Drinking) shall be tested periodically by concessionaire to conform to applicable National Standards, and monitoring results shall be maintained. • All Wastes shall be disposed in line with National/ State Regulations and the record shall be maintained. • All records shall be kept at the project office including incident reports, monitoring results, waste quantity generated etc. All permits and clearances shall be obtained and copy of records maintained on site. • Incidents (Severe, Serious and Indicative) records shall be maintained on site. All severe & serious incidents (on project workers, communities) shall be reported to the Client immediately after arranging timely support to the injured.
C12	Information Meetings	• The concessionaire shall organize information meetings in the vicinity of project site (minimum one in each section) for public to consult and inform people about his plans covering overall construction schedule, traffic safety and management plans of debris disposal, drainage protection during construction, pollution abetment and other plans, measures to minimize disruption, damage and in convenience to roadside users and people along the road. • The concessionaire shall maintain a channel of communication with the communities through his designated Environment and Safety Officer to address any concern or grievances. • Periodic meetings will also be conducted during the construction period to take feedback from communities or their representatives to ensure minimum disturbance.
C13	Clean-up Operations, Restoration and Rehabilitation	• Concessionaire shall prepare site restoration plans and implement the same prior to demobilization.
OPERATION STAGE		
SL No	**Environment & Social Issues**	**Management Measures**
O1	During any construction and maintenance activities during operation and maintenance phase, the concessionaire shall prepare and follow the ESMP as specified for construction phase.	

6. ESMP Activities for the Project:

Sl. No	Item	Unit	Minimum Quantity	Remarks
1.	Medical health checkups of workers (Twice a year)	Number	100 x 2	Rate considered in consultation with physician (doctor) for half yearly health check. Two times health check-up of 50 nos. of labourers on average.
2.	Three EHS module training for capacity building of Construction staff / laborers etc.	Number	3	Training can be conducted at site or at CMWSSB zonal premises clubbing up to three work fronts. The cost would include training, material, refreshments etc.
3.	3 Stakeholders Consultation at appropriate stages	Number	3	Stakeholder's Meeting shall be conducted at CMWSSB premises and will include agenda notes / writing pads / refreshments etc.
4.	Tree Plantation under afforestation program including maintenance and replacement (if any)	Number	500	Plantation of Saplings including primary maintenance for the 1st year.
5.	Worker's GRM	Number	8	The Grievance Redressal Committee (GRC) to have a meeting once in every quarter during the overall project period. Rs. 5000 each for Meeting expenditure, transportation of the GRC members. Including IEC materials such as pamphlets, writing pads etc.
6.	Capacity building and awareness among Concessionaire's /sub-contractors' workers and community members on SEA/SH prevention, community health and safety, labor management, etc.	Number	8	Awareness programs to be conducted once every quarter during the overall project period. Rs. 5000 each for awareness program including expenditure on IEC materials such as pamphlets, guest felicitations, flyers, standees etc.

The above ESMP activities have been provisioned in the DPR. The bidder has to include the cost for the above activities in its quoted bid price.

SCHEDULE Q: SAFETY REQUIREMENTS

1. Guiding principles

1.1. Safety Requirements aim at reduction in injuries, loss of life and damage to the properties resulting from accidents on the Project, irrespective of the person(s) at fault.

1.2. Safety Requirements apply to all phases of construction, operation and maintenance with emphasis on identification of factors associated with accidents, consideration of the same, and implementation of appropriate remedial measures.

2. Obligations of the Concessionaire

The Concessionaire shall abide by the following as they relate to safety of the Users:

a) Applicable Laws and Applicable Permits;

b) Manual for Water Supply and Treatment, issued by CPHEEO;

c) relevant Technical Specification;

d) provisions of this Agreement; and

e) Good Industry Practice.

f) Appoint a safety officer to ensure all the safety measures are implemented by the concessionaire.

SCHEDULE R: INDEPENDENT ENGINEER

1. Selection of Independent Engineer

1.1. The Authority shall appoint a consulting engineering firm substantially in accordance with the selection criteria set forth in the Tamil Nadu Transparency in Tenders Act, 1998 and read with the Tamil Nadu Transparency in Tenders (Public Private Partnership Procurement) Rules, 2012 and any amendments thereof to be the independent consultant under this Agreement (the "Independent Engineer"). The appointment shall be made no later than 60 (sixty) days from the Effective Date and shall initially be for a period of 5 (five) years which may be extended for a further term of 5 (five) years. On expiry of the aforesaid appointment, the Authority shall appoint an Independent Engineer for a further terms in accordance with the provisions of the above stated legislations and such procedure shall be repeated after expiry of each appointment.

1.2. In the event of termination of an Independent Engineer appointed in accordance with the provisions of Paragraph 1.1, the Authority shall appoint another firm of Technical Consultants forthwith or may engage a government-owned entity in accordance with the provisions of Paragraph 5 of this Schedule-M.

1.3. The Concessionaire may, in its discretion, nominate a representative to participate in the process of selection to be undertaken by the Authority under this Schedule-M.

2. Terms of Reference

The Terms of Reference for the Independent Engineer shall substantially conform to Schedule-N.

3. Fee and expenses

3.1. In determining the nature and quantum of duties and services to be performed by the Independent Engineer during the Development Period and Construction Period, the Authority shall endeavour that payments to the Independent Engineer on account of fee and expenses do not exceed 3% (three per cent) of the Bid Project Cost. Payments not exceeding such 3% (three per cent) shall be borne equally by the Authority and the Concessionaire in accordance with the provisions of this Agreement and any payments in excess thereof shall be borne entirely by the Authority.

3.2. The nature and quantum of duties and services to be performed by the Independent Engineer during the Operation Period shall be determined by the Authority in conformity with the provisions of this Agreement and with due regard for economy in expenditure. All payments made to the Independent Engineer on account of fee and expenses during the Operation Period shall be borne equally by the Authority and the Concessionaire.

4. Selection every three years

No later than 3 (three) years from the date of appointment of Independent Engineer pursuant to the provisions of Paragraph 1 of this Schedule-M, and every 3 (three) years thereafter, the Authority shall engage another firm in accordance with the criteria set forth in this Schedule-M.

5. Appointment of government entity as Independent Engineer

Notwithstanding anything to the contrary contained in this Schedule, the Authority may in its discretion appoint a government-owned entity as the Independent Engineer; provided that such entity shall be a body corporate having as one of its primary function the provision of consulting, advisory and supervisory services for engineering projects; provided further that a government- owned entity which is owned or controlled by the Authority shall not be eligible for appointment as Independent Engineer.

SCHEDULE S: TERMS OF REFERENCE FOR INDEPENDENT ENGINEER

1. Scope

These Terms of Reference for the Independent Engineer (the "TOR") are being specified pursuant to the Concession Agreement dated (the "Agreement"), which has been entered into between the Authority and the "Concessionaire") for _____on HAM mode in the state of Tamil Nadu on design, build, operate and transfer (the "DBFOT Annuity or Hybrid Annuity") basis, and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.

2. Definitions and interpretation

1.1 The words and expressions beginning with or in capital letters used in this TOR and not defined herein but defined in the Agreement shall have, unless repugnant to the context, the meaning respectively assigned to them in the Agreement.

1.2 References to Articles, Clauses and Schedules in this TOR shall, except where the context otherwise requires, be deemed to be references to the Articles, Clauses and Schedules of the Agreement, and references to Paragraphs shall be deemed to be references to Paragraphs of this TOR.

1.1. The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Agreement shall apply, mutatis mutandis, to this TOR.

3. Role and functions of Independent Engineer

3.1. The role and functions of the Independent Engineer shall include the following:

i. review of the detailed Drawings, DPR and other documents as set forth in Paragraph 4;

ii. Review, inspection and monitoring of Construction Works as set forth in Paragraph 5; conducting Tests on completion of construction and issuing Completion/ Provisional Certificate as set forth in Paragraph 5

iii. Review, inspection and monitoring of O&M as set forth in Paragraph 6;

iv. review, inspection and monitoring of Divestment Requirements as set forth in Paragraph 7;

v. determining, as required under the Agreement, the costs of any works or services and/or their reasonableness;

vi. determining, as required under the Agreement, the period or any extension thereof, for performing any duty or obligation;

vii. Assisting the Parties in resolution of Disputes as set forth in Paragraph 9; and

viii. Undertaking all other duties and functions in accordance with the Agreement.

4. Development Period

4.1. During the Development Period, the Independent Engineer shall undertake a detailed review of the detailed Drawings and DPR to be furnished by the Concessionaire along with supporting data, including the geo-technical and hydrological investigations, characteristics of materials from borrow areas and quarry sites, topographical surveys and traffic surveys. The Independent Engineer shall complete such review and send its comments/ observations to the Authority and the Concessionaire within 15 (fifteen) days of receipt of such Drawings and DPR. In particular, such comments shall specify the conformity or otherwise of such Drawings and DPR with the Scope of the Project and Specifications and Standards.

4.2. The Independent Engineer shall review any modified Drawings and DPR or supporting Documents sent to it by the Concessionaire and furnish its comments within 7 (seven) days of receiving such Drawings or DPR.

4.3. The Independent Engineer shall review the detailed Drawings and DPR comprising construction methodology, quality assurance procedures and the procurement, engineering and construction time schedule sent to it by the Concessionaire and furnish its comments within 15 (fifteen) days of receipt thereof.

4.4. Upon reference by the Authority, the Independent Engineer shall review and; comment on the EPC Contract or any other contract for construction, operation and maintenance of the Project, and furnish its comments within 7 (seven) days from receipt of such reference from the Authority.

5. Construction Period

5.1. In respect of the detailed Drawings and DPR received by the Independent Engineer for its review and comments during the Construction Period, the provisions of Paragraph 4 shall apply, mutatis mutandis.

5.2. The Independent Engineer shall review the monthly progress report furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 7 (seven) days of receipt of such report

5.3. The Independent Engineer shall inspect the Construction Works and the Project once every month, preferably after receipt of the monthly progress report from the Concessionaire, but before the 20th (twentieth) day of each month in any case, and make out a report of such inspection (the "Inspection Report") setting forth an overview of the status, progress, quality and safety of construction, including the work methodology adopted, the materials used and their sources, and conformity of Construction Works with the Scope of the Project and the Specifications and Standards. In a separate section of the Inspection Report, the Independent Engineer shall describe in reasonable detail the lapses, defects or deficiencies observed by it in the construction of the Project. The Inspection Report shall also contain a review of the maintenance of the existing lanes in conformity with the provisions of the Agreement. The Independent Engineer shall send a copy of its Inspection

Report to the Authority and the Concessionaire within 7 (seven) days of the inspection.

5.4. The Independent Engineer may inspect the Project more than once in a month if any lapses, defects or deficiencies require such inspections.

5.5. For determining that the Construction Works conform to Specifications and Standards, the Independent Engineer shall require the Concessionaire to carry out, or cause to be carried out, tests on a sample basis, to be specified by the Independent Engineer in accordance with Good Industry Practice for quality assurance. The Independent Engineer shall issue necessary directions to the Concessionaire for ensuring that the tests are conducted in a fair and efficient manner, and shall monitor and review the results thereof.

5.6. The sample size of the tests, to be specified by the Independent Engineer under Paragraph 5.5, shall comprise 10% (ten per cent) of the quantity or number of tests prescribed for each category or type of tests in the Quality Control Manuals; provided that the Independent Engineer may, for reasons to be recorded in writing, increase the aforesaid sample size by up to 10% (ten per cent) for certain categories or types of tests.

5.7. The timing of tests referred to in Paragraph 5.5, and the criteria for acceptance/ rejection of their results shall be determined by the Independent Engineer in accordance with the Quality Control Manuals. The tests shall be undertaken on a random sample basis and shall be in addition to, and independent of, the tests that may be carried out by the Concessionaire for its own quality assurance in accordance with Good Industry Practice.

5.8. In the event that the Concessionaire carries out any remedial works for removal or rectification of any defects or deficiencies, the Independent Engineer shall require the Concessionaire to carry out, or cause to be carried out, tests to determine that such remedial works have brought the Construction Works into conformity with the Specifications and Standards, and the provisions of this Paragraph 5 shall apply to such tests

5.9. In the event that the Concessionaire fails to achieve any of the Project Milestones, the Independent Engineer shall undertake a review of the progress of construction and identify potential delays, if any. If the Independent Engineer shall determine that completion of the Project is not feasible within the time specified in the Agreement, it shall require the Concessionaire to indicate within 15 (fifteen) days the steps proposed to be taken to expedite progress, and the period within which COD shall be achieved. Upon receipt of a report from the Concessionaire, the Independent Engineer shall review the same and send its comments to the Authority and the Concessionaire forthwith.

5.10. If at any time during the Construction Period, the Independent Engineer determines that the Concessionaire has not made adequate arrangements for the safety of workers and Users in the zone of construction or that any work is being carried out in a manner that threatens the safety of the workers and the Users, it shall make a recommendation to the Authority forthwith, identifying the whole or part of the Construction Works that should be suspended for

ensuring safety in respect thereof .

5.11. In the event that the Concessionaire carries out any remedial measures to secure the safety of suspended works and Users, it may, by notice in writing, require the Independent Engineer to inspect such works, and within 3 (three) days of receiving such notice, the Independent Engineer shall inspect the suspended works and make a report to the Authority forthwith, recommending whether or not such suspension may be revoked by the Authority.

5.12. If suspension of Construction Works is for reasons not attributable to the Concessionaire, the Independent Engineer shall determine the extension of dates set forth in the Project Completion Schedule, to which the Concessionaire is reasonably entitled, and shall notify the Authority and the Concessionaire of the same.

5.13. The Independent Engineer shall carry out, or cause to be carried out, all the Tests specified in Schedule-I and issue a Completion Certificate or Provisional Certificate, as the case may be. For carrying out its functions under this Paragraph 5.13 and all matters incidental thereto, the Independent Engineer shall act under and in accordance with the provisions of Article 14 and Schedule-I.

5.14. Upon reference from the Authority, the Independent Engineer shall make a fair and reasonable assessment of the costs of providing information, works and services as set forth in Article 16 and certify the reasonableness of such costs for payment by the Authority to the Concessionaire

5.15. The Independent Engineer shall aid and advise the Concessionaire in preparing the Operation and Maintenance Manual

5.16. Upon reference from the Authority, the Independent Engineer shall undertake the assessment of cost of civil works, as per applicable schedule of rates, for the reduction of Scope of work as provided in Article 16.6.1 of the Concession Agreement.

6. Operations Period

6.1. In respect of the Drawings, Documents and Safety Report received by the Independent Engineer for its review and comments during the Operation Period, the provisions of Paragraph 4 shall apply, mutatis mutandis.

6.2. The Independent Engineer shall review the annual Maintenance Program furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 15 (fifteen) days of receipt of the Maintenance Program.

6.3. The Independent Engineer shall review the monthly status report furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 7 (seven) days of receipt of such report.

6.4. The Independent Engineer shall inspect the Project once every month, preferably after receipt of the monthly status report from the Concessionaire, but before the 20th (twentieth) day of each month in any case, and make out an O&M Inspection Report setting forth an overview of the status, quality and safety of O&M including its conformity with the Maintenance Requirements

and EHS Requirements. In a separate section of the O&M Inspection Report, the Independent Engineer shall describe in reasonable detail the lapses, defects or deficiencies observed by it in O&M of the Project. The Independent Engineer shall send a copy of its O&M Inspection Report to the Authority and the Concessionaire within 7 (seven) days of the inspection.

6.5. The Independent Engineer may inspect the Project more than once in a month, if any lapses, defects or deficiencies require such inspections.

6.6. The Independent Engineer shall in its O&M Inspection Report specify the tests, if any, that the Concessionaire shall carry out, or cause to be carried out, for the purpose of determining that the Project is in conformity with the Maintenance Requirements. It shall monitor and review the results of such tests and the remedial measures, if any, taken by the Concessionaire in this behalf.

6.7. In respect of any defect or deficiency referred to in Paragraph 3 of Schedule-K, the Independent Engineer shall, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards and shall also specify the time limit for repair or rectification of any deviation or deterioration beyond the permissible limit.

6.8. The Independent Engineer shall determine if any delay has occurred in completion of repair or remedial works in accordance with the Agreement, and shall also determine the Damages, if any, payable by the Concessionaire to the Authority for such delay.

6.9. The Independent Engineer shall examine the request of the Concessionaire for closure of any lane(s) of the carriageway for undertaking maintenance/repair thereof, keeping in view the need to minimize disruption in traffic and the time required for completing such maintenance/repair in accordance with Good Industry Practice. It shall grant permission with such modifications, as it may deem necessary, within 3 (three) days of receiving a request from the Concessionaire. Upon expiry of the permitted period of closure, the Independent Engineer shall monitor the re-opening of such lane(s), and in case of delay, determine the Damages payable by the Concessionaire to the Authority under Article 17.7

6.10. The Independent Engineer shall monitor and review the curing of defects and deficiencies by the Concessionaire as set forth in Article 19.3

6.11. In the event that the Concessionaire notifies the Independent Engineer of any modifications that it proposes to make to the Project, the Independent Engineer shall review the same and send its comments to the Authority and the Concessionaire within 15 (fifteen) days of receiving the proposal.

6.12. The Independent Engineer shall undertake traffic sampling, as and when required by the Authority, under and in accordance with the provisions of this Agreement.

7. Termination

7.1. At any time, not earlier than 90 (ninety) days prior to Termination but not later than 15 (fifteen) days prior to such Termination, the Independent Engineer

shall, in the presence of a representative of the Concessionaire, inspect the Project for determining compliance by the Concessionaire with the Divestment Requirements set forth in Article 32.1 and, if required, cause tests to be carried out at the Concessionaire's cost for determining such compliance. If the Independent Engineer determines that the status of the Project is such that its repair and rectification would require a larger amount than the sum set forth in Article 33.2, it shall recommend retention of the required amount in the Escrow Account and the period of retention thereof.

7.2. The Independent Engineer shall inspect the Project once in every 15 (fifteen) days during a period of 90 (ninety) days after Termination for determining the liability of the Concessionaire under Article 33, in respect of the defects or deficiencies specified therein. If any such defect or deficiency is found by the Independent Engineer, it shall make a report in reasonable detail and send it forthwith to the Authority and the Concessionaire.

8. Determination of costs and time

8.1. The Independent Engineer shall determine the costs, and/or their reasonableness, that are required to be determined by it under the Agreement.

8.2. The Independent Engineer shall determine the period, or any extension thereof, that is required to be determined by it under the Agreement.

9. Assistance in Dispute resolution

9.1. When called upon by either Party in the event of any Dispute, the Independent Engineer shall mediate and assist the Parties in arriving at an amicable settlement.

9.2. In the event of any disagreement between the Parties regarding the meaning, scope and nature of Good Industry Practice, as set forth in any provision of the Agreement, the Independent Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

10. Other duties and functions

The Independent Engineer shall perform all other duties and functions specified in the Agreement.

11. Miscellaneous

11.1. The Independent Engineer shall notify its programmer of inspection to the Authority and to the Concessionaire, who may, in their discretion, depute their respective representatives to be present during the inspection.

11.2. A copy of all communications, comments, instructions, Drawings or Documents sent by the Independent Engineer to the Concessionaire pursuant to this TOR, and a copy of all the test results with comments of the Independent Engineer thereon shall be furnished by the Independent Engineer to the Authority forthwith.

11.3. The Independent Engineer shall obtain, and the Concessionaire shall furnish

in 2 (two) …….. Copies thereof, all communications and reports required to be submitted, under this Agreement, by the Concessionaire to the Independent Engineer, whereupon the Independent Engineer shall send 1 (one) of the copies to the Authority along with its comments thereon.

11.4. The Independent Engineer shall retain at least one copy each of all Drawings and Documents received by it, including 'as-built' Drawings, and keep them in its safe custody

11.5. Upon completion of its assignment hereunder, the Independent Engineer shall duly classify and list all Drawings, Documents, results of tests and other relevant records, and hand them over to the Authority or such other person as the Authority may specify, and obtain written receipt thereof. Two copies of the said documents shall also be furnished in their editable digital format or in such other medium or manner as may be acceptable to the Authority.

11.6. Wherever no period has been specified for delivery of services by the Independent Engineer, the Independent Engineer shall act with the efficiency and urgency necessary for discharging its functions in accordance with Good Industry Practice.

SCHEDULE T: ESCROW AGREEMENT

THIS ESCROW AGREEMENT is entered into on this the day of 20__ AMONGST

1. ……..Limited, a company incorporated under the provisions of the Companies Act, 2013 and having its registered office at…….. (hereinafter referred to as the "Concessionaire" which expression shall, unless repugnant to the context or meaning thereof, include its successors, permitted assigns and substitutes);

2. ……(insert name and particulars of Lenders' Representative) and having its registered office at…… acting for and on behalf of the Senior Lenders as their duly authorized agent with regard to matters arising out of or in relation to this Agreement (hereinafter referred to as the "Lenders' Representative" which expression shall, unless repugnant to the context or meaning thereof, include its successors and substitutes);

3. ……..(insert name and particulars of the Escrow Bank) and having its registered office at …… …….. (hereinafter referred to as the "Escrow Bank" which expression shall, unless repugnant to the context or meaning thereof, include its successors and substitutes); and

4. The _____, established under the _____, represented by its _____ and having its principal offices at _____ (hereinafter referred to as the "Authority" which expression shall, unless repugnant to the context or meaning thereof, include its administrators, successors and assigns).

WHEREAS:

A. The Authority has entered into a Concession Agreement dated_____ with the Concessionaire (the "Concession Agreement") for the _____ on HAM mode in the state of Tamil Nadu. Project (the "Project") on design, build, operate and transfer (the "DBFOT Annuity or Hybrid Annuity") basis, and a copy of which is annexed hereto and marked as Annex-A to form part of this Agreement.

B. Senior Lenders have agreed to finance the Project in accordance with the terms and conditions set forth in the Financing Agreements.

C. The Concession Agreement requires the Concessionaire to establish an Escrow Account, inter alia, on the terms and conditions stated therein.

NOW, THEREFORE, in consideration of the foregoing and the respective covenants and agreements set forth in this Agreement, the receipt and sufficiency of which is hereby acknowledged, and intending to be legally bound hereby, the Parties agree as follows:

1. DEFINITIONS AND INTERPRETATION

1.1. Definitions

In this Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively assigned to them:

"Agreement" means this Escrow Agreement and any amendment thereto made in accordance with the provisions contained herein;

"Concession Agreement" means the Concession Agreement referred to in Recital (A) above and annexed hereto as Annex-A, and shall include all of its Recitals and Schedules and any amendments made thereto in accordance with the provisions contained in this behalf therein;

"Cure Period" means the period specified in this Agreement for curing any breach or default of any provision of this Agreement by the Concessionaire, and shall commence from the date on which a notice is delivered by the Authority or the Lenders' Representative, as the case may be, to the Concessionaire asking the latter to cure the breach or default specified in such notice;

"Escrow Account" means an escrow account established in terms of and under this Agreement, and shall include the Sub-Accounts;

"Escrow Default" shall have the meaning ascribed thereto in Article 31.1.1;

"Lenders' Representative" means the person referred to as the Lenders' Representative in the foregoing Recitals;

"Parties" means the parties to this Agreement collectively and "Party" shall mean any of the Parties to this Agreement individually;

"Payment Date" means, in relation to any payment specified in Clause 4.1, the date(s) specified for such payment; and

"Sub-Accounts" means the respective sub-accounts of the Escrow Account, into which the monies specified in Clause 4.1 would be credited every month and paid out if due, and if not due in a month then appropriated proportionately in such month and retained in the respective sub-accounts and paid out therefrom on the Payment Date(s).

1.2. Interpretation

1.2.1. References to Lenders' Representative shall, unless repugnant to the context or meaning thereof, mean references to the Lenders' Representative, acting for and on behalf of Senior Lenders.

1.2.2. The words and expressions beginning with capital letters and defined in this Agreement shall have the meaning ascribed thereto herein, and the words and expressions used in this Agreement and not defined herein but defined in the Concession Agreement shall, unless repugnant to the context, have the meaning ascribed thereto in the Concession Agreement.

1.2.3. References to Clauses are, unless stated otherwise, references to Clauses of this Agreement.

1.2.4. The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Concession Agreement shall apply, mutatis mutandis, to this Agreement.

2. ESCROW ACCOUNT

2.1. Escrow Bank to act as trustee

2.1.1. The Concessionaire hereby appoints the Escrow Bank to act as trustee for the Authority, the Lenders' Representative and the Concessionaire in connection herewith and authorizes the Escrow Bank to exercise such rights, powers, authorities and discretion as are specifically delegated to the Escrow Bank by the terms hereof together with all such rights, powers, authorities and discretion as are reasonably incidental hereto, and the Escrow Bank accepts such appointment pursuant to the terms hereof.

2.1.2. The Concessionaire hereby declares that all rights, title and interest in and to the Escrow Account shall be vested in the Escrow Bank and held in trust for the Authority, the Lenders' Representative and the Concessionaire, and applied in accordance with the terms of this Agreement. No person other than the Authority, the Lenders' Representative and the Concessionaire shall have any rights hereunder as the beneficiaries of or as third party beneficiaries under this Agreement.

2.2. Acceptance of Escrow Bank

The Escrow Bank hereby agrees to act as such and to accept all payments and other amounts to be delivered to and held by the Escrow Bank pursuant to the provisions of this Agreement. The Escrow Bank shall hold and safeguard the Escrow Account during the term of this Agreement and shall treat the amount in the Escrow Account as monies deposited by the Concessionaire, Senior Lenders or the Authority with the Escrow Bank. In performing its functions and duties under this Agreement, the Escrow Bank shall act in trust for the benefit of, and as agent for, the Authority, the Lenders' Representative and the Concessionaire or their nominees, successors or assigns, in accordance with the provisions of this Agreement.

2.3. Establishment and operation of Escrow Account

2.3.1. Within 30 (thirty) days from the date of this Agreement, and in any case prior to the Appointed Date, the Concessionaire shall open and establish the Escrow Account with the (name of Branch) Branch of the Escrow Bank. The Escrow Account shall be denominated in Rupees.

2.3.2. The Escrow Bank shall maintain the Escrow Account in accordance with the terms of this Agreement and its usual practices and applicable regulations, and pay the maximum rate of interest payable to similar customers on the balance in the said account from time to time.

2.3.3. The Escrow Bank and the Concessionaire shall, after consultation with the Lenders' Representative, agree on the detailed mandates, terms and conditions, and operating procedures for the Escrow Account, but in the event of any conflict or inconsistency between this Agreement and such mandates, terms and conditions, or procedures, this Agreement shall prevail.

2.4. Escrow Bank's fee The Escrow Bank shall be entitled to receive its fee and expenses in an amount, and at such times, as may be agreed between the Escrow Bank and the Concessionaire. For the avoidance of doubt, such fee and expenses shall form part of the O&M Expenses and shall be appropriated from the Escrow Account in accordance with Clause 4.1.

2.5. Rights of the Parties Save and except as otherwise provided in the Concession Agreement, the rights of the Authority, the Lenders' Representative and the Concessionaire in the monies held in the Escrow Account are set forth in their entirety in this Agreement and the Authority, the Lenders' Representative and the Concessionaire shall have no other rights against or to the monies in the Escrow Account.

2.6. Substitution of the Concessionaire The Parties hereto acknowledge and agree that upon substitution of the Concessionaire with the Nominated Company, pursuant to the Substitution Agreement, it shall be deemed for the purposes of this Agreement that the Nominated Company is a Party hereto and the Nominated Company shall accordingly be deemed to have succeeded to the rights and obligations of the Concessionaire under this Agreement on and with effect from the date of substitution of the Concessionaire with the Nominated Company.

3. DEPOSITS INTO ESCROW ACCOUNT

3.1. Deposits by the Concessionaire

3.1.1. The Concessionaire agrees and undertakes that it shall deposit into and/or credit the Escrow Account with:

a. All monies received in relation to the Project from any source, including the Senior Lenders, lenders of Subordinated Debt and the Authority;

b. All funds received by the Concessionaire from its shareholders, in any manner or form;

c. Any other revenues; rentals, deposits or capital receipts, as the case may be, from or in respect of the Project; and

d. All proceeds received pursuant to any insurance claims

3.1.2. The Concessionaire may at any time make deposits of its other funds into the Escrow Account, provided that the provisions of this Agreement shall apply to such deposits.

3.2. Deposits by the Authority

3.2.1. The Authority agrees and undertakes that, as and when due and payable, it shall deposit into and/or credit the Escrow Account with:

a. Grant and any other monies disbursed by the Authority to the Concessionaire;

b. All revenues collected by the Authority in exercise of its rights under the Concession Agreement; and

c. Termination Payments

Provided that, notwithstanding the provisions of Clause 4.1.1, the Authority shall be entitled to appropriate from the aforesaid amounts, any amounts due and payable to it by the Concessionaire, and the balance remaining shall be deposited into the Escrow Account.

3.3. Deposits by Senior Lenders

The Lenders' Representative agrees, confirms and undertakes that the Senior Lenders shall deposit into and/or credit the Escrow Account with all disbursements made by them in relation to or in respect of the Project; provided that notwithstanding anything to the contrary contained in this Agreement, the Senior Lenders shall be entitled to make direct payments to the EPC Concessionaire under and in accordance with the express provisions contained in this behalf in the Financing Agreements.

3.4. Interest on deposits

The Escrow Bank agrees and undertakes that all interest accruing on the balances of the Escrow Account shall be credited to the Escrow Account; provided that the Escrow Bank shall be entitled to appropriate therefrom the fee and expenses due to it from the Concessionaire in relation to the Escrow Account and credit the balance remaining to the Escrow Account.

4. WITHDRAWALS FROM ESCROW ACCOUNT

4.1. Withdrawals during Concession Period

4.1.1. At the beginning of every month, or at such shorter intervals as the Lenders' Representative and the Concessionaire may by written instructions determine, the Escrow Bank shall withdraw amounts from the Escrow Account and appropriate them in the following order by depositing such amounts in the relevant Sub-Accounts for making due payments, and if such payments are not due in any month, then retain such monies in such Sub-Accounts and pay out therefrom on the Payment Date(s):

a. All taxes due and payable by the Concessionaire for and in respect of the Project;

b. Deleted;

c. All payments relating to construction of Additional Project Facilities, subject to and in accordance with the conditions, if any, set forth in the Financing Agreements;

d. O&M Expenses, subject to the ceiling, if any, set forth in the Financing Agreements;

e. O&M Expenses and other costs and expenses incurred by the Authority in accordance with the provisions of the Concession Agreement, and certified by the Authority as due and payable to it;

f. Any amounts due and payable to the Authority;

g. Monthly proportionate provision of Debt Service due in an Accounting Year;

h. all payments and Damages certified by the Authority as due and payable to it by the Concessionaire pursuant to the Concession Agreement;

i. Monthly proportionate provision of debt service payments due in an Accounting Year in respect of Subordinated Debt;

j. any reserve requirements set forth in the Financing Agreements; and

k. Balance, if any, in accordance with the instructions of the Concessionaire and the Authority.

4.1.2. No later than 60 (sixty) days prior to the commencement of each Accounting Year, the Concessionaire shall provide to the Escrow Bank, with prior written approval of the Lenders' Representative, details of the amounts likely to be required for each of the payment obligations set forth in this Clause 4.1; provided that such amounts may be subsequently modified, with prior written approval of the Lenders' Representative, if fresh information received during the course of the year makes such modification necessary.

4.2. Withdrawals upon Termination upon Termination of the Concession Agreement, all amounts standing to the credit of the Escrow Account shall, notwithstanding anything in this Agreement, be appropriated and dealt with in the following order:

a. All taxes due and payable by the Concessionaire for and in respect of the Project;

b. Deleted;

c. amount of the Debt Due approved by the Authority as part of the Termination Payment, excluding Subordinated Debt;

d. all payments and Damages certified by the Authority as due and payable to it by the Concessionaire pursuant to the Concession Agreement, including any claims in connection with or arising out of Termination;

e. Retention and payments arising out of, or in relation to, liability for defects and deficiencies set forth in Article 33 of the Concession Agreement;

f. Outstanding Debt Service including the balance of Debt Due;

g. Outstanding Subordinated Debt;

h. Incurred or accrued O&M Expenses;

i. Any other payments required to be made under the Concession Agreement; and

j. Balance, if any, in accordance with the instructions of the Concessionaire and the Authority:

Provided that the disbursements specified in Sub-clause (i) of this Clause 4.2 shall be undertaken only after the Vesting Certificate has been issued by the Authority.

4.3. Application of insufficient funds:

Funds in the Escrow Account shall be applied in the serial order of priority set forth in Clauses 4.1 and 4.2, as the case may be. If the funds available are not sufficient to meet all the requirements, the Escrow Bank shall apply such funds in the serial order of priority until exhaustion thereof.

4.4. Application of insurance proceeds

Notwithstanding anything in this Agreement, the proceeds from all insurance claims, except life and injury, shall be deposited into and/or credited to the Escrow Account and utilized for any necessary repair, reconstruction, reinstatement, replacement, improvement, delivery or installation of the Project, and the balance remaining, if any, shall be applied in accordance with the provisions contained in this behalf in the Financing Agreements.

4.5. Withdrawals during Suspension

Notwithstanding anything to the contrary contained in this Agreement, the Authority may exercise all or any of the rights of the Concessionaire during the period of Suspension under Article 30 of the Concession Agreement. Any instructions given by the Authority to the Escrow Bank during such period shall be complied with as if such instructions were given by the Concessionaire under this Agreement and all actions of the Authority hereunder shall be deemed to have been taken for and on behalf of the Concessionaire.

5. OBLIGATIONS OF THE ESCROW BANK

5.1. Segregation of funds

Monies and other property received by the Escrow Bank under this Agreement shall, until used or applied in accordance with this Agreement, be held by the Escrow Bank in trust for the purposes for which they were received, and shall be segregated from other funds and property of the Escrow Bank.

5.2. Notification of balances

7 (Seven) business days prior to each Payment Date (and for this purpose the Escrow Bank shall be entitled to rely on an affirmation by the Concessionaire and/or the Lenders' Representative as to the relevant Payment Dates), the Escrow Bank shall notify the Lenders' Representative of the balances in the Escrow Account and Sub-Accounts as at the close of business on the immediately preceding business day.

5.3. Communications and notices

In discharge of its duties and obligations hereunder, the Escrow Bank:

a. May, in the absence of bad faith or gross negligence on its part, rely as to any matters of fact which might reasonably be expected to be within the knowledge of the Concessionaire upon a certificate signed by or on behalf of the Concessionaire;

b. may, in the absence of bad faith or gross negligence on its part, rely upon the authenticity of any communication or document believed by it to be authentic;

c. shall, within 5 (five) business days after receipt, deliver a copy to the Lenders' Representative of any notice or document received by it in its capacity as the Escrow Bank from the Concessionaire or any other person hereunder or in connection herewith; and

d. shall, within 5 (five) business days after receipt, deliver a copy to the

Concessionaire of any notice or document received by it from the Lenders' Representative in connection herewith.

5.4. No set off

The Escrow Bank agrees not to claim or exercise any right of set off, banker's lien or other right or remedy with respect to amounts standing to the credit of the Escrow Account. For the avoidance of doubt, it is hereby acknowledged and agreed by the Escrow Bank that the monies and properties held by the Escrow Bank in the Escrow Account shall not be considered as part of the assets of the Escrow Bank and being trust property, shall in the case of bankruptcy or liquidation of the Escrow Bank, be wholly excluded from the assets of the Escrow Bank in such bankruptcy or liquidation.

5.5. Regulatory approvals

The Escrow Bank shall use its best efforts to procure, and thereafter maintain and comply with, all regulatory approvals required for it to establish and operate the Escrow Account. The Escrow Bank represents and warrants that it is not aware of any reason why such regulatory approvals will not ordinarily be granted to the Escrow Bank.

6. ESCROW DEFAULT

6.1. Escrow Default

6.1.1. Following events shall constitute an event of default by the Concessionaire (an "Escrow Default") unless such event of default has occurred as a result of Force Majeure or any act or omission of the Authority or the Lenders' Representative:

a. the Concessionaire commits breach of this Agreement by failing to deposit any receipts into the Escrow Account as provided herein and fails to cure such breach by depositing the same into the Escrow Account within a Cure Period of 5 (five) business days;

b. the Concessionaire causes the Escrow Bank to transfer funds to any account of the Concessionaire in breach of the terms of this Agreement and fails to cure such breach by depositing the relevant funds into the Escrow Account or any Sub Account in which such transfer should have been made, within a Cure Period of 5 (five) business days; or

c. the Concessionaire commits or causes any other breach of the provisions of this Agreement and fails to cure the same within a Cure Period of 5 (five) business days.

6.1.2. Upon occurrence of an Escrow Default, the consequences thereof shall be dealt with under and in accordance with the provisions of the Concession Agreement**.**

7. Termination of Escrow Agreement

7.1. Duration of Escrow Agreement

This Agreement shall remain in full force and effect so long as any sum

remains to be advanced or is outstanding from the Concessionaire in respect of the debt, guarantee or financial assistance received by it from the Senior Lenders, or any of its obligations to the Authority remain to be discharged, unless terminated earlier by consent of all the Parties or otherwise in accordance with the provisions of this Agreement.

7.2. Substitution of Escrow Bank

The Concessionaire may, by not less than 45 (forty five) days prior notice to the Escrow Bank, the Authority and the Lenders' Representative, terminate this Agreement and appoint a new Escrow Bank, provided that the new Escrow Bank is acceptable to the Lenders' Representative and arrangements are made satisfactory to the Lenders' Representative for transfer of amounts deposited in the Escrow Account to a new Escrow Account established with the successor Escrow Bank.

The termination of this Agreement shall take effect only upon coming into force of an Escrow Agreement with the substitute Escrow Bank.

7.3. Closure of Escrow Account

The Escrow Bank shall, at the request of the Concessionaire and the Lenders' Representative made on or after the payment by the Concessionaire of all outstanding amounts under the Concession Agreement and the Financing Agreements including the payments specified in Clause 4.2, and upon confirmation of receipt of such payments, close the Escrow Account and Sub-Accounts and pay any amount standing to the credit thereof to the Concessionaire. Upon closure of the Escrow Account hereunder, the Escrow Agreement shall be deemed to be terminated.

8. SUPPLEMENTARY ESCROW AGREEMENT

8.1. Supplementary escrow agreement

The Lenders' Representative and the Concessionaire shall be entitled to enter into a supplementary escrow agreement with the Escrow Bank providing, inter alia, for detailed procedures and documentation for withdrawals from Sub-Accounts pursuant to Clause 4.1.1 and for matters not covered under this Agreement such as the rights and obligations of Senior Lenders and lenders of Subordinated Debt, investment of surplus funds, restrictions on withdrawals by the Concessionaire in the event of breach of this Agreement or upon occurrence of an Escrow Default, procedures relating to operation of the Escrow Account and withdrawal therefrom, reporting requirements and any matters incidental thereto; provided that such supplementary escrow agreement shall not contain any provision which is inconsistent with this Agreement and in the event of any conflict or inconsistency between provisions of this Agreement and such supplementary escrow agreement, the provisions of this Agreement shall prevail.

9. INDEMNITIES

9.1. General indemnity

9.1.1. The Concessionaire will indemnify, defend and hold the Authority, Escrow Bank and the Senior Lenders, acting through the Lenders' Representative, harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of any breach by the Concessionaire of any of its obligations under this Agreement or on account of failure of the Concessionaire to comply with Applicable Laws and Applicable Permits.

9.1.2. The Authority will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Authority to fulfil any of its obligations under this Agreement materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement or this Agreement other than any loss, damage, cost and expense arising out of acts done in discharge of their lawful functions by the Authority, its officers, servants and agents.

9.1.3. The Escrow Bank will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Escrow Bank to fulfil its obligations under this Agreement materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement other than any loss, damage, cost and expense, arising out of acts done in discharge of their lawful functions by the Escrow Bank, its officers, servants and agents.

9.2. Notice and contest of claims

In the event that any Party hereto receives a claim from a third party in respect of which it is entitled to the benefit of an indemnity under Clause 9.1 or in respect of which it is entitled to reimbursement (the "Indemnified Party"), it shall notify the other Party responsible for indemnifying such claim hereunder (the "Indemnifying Party") within 15 (fifteen) days of receipt of the claim and shall not settle or pay the claim without the prior approval of the Indemnifying Party, which approval shall not be unreasonably withheld or delayed. In the event that the Indemnifying Party wishes to contest or dispute the claim, it may conduct the proceedings in the name of the Indemnified Party and shall bear all costs involved in contesting the same. The Indemnified Party shall provide all cooperation and assistance in contesting any claim and shall sign all such writings and documents as the Indemnifying Party may reasonably require.

10. DISPUTE RESOLUTION

10.1. Dispute resolution

10.1.1. Any dispute, difference or claim arising out of or in connection with this Agreement, which is not resolved amicably, shall be decided finally by reference to arbitration to a Board of Arbitrators comprising one nominee of each Party to the dispute, and where the number of such nominees is an even number, the nominees shall elect another person to such Board. Such arbitration shall be held in accordance with the Rules of Arbitration of the

International Centre for Alternative Dispute Resolution, New Delhi (the "Rules") or such other rules as may be mutually agreed by the Parties, and shall be subject to the provisions of the Arbitration and Conciliation Act, 1996.

10.1.2. The Arbitrators shall issue a reasoned award and such award shall be final and binding on the Parties. The place of arbitration shall be the capital of the State and the language of arbitration shall be English.

11. MISCELLANEOUS PROVISIONS

11.1. Governing law and jurisdiction

This Agreement shall be construed and interpreted in accordance with and governed by the laws of India, and the courts in Chennai shall have jurisdiction over all matters arising out of or relating to this Agreement.

11.2. Waiver of sovereign immunity The Authority unconditionally and irrevocably:

a. agrees that the execution, delivery and performance by it of this Agreement constitute commercial acts done and performed for commercial purpose;

b. agrees that, should any proceedings be brought against it or its assets, property or revenues in any jurisdiction in relation to this Agreement or any transaction contemplated by this Agreement, no immunity (whether by reason of sovereignty or otherwise) from such proceedings shall be claimed by or on behalf of the Authority with respect to its assets;

c. waives any right of immunity which it or its assets, property or revenues now has, may acquire in the future or which may be attributed to it in any jurisdiction; and

d. consents generally in respect of the enforcement of any judgment or award against it in any such proceedings to the giving of any relief or the issue of any process in any jurisdiction in connection with such proceedings (including the making, enforcement or execution against it or in respect of any assets, property or revenues whatsoever irrespective of their use or intended use of any order or judgment that may be made or given in connection therewith).

11.3. Priority of agreements

In the event of any conflict between the Concession Agreement and this Agreement, the provisions contained in the Concession Agreement shall prevail over this Agreement.

11.4. Alteration of term

All additions, amendments, modifications and variations to this Agreement shall be effectual and binding only if in writing and signed by the duly authorized representatives of the Parties.

11.5. Waiver

11.5.1. Waiver by any Party of a default by another Party in the observance and performance of any provision of or obligations under this Agreement:

a. Shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions of or obligations under this Agreement;

b. shall not be effective unless it is in writing and executed by a duly authorized representative of the Party; and

c. shall not affect the validity or enforceability of this Agreement in any manner

11.5.2. Neither the failure by any Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation thereunder nor time or other indulgence granted by any Party to another Party shall be treated or deemed as waiver of such breach or acceptance of any variation or the relinquishment of any such right hereunder.

11.6. No third party beneficiaries This Agreement is solely for the benefit of the Parties and no other person or entity shall have any rights hereunder.

11.7. Survival

11.7.1. **Termination of this Agreement**

a. shall not relieve the Parties of any obligations hereunder which expressly or by implication survive termination hereof; and

b. except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, shall not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of, or caused by, acts or omissions of such Party prior to the effectiveness of such termination or arising out of such termination.

11.7.2. All obligations surviving the cancellation, expiration or termination of this Agreement shall only survive for a period of 3 (three) years following the date of such termination or expiry of this Agreement.

11.8. Severability

If for any reason whatever any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected in any manner, and the Parties will negotiate in good faith with a view to agreeing to one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable to such invalid, illegal or unenforceable provision. Failure to agree upon any such provisions shall not be subject to dispute resolution under Clause 10.1 of this Agreement or otherwise.

11.9. Successors and assigns

This Agreement shall be binding on and shall inure to the benefit of the Parties and their respective successors and permitted assigns.

11.10. Notices

All notices or other communications to be given or made under this Agreement shall be in writing and shall either be delivered personally or sent by courier or registered post with an additional copy to be sent by facsimile or e-mail. The address for service of each Party, its facsimile number and e-mail are set out under its name on the signing pages hereto. A notice shall be effective upon actual receipt thereof, save that where it is received after 5.30 (five thirty) p.m. on a business day, or on a day that is not a business day, the notice shall be deemed to be received on the first business day following the date of actual receipt. Without prejudice to the foregoing, a Party giving or making a notice or communication by facsimile or e-mail shall promptly deliver a copy thereof personally, or send it by courier or registered post to the addressee of such notice or communication. It is hereby agreed and acknowledged that any Party may by notice change the address to which such notices and communications to it are to be delivered or mailed. Such change shall be effective when all the Parties have notice of it.

11.11. Language

All notices, certificates, correspondence and proceedings under or in connection with this Agreement shall be in English.

11.12. Authorized representatives

Each of the Parties shall, by notice in writing, designate their respective authorized representatives through whom only all communications shall be made. A Party hereto shall be entitled to remove and/or substitute or make fresh appointment of such authorized representative by similar notice.

11.13. Original Document

This Agreement may be executed in four counterparts, each of which when executed and delivered shall constitute an original of this Agreement.

IN WITNESS WHEREOF THE PARTIES HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.

THE COMMON SEAL OF CONCESSIONAIRE has been affixed pursuant to the resolution passed by the Board of Directors of the Concessionaire at its meeting held on the day of 20 hereunto affixed in the presence of , Director, who has signed these presents in token thereof and Company Secretary / Authorized Officer who has countersigned the same in token thereof[2].

(Signature)

(Name)

(Designation)

(Address)

(Fax No.)

(E-mail address)

SIGNED SEALED AND DELIVERED

For and on behalf of SENIOR LENDERS by the Lender's representative:

(Signature)

(Name)

(Designation)

(Address)

(Fax No.)

(E-mail address)

SIGNED, SEALED AND DELIVERED

SIGNED, SEALED AND DELIVERED

[2] To be affixed in accordance with the articles of association of the Concessionaire and the resolution passed by its Board of Directors

For and on behalf of THE ESCROW BANK by	for and on behalf of THE AUTHORITY by:
(Signature) (Name) (Designation) (Address) (Fax No.) (E-mail address)	(Signature) (Name) (Designation) (Address) (Fax No.) (E-mail address)

SIGNED, SEALED In the presence of:

SCHEDULE U: PANEL OF CHARTERED ACCOUNTANTS

1 Panel of Chartered Accountants

Pursuant to the provisions of Article 27.2.1 of the Agreement, the Authority and the Concessionaire shall prepare a mutually agreed panel of 5 (five) reputable firms of Chartered Accountants having their registered offices in India (the "Panel of Chartered Accountants"). The criteria for preparing such Panel and the procedure to be adopted in this behalf shall be as set forth in this Schedule-P.

2 Invitation for empanelment

2.1 The Authority shall invite offers from all reputed firms of Chartered Accountants who fulfil the following eligibility criteria, namely:

a) the firm should have conducted statutory audit of the annual accounts of at least fifty companies registered under the Companies Act, 1956, including any re-enactment or amendment thereof, of which at least ten should have been public sector undertakings;

b) The firm should have at least 5 (five) practicing Chartered Accountants on its rolls, each with a minimum experience of ten years in the profession;

c) The firm or any of its partners should not have been disqualified or black-listed by the Comptroller and Auditor General of India or the Authority; and

d) The firm should have an office in the State or in an adjacent State with at least 2 (two) practicing Chartered Accountants on its rolls in such State.

2.2 Interested firms meeting the eligibility criteria shall be required to submit a statement of their capability including the bio-data of all the practicing Chartered Accountants on its rolls. In particular, each firm shall be required to furnish year-wise information relating to the names of all the companies with an annual turnover exceeding Rs. 25,00,00,000 (Rs. twenty five crore) whose annual accounts were audited by such firm in any of the preceding 5 (five) Accounting Years

3 Evaluation and selection

3.1 The information furnished by each firm shall be scrutinized and evaluated by the Authority and 1 (one) point shall be awarded for each annual audit of the companies specified in Paragraph 2.2 above. (For the avoidance of doubt and by way of illustration, a firm which has conducted audit of the annual accounts of any such company for 5 (five) years shall be awarded 5 (five) points).

3.2 The Authority shall prepare a list of all the eligible firms along with the points scored by each such firm and 5 (five) firms scoring the highest points shall be identified and included in the draft Panel of Chartered Accountants.

4 Consultation with the Concessionaire

The Authority shall convey the aforesaid panel of firms to the Concessionaire for scrutiny and comments, if any. The Concessionaire shall be entitled to scrutinize the relevant records of the Authority to ascertain whether the

selection of firms has been undertaken in accordance with the prescribed procedure and it shall send its comments, if any, to the Authority within 15 (fifteen) days of receiving the aforesaid panel.

5 Mutually agreed panel

5.1 The Authority shall, after considering all relevant factors including the comments, if any, of the Concessionaire, finalize and constitute a panel of 5 (five) firms which shall be deemed to be the mutually agreed Panel of Chartered Accountants.

5.2 After completion of every 5 (five) years from the date of preparing the mutually agreed Panel of Chartered Accountants, or such earlier period as may be agreed between the Authority and the Concessionaire, a new panel shall be prepared in accordance with the provisions of this Schedule-J.

SCHEDULE V: VESTING CERTIFICATE

1. The _____, _____ (the "Authority") refers to the Concession Agreement dated …….. (the "Agreement") entered into between the Authority and ……. (the "Concessionaire") for _____on HAM mode in the state of Tamil Nadu. (the "Project") on design, build, operate and transfer ("DBFOT Annuity or Hybrid Annuity") basis.
2. The Authority hereby acknowledges compliance and fulfilment by the Concessionaire of the Divestment Requirements set forth in Article 32.1 of the Agreement on the basis that upon issue of this Vesting Certificate, the Authority shall be deemed to have acquired, and all title and interest of the Concessionaire in or about the Project shall be deemed to have vested unto the Authority, free from any encumbrances, charges and liens whatsoever.
3. Notwithstanding anything to the contrary contained hereinabove, it shall be a condition of this Vesting Certificate that nothing contained herein shall be construed or interpreted as waiving the obligation of the Concessionaire to rectify and remedy any defect or deficiency in any of the Divestment Requirements and/or relieving the Concessionaire in any manner of the same.

Signed this…… day of……., 20……. At……..

AGREED, ACCEPTED AND SIGNED	AGREED, ACCEPTED AND SIGNED
For and on behalf of for and on behalf of	For and on behalf of for and on behalf of
CONCESSIONAIRE by:	AUTHORITY by:
(Signature)	(Signature)
(Name)	(Name)
(Designation)	(Designation)
(Address)	(Address)
In the presence of: 1. 2	

SCHEDULE W: SUBSTITUTION AGREEMENT

THIS SUBSTITUTION AGREEMENT is entered into on this the……day of……..20…….

AMONGST

1 The _____, established under the _____ Act _____, represented by its _____ and having its principal offices at _____ (Hereinafter referred to as the "Authority" which expression shall unless repugnant to the context or meaning thereof include its administrators, successors and assigns);

2 ……Limited, a company incorporated under the provisions of the Companies Act, 2013 and having its registered office at ……. (Hereinafter referred to as the "Concessionaire" which expression shall unless repugnant to the context or meaning thereof include its successors and permitted assigns and substitutes);

3 …….. (insert name and particulars of Lenders' Representative) and having its registered office at……., acting for and on behalf of the Senior Lenders as their duly authorized agent with regard to matters arising out of or in relation to this Agreement (hereinafter referred to as the "Lenders' Representative", which expression shall unless repugnant to the context or meaning thereof include its successors and substitutes);

WHEREAS:

A. The Authority has entered into a Concession Agreement dated……. With the Concessionaire (the "Concession Agreement") for _____ on HAM mode in the state of Tamilnadu. (the "Project") on design, build, operate and transfer basis (the "DBFOT Annuity or Hybrid Annuity"), and a copy of which is annexed hereto and marked as Annex-A to form part of this Agreement.

B. Senior Lenders have agreed to finance the Project in accordance with the terms and conditions set forth in the Financing Agreements.

C. Senior Lenders have requested the Authority to enter into this Substitution Agreement for securing their interests through assignment, transfer and substitution of the Concession to a Nominated Company in accordance with the provisions of this Agreement and the Concession Agreement.

D. In order to enable implementation of the Project including its financing, construction, operation and maintenance, the Authority has agreed and undertaken to transfer and assign the Concession to a Nominated Company in accordance with the terms and conditions set forth in this Agreement and the Concession Agreement.

NOW, THEREFORE, in consideration of the foregoing and the respective covenants and agreements set forth in this Agreement, the receipt and sufficiency of which is hereby acknowledged, and intending to be legally bound hereby, the Parties agree as follows:

1. DEFINITIONS AND INTERPRETATION

1.1. Definitions

In this Substitution Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively assigned to them: "Agreement" means this Substitution Agreement and any amendment thereto made in accordance with the provisions contained in this Agreement;

"Financial Default" means occurrence of a material breach of the terms and conditions of the Financing Agreements or a continuous default in Debt Service by the Concessionaire for a minimum period of 3 (three) months;

"Lenders' Representative" means the person referred to as the Lenders' Representative in the foregoing Recitals;

"Nominated Company" means a company, incorporated under the provisions of the Companies Act, 1956, including any re-enactment or amendment thereof, selected by the Lenders' Representative, on behalf of Senior Lenders, and proposed to the Authority for assignment/transfer of the Concession as provided in this Agreement;

"Notice of Financial Default" shall have the meaning ascribed thereto in Clause 3.2.1; and

"Parties" means the parties to this Agreement collectively and "Party" shall mean any of the Parties to this Agreement individually.

1.2. Interpretation

1.2.1. References to Lenders' Representative shall, unless repugnant to the context or meaning thereof, mean references to the Lenders' Representative, acting for and on behalf of Senior Lenders.

1.2.2. References to Clauses are, unless stated otherwise, references to Clauses of this Agreement.

1.2.3. The words and expressions beginning with capital letters and defined in this Agreement shall have the meaning ascribed thereto herein, and the words and expressions used in this Agreement and not defined herein but defined in .the Concession Agreement shall, unless repugnant to the context, have the meaning ascribed thereto in the Concession Agreement.

1.2.4. The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Concession Agreement shall apply, mutatis mutandis, to this Agreement.

2. ASSIGNMENT

2.1. Assignment of rights and title

The Concessionaire hereby agrees to assign the rights, title and interest in the Concession to, and in favor of, the Lenders' Representative pursuant to and in accordance with the provisions of this Agreement and the Concession Agreement by way of security in respect of financing by the Senior Lenders under the Financing Agreements.

3. SUBSTITUTION OF THE CONCESSIONAIRE

3.1. Rights of substitution

3.1.1. Pursuant to the rights, title and interest assigned under Clause 2.1, the Lenders' Representative shall be entitled to substitute the Concessionaire by a Nominated Company under and in accordance with the provisions of this Agreement and the Concession Agreement.

3.1.2. The Authority hereby agrees to substitute the Concessionaire by endorsement on the Concession Agreement in favor of the Nominated Company selected by the Lenders' Representative in accordance with this Agreement. For the avoidance of doubt, the Senior Lenders or the Lenders' Representative shall not be entitled to operate and maintain the Project as Concessionaire either individually or collectively.

3.2. Substitution upon occurrence of Financial Default

3.2.1. Upon occurrence of a Financial Default, the Lenders' Representative may issue a notice to the Concessionaire (the "Notice of Financial Default") along with particulars thereof, and send a copy to the Authority for its information and record. A Notice of Financial Default under this Clause 3 shall be conclusive evidence of such Financial Default and it shall be final and binding upon the Concessionaire for the purposes of this Agreement.

3.2.2. Upon issue of a Notice of Financial Default hereunder, the Lenders' Representative may, without prejudice to any of its rights or remedies under this Agreement or the Financing Agreements, substitute the Concessionaire by a Nominated Company in accordance with the provisions of this Agreement.

3.2.3. At any time after the Lenders' Representative has issued a Notice of Financial Default, it may by notice require the Authority to suspend all the rights of the Concessionaire and undertake the operation and maintenance of the Project in accordance with the provisions of Article 30 of the Concession Agreement, and upon receipt of such notice, the Authority shall undertake Suspension under and in accordance with the provisions of the Concession Agreement. The aforesaid Suspension shall be revoked upon substitution of the Concessionaire by a Nominated Company, and in the event such substitution is not completed within 180 (one hundred and eighty) days from the date of such Suspension, the Authority may terminate the Concession Agreement forthwith by issuing a Termination Notice in accordance with the provisions of the Concession Agreement; provided that upon written request from the Lenders' Representative and the Concessionaire, the Authority may extend the aforesaid period of 180 (one hundred and eighty) days by a period not exceeding 90 (ninety) days. For the avoidance of doubt, the Authority expressly agrees and undertakes to terminate the Concession Agreement forthwith, upon receipt of a written request from the Lenders' Representative at any time after 240 (two hundred and forty) days from the date of Suspension hereunder.

3.3. Substitution upon occurrence of Concessionaire Default

3.3.1. Upon occurrence of a Concessionaire Default, the Authority shall by a notice inform the Lenders' Representative of its intention to issue a Termination Notice and grant 15 (fifteen) days' time to the Lenders' Representative to make a representation, stating the intention to substitute the Concessionaire by a Nominated Company.

3.3.2. In the event that the Lenders' Representative makes a representation to the Authority within the period of 15 (fifteen) days specified in Clause 3.3.1, stating that it intends to substitute the Concessionaire by a Nominated Company, the Lenders' Representative shall be entitled to undertake and complete the substitution of the Concessionaire by a Nominated Company in accordance with the provisions of this Agreement within a period of 180 (one hundred and eighty) days from the date of such representation, and the Authority shall either withhold Termination or undertake Suspension for the aforesaid period of 180 (one hundred and eighty) days; provided that upon written request from the Lenders' Representative and the Concessionaire, the Authority shall extend the aforesaid period of 180 (one hundred and eighty) days by a period not exceeding 90 (ninety) days; provided further that the Lenders' Representative may at any time withdraw its representation hereunder and upon such withdrawal, the Authority may terminate this Agreement in accordance with the provisions hereof.

3.4. Procedure for substitution

3.4.1. The Authority and the Concessionaire hereby agree that on or after the date of Notice of Financial Default or the date of representation to the Authority under Clause 3.3.2, as the case may be, the Lenders' Representative may, without prejudice to any of the other rights or remedies of the Senior Lenders, invite, negotiate and procure offers, either by private negotiations or public auction or tenders for the take over and transfer of the Project including the Concession to the Nominated Company upon such Nominated Company's assumption of the liabilities and obligations of the Concessionaire towards the Authority under the Concession Agreement and towards the Senior Lenders under the Financing Agreements.

3.4.2. To be eligible for substitution in place of the Concessionaire, the Nominated Company shall be required to fulfil the eligibility criteria that were laid down by the Authority for short listing the bidders for award of the Concession; provided that the Lenders' Representative may represent to the Authority that all or any of such criteria may be waived in the interest of the Project, and if the Authority determines that such waiver shall not have any material adverse effect on the Project, it may waive all or any of such eligibility criteria.

3.4.3. Upon selection of a Nominated Company, the Lenders' Representative shall request the Authority to:

a. Accede to transfer to the Nominated Company the right to construct, operate and maintain the Project in accordance with the provisions of the Concession Agreement;

b. Endorse and transfer the Concession to the Nominated Company, on the same terms and conditions, for the residual Concession Period; and

c. Enter into a Substitution Agreement with the Lenders' Representative and the Nominated Company on the same terms as are contained in this Agreement.

3.4.4. If the Authority has any objection to the transfer of Concession in favor of the Nominated Company in accordance with this Agreement, it shall within 15 (fifteen) days from the date of proposal made by the Lenders' Representative, give a reasoned order after hearing the Lenders' Representative. If no such objection is raised by the Authority, the Nominated Company shall be deemed to have been accepted. The Authority shall thereupon transfer and endorse the Concession within 15 (fifteen) days of its acceptance/deemed acceptance of the Nominated Company; provided that in the event of such objection by the Authority, the Lenders' Representative may propose another Nominated Company whereupon the procedure set forth in this Clause 3.4 shall be followed for substitution of such Nominated Company in place of the Concessionaire.

3.4.5. The transfer of Concession hereunder to a Nominated Company may, notwithstanding anything to the contrary in this Agreement and the Concession Agreement, be undertaken by transfer of no less than 75% (seventy five per cent) of the equity of the Concessionaire to the Nominated Company, and upon such transfer hereunder, the Concessionaire shall be deemed to be the Nominated Company under and in accordance with the provisions of this Agreement and the Concession Agreement.

3.5. Selection to be binding

The decision of the Lenders' Representative and the Authority in selection of the Nominated Company shall be final and binding on the Concessionaire. The Concessionaire irrevocably agrees and waives any right to challenge the actions of the Lenders' Representative or the Senior Lenders or the Authority taken pursuant to this Agreement including the transfer/assignment of the Concession in favor of the Nominated Company. The Concessionaire agrees and confirms that it shall not have any right to seek revaluation of assets of the Project or the Concessionaire's shares. It is hereby acknowledged by the Parties that the rights of the Lenders' Representative are irrevocable and shall not be contested in any proceedings before any court or Authority and the Concessionaire shall have no right or remedy to prevent, obstruct or restrain the Authority or the Lenders' Representative from effecting or causing the transfer by substitution and endorsement of the Concession as requested by the Lenders' Representative.

4. PROJECT AGREEMENTS

4.1. Substitution of Nominated Company in Project Agreements

The Concessionaire shall ensure and procure that each Project Agreement contains provisions that entitle the Nominated Company to step into such Project Agreement, in its discretion, in place and substitution of the Concessionaire in the event of such Nominated Company's assumption of the liabilities and obligations of the Concessionaire under the Concession Agreement.

5. TERMINATION OF CONCESSION AGREEMENT

5.1. Termination upon occurrence of Financial Default

At any time after issue of a Notice of Financial Default, the Lenders' Representative may by a notice in writing require the Authority to terminate the Concession Agreement forthwith, and upon receipt of such notice, the Authority shall undertake Termination under and in accordance with the provisions of Article 31 of the Concession Agreement.

5.2. Termination when no Nominated Company is selected

In the event that no Nominated Company acceptable to the Authority is selected and recommended by the Lenders' Representative within the period of 180 (one hundred and eighty) days or any extension thereof as set forth in Clause 3.3.2, the Authority may terminate the Concession Agreement forthwith in accordance with the provisions thereof.

5.3. Realization of Debt Due

The Authority and the Concessionaire hereby acknowledge and agree that, without prejudice to their any other right or remedy, the Lenders' Representative is entitled to receive from the Concessionaire, without any further reference to or consent of the Concessionaire, the Debt Due upon Termination of the Concession Agreement. For realization of the Debt Due, the Lenders' Representative shall be entitled to make its claim from the Escrow Account in accordance with the provisions of the Concession Agreement and the Escrow Agreement.

6. DURATION OF THE AGREEMENT

6.1. Duration of the Agreement

This Agreement shall come into force from the date hereof and shall expire at the earliest to occur of the following events:

A. Termination of the Agreement; or

B. No sum remains to be advanced and no sum are outstanding to the Senior Lenders, under the Financing Agreements.

7. INDEMNITY

7.1. General indemnity

7.1.1. The Concessionaire will indemnify, defend and hold the Authority and the Lenders' Representative harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense of whatever kind and nature arising out of any breach by the Concessionaire of any of its obligations under this Agreement or on account of failure of the Concessionaire to comply with Applicable Laws and Applicable Permits.

7.1.2. The Authority will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Authority to fulfil any of

its obligations under this Agreement, materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement or this Agreement, other than any loss, damage, cost and expense, arising out of acts done in discharge of their lawful functions by the Authority, its officers, servants and agents.

7.1.3. The Lenders' Representative will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Lenders' Representative to fulfil its obligations under this Agreement, materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement, other than any loss, damage, cost and expense, arising out of acts done in discharge of their lawful functions by the Lenders' Representative, its officers, servants and agents.

7.2. Notice and contest of claims

In the event that any Party hereto receives a claim from a third party in respect of which it is entitled to the benefit of an indemnity under Clause 7.1 or in respect of which it is entitled to reimbursement (the "Indemnified Party"), it shall notify the other Party responsible for indemnifying such claim hereunder (the "Indemnifying Party") within 15 (fifteen) days of receipt of the claim and shall not settle or pay the claim without the prior approval of the Indemnifying Party, such approval not to be unreasonably withheld or delayed. In the event that the Indemnifying Party wishes to contest or dispute the claim, it may conduct the proceedings in the name of the Indemnified Party and shall bear all costs involved in contesting the same. The Indemnified Party shall provide all cooperation and assistance in contesting any claim and shall sign all such writings and documents as the Indemnifying Party may reasonably require.

8. DISPUTE RESOLUTION

8.1. Dispute resolution

8.1.1. Any dispute, difference or claim arising out of or in connection with this Agreement which is not resolved amicably shall be decided by reference to arbitration to a Board of Arbitrators comprising one nominee each of the Authority, Concessionaire and the Lenders' Representative. Such arbitration shall be held in accordance with the Rules of Arbitration of the International Centre for Alternative Dispute Resolution, New Delhi (the "Rules") or such other rules as may be mutually agreed by the Parties, and shall be subject to provisions of the Arbitration and Conciliation Act, 1996.

8.1.2. The Arbitrators shall issue a reasoned award and such award shall be final and binding on the Parties. The place of arbitration shall be the capital of the State and the language of arbitration shall be English.

9. MISCELLANEOUS PROVISIONS

9.1. Governing law and jurisdiction

This Agreement shall be construed and interpreted in accordance with and

governed by the laws of India, and the courts in the New Delhi shall have jurisdiction over all matters arising out of or relating to this Agreement.

9.2. Waiver of sovereign immunity

The Authority unconditionally and irrevocably:

a) agrees that the execution, delivery and performance by it of this Agreement constitute commercial acts done and performed for commercial purpose;

b) agrees that, should any proceedings be brought against it or its assets, property or revenues in any jurisdiction in relation to this Agreement or any transaction contemplated by this Agreement, no immunity (whether by reason of sovereignty or otherwise) from such proceedings shall be claimed by or on behalf of the Authority with respect to its assets;

c) waives any right of immunity which it or its assets, property or revenues now has, may acquire in the future or which may be attributed to it in any jurisdiction; and

d) consents generally in respect of the enforcement of any judgment or award against it in any such proceedings to the giving of any relief or the issue of any process in any jurisdiction in connection with such proceedings (including the making, enforcement or execution against it or in respect of any assets, property or revenues whatsoever irrespective of their use or intended use of any order or judgment that may be made or given in connection therewith).

9.3. Priority of agreements

In the event of any conflict between the Concession Agreement and this Agreement, the provisions contained in the Concession Agreement shall prevail over this Agreement.

9.4. Alteration of terms

All additions, amendments, modifications and variations to this Agreement shall be effectual and binding only if in writing and signed by the duly authorized representatives of the Parties.

9.5. Waiver

9.5.1. Waiver by any Party of a default by another Party in the observance and performance of any provision of or obligations under this Agreement:

a) Shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions of or obligations under this Agreement;

b) Shall not be effective unless it is in writing and executed by a duly authorized representative of the Party; and

c) Shall not affect the validity or enforceability of this Agreement in any manner.

9.5.2. Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation thereunder nor time or other indulgence granted by a Party to

another Party shall be treated or deemed as waiver of such breach or acceptance of any variation or the relinquishment of any such right hereunder.

9.6. No third party beneficiaries

This Agreement is solely for the benefit of the Parties and no other person or entity shall have any rights hereunder.

9.7. Survival

9.7.1. Termination of this Agreement:

a) Shall not relieve the Parties of any obligations hereunder which expressly or by implication survive termination hereof; and

b) except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, shall not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of or caused by acts or omissions of such Party prior to the effectiveness of such termination or arising out of such termination.

9.7.2. All obligations surviving the cancellation, expiration or termination of this Agreement shall only survive for a period of 3 (three) years following the date of such termination or expiry of this Agreement.

9.8. Severability

If for any reason whatever any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected in any manner, and the Parties will negotiate in good faith with a view to agreeing to one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable to such invalid, illegal or unenforceable provision. Failure to agree upon any such provisions shall not be subject to dispute resolution under Clause 8 of this Agreement or otherwise.

9.9. Successors and assigns

This Agreement shall be binding on and shall inure to the benefit of the Parties and their respective successors and permitted assigns.

9.10. Notices

All notices or other communications to be given or made under this Agreement shall be in writing, shall either be delivered personally or sent by courier or registered post with an additional copy to be sent by facsimile or e-mail. The address for service of each Party, its facsimile number and e-mail address are set out under its name on the signing pages hereto. A notice shall be effective upon actual receipt thereof, save that where it is received after 5.30 (five thirty) p.m. on any day, or on a day that is a public holiday, the notice shall be deemed to be received on the first working day following the date of actual receipt. Without prejudice to the foregoing, a Party giving or making a notice or communication by facsimile or e-mail shall promptly deliver a copy thereof

personally, or send it by courier or registered post to the addressee of such notice or communication. It is hereby agreed and acknowledged that any Party may by notice change the address to which such notices and communications to it are to be delivered or mailed. Such change shall be effective when all the Parties have notice of it.

9.11. Language

All notices, certificates, correspondence and proceedings under or in connection with this Agreement shall be in English.

9.12. Authorized representatives

Each of the Parties shall by notice in writing designate their respective authorized representatives through whom only all communications shall be made. A Party hereto shall be entitled to remove and/or substitute or make fresh appointment of such authorized representative by similar notice.

9.13. Original Document

This Agreement may be executed in three counterparts, each of which when executed and delivered shall constitute an original of this Agreement.

IN WITNESS WHEREOF THE PARTIES HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN

THE COMMON SEAL OF CONCESSIONAIRE has been affixed pursuant to the resolution passed by the Board of Directors of the Concessionaire at its meeting held on the……..day of the …….20……..here unto affixed in to the presence of……the Director, who has signed these presents in token thereof, ……Company Secretary /Authorized Officer who has countersigned the same in token thereof	SIGNED, SEALED AND DELIVERED For and behalf of THE AUTHORITY by:
(Signature) (Name) (Designation) (Address) (Fax No.) (e-mail address)	(Signature) (Name) (Designation) (Address) (Fax No.) (e-mail address)

SIGNED, SEALED AND DELIVERED
For and on behalf of
SENIOR LENDERS by the
Lenders' Representative:
(Signature)
(Name)
(Designation)
(Address)
(Fax No.)
(E-mail address)
In the presence of:
1.
2.