Central Monitoring System Covering Water Treatment Plants, UGRs and Distribution Network for **Delhi Jal Board**

FUNCTIONAL & TECHNICAL REQUIREMENTS

Request for Proposal

Volume I

Table of Content

1. Introduction

For effective management of the water supply and sewerage in the NCT of Delhi, the Delhi Government reconstituted the Delhi water supply and sewage disposal undertaking into the Delhi Jal Board (DJB), with the Chief Minister of NCT as Chairman of the Board.

Aimed at meeting the needs of potable water within the National Capital Territory of Delhi (NCTD), formally the Delhi Jal Board (DJB) was constituted through a legislative act of the Delhi Legislative Assembly on the 6th April 1998. DJB's vision is to be environmentally sensitive in providing quality, reliable, and reasonably priced drinking water and waste water collection and treatment systems.

The DJB is responsible for water resources management, monitoring the pollution of water and the treatment and supply of potable water. Wastewater collection, conveyance, treatment and disposal facilities are also the responsibility of DJB. The existing demand of drinking water in Delhi is about 1,100 million gallons per day (mgd) whereas the water production capacity is over 800 mgd. The increase in annual demand of water is projected at 40 to 50 mgd. With the increase in current population crossing 18 million[1], and a floating population of 4 to 5 lakhs, the demand for water supply is likely to be of an order of magnitude much higher.

DJB is responsible for providing water supply to over 18 million people in the National Capital Territory (NCT) which covers an area of about 1500 sq kms. The total quantity of water supplied to the city is about 3800 million liters of water per day. There are 9 Water Treatment Plants (WTPs) which receive raw water from different sources and treat them to drinking quality.

At each WTP, Clear water pumping stations are installed which transmit the water produced at the WTPs to approximately 120 Nos of Distribution Centers spread over the city. Each Distribution Center consists of an Underground Reservoir (UGR) and a booster pumping station and is responsible for water distribution to the consumers in its Command Area.

The UGRs receive water from the WTPs and the water is pumped to the distribution network in the Command Areas by the booster pumps at the Distribution Centers. The water supply is intermittent and the supply hours to consumers are limited.

Some measuring instruments such as flow meters and pressure meters have been installed at various locations in the water supply network. The readings are available locally which are being used for day-to-day operations of the water works.

© Delhi Jal Board

2. Introduction to Central Monitoring System

2.1 Project Background

Delhi Jal Board is committed for the augmentation of water supply in Delhi and has taken many steps in this direction. Delhi Jal Board has ensured average availability of 50 gallons per capita per day of filtered water through an efficient network of water treatment plants, booster pumping stations and about 11000 kms* of water mains & distribution system.

DJB proposed to establish **Central Monitoring System** (**CMS**) to monitor quantitative parameters (flow, pressure, tank levels), Qualitative (Chlorine, Turbidity, BOD, SS) and energy at Water Treatment Plants / Under Ground Reservoirs / Transmission & distribution network with the following objectives:-

- Effective on line monitoring of water quality
- Effective utilization of present raw WATER available
- Water resource augmentation through leakage reduction
- Improvising System efficiency including
- Monitoring the energy consumption

Current initiative

Delhi Jal Board had started action to carry out the availability of potable water and to know the production of water at various water works and pumped in distribution through various pipelines. 86 number of flow meters are already installed at Water treatment plants and their rising mains. In addition, DJB is already in process of installing 319 nos. flow meters in various raw water channels, rising mains and distribution lines for measurement of raw water and potable water.

These are the following features of existing system:

- There are four centralized control stations & one main control station (Varunalaya)
- The totalized flow through each flow meter is transmitted from each flow meter to their respective centralized location as well as to be main control station located at Varunalaya.
- Total 319 no.s flow meters are segregated in four groups & the data of the FM from each group is transmitted to the respective control station as assigned. Additionally the data of each FM is sent to main control station through SMS.
- The totalized flow from each flow meter of the particular group is available at the specified control station's PC in the form of SCADA. The SCADA provides the totalized flow of each flow meter with respect to time along with trends, history and MIS report, alarm, graphics, mimics as per system requirement.
- Although there is a need for more flow meters, pressure meters, level meters, energy meters and quality meters at various critical points for the comprehensive monitoring and auditing of water supply network. The proposed CMS will be integrated with the existing system and support all the analytical instruments and help in better decision making.

Proposed system

The current RFP is to introduce a Centralized Monitoring System for all WTPs and their command areas. This would cover all areas. The centralized monitoring system will result in commissioning of pressure gauges, flow meters, UGR level gauges, residual chlorine measurement, turbidity measurement and UGR / WTP energy meters and BOD, SS at 19 STPs.

2.2 Intent of the Project

The CMS project is intended for capturing the on-line real time information of the water supply operating parameters regarding quantity and quality of water and electrical energy being consumed at various water works. The CMS system will cover the data from all the water works viz. 9 WTPS, 120 Underground Reservoirs / Distribution Centers (UGRs and Pumping stations) and the distribution systems in 61 Command areas. CMS system will be a tool for effective management of water supply system. Readily available on-line information will be used for coordinated operations among various water works and will help in prompt actions regarding water shortages and leakages. In addition, 19 nos. of Sewage treatment plants will also be covered to include treated water flow and BOD, SS at each of the these plants.

2.3 Objectives

The primary objective of this initiative is real time remote monitoring of Water treatment to distribution network of Delhi Jal Board on parameters like Flow, Pressure, UGR & SUMP Levels, Energy Consumption and Water Quality. In addition treated water flow and BOD, SS shall be measured for STPs.

The objectives of this initiative are following:

- Timely availability of real time operating parameters
- Real time assessment of water supply situation
- Real time data on water quality
- Readily available on-line information of distribution data in command areas periphery network
- Reliable real time data for service level parameters
- To provide alert in case of deviation to set parameters.
- To bring in accountability into the system and the services
    - To use latest technology effectively and efficiently to yield significant improvements in efficiency, productivity, profitability and competitive advantage to Delhi Jal Board.
    - To enable better decision making by providing real time data and a technological platform for effective integration with other communications and information management technology.
    - To provide significant opportunities for item-based process improvement and innovation in the functioning of Water network

Establishment of the Centralized Monitoring Station will result in accurate and automated data in continuity for pressure , flow, energy consumption monitoring , water quality monitoring including complete water audit for the transmission mains. The system will also monitor treated effluent quality in terms of BOD & SS for 19 Sewage Treatment Plants .

Current project is aimed at

- Real time Dash board view of Overall system on healthiness
- Efficient utilization of water
- Ease of coordination for maintenance activities

- Specialized focus and monitoring over each part of the distribution value chain, thereby ensuring attention on each part
- The area of operation under a unit would be manageable in terms of the geographic spread
- Focused attention to all maintenance works from the plant to the consumers-end

The CMS would effectively monitor the activity of water systems from a single location. Immediate detection of problems through diagnostic displays will enable quick intervention for fast resolution. Centralized control and monitoring of distribution and collection system will provide data for water modelling and energy use optimization, as well as predictive maintenance of distributed equipment.

CMS system design is centered on reliability, ensuring constant communication from the server to the remote units. The system will have configuration to support fail safe design for round the clock monitoring.

3. RFP Structure

The content of this RFP has been documented as a set of two volumes as explained below:

Volume I: Functional, Technical & Legal Requirements

Volume I of RFP intends to bring out all the details with respect to solution and other requirements that Department deems necessary to share with the potential bidders. The information set out in this volume has been broadly categorized as Functional, Technical, Contractual, Legal and Non-functional requirements covering multiple aspects of the requirements.

Volume II: Commercial and Bidding Terms

Volume II of RFP purports to detail out all that may be needed by the potential bidders to understand the scope of work, project implementation, timelines, commercial terms and bidding process details.

Volume III: Contractual & Legal Specifications

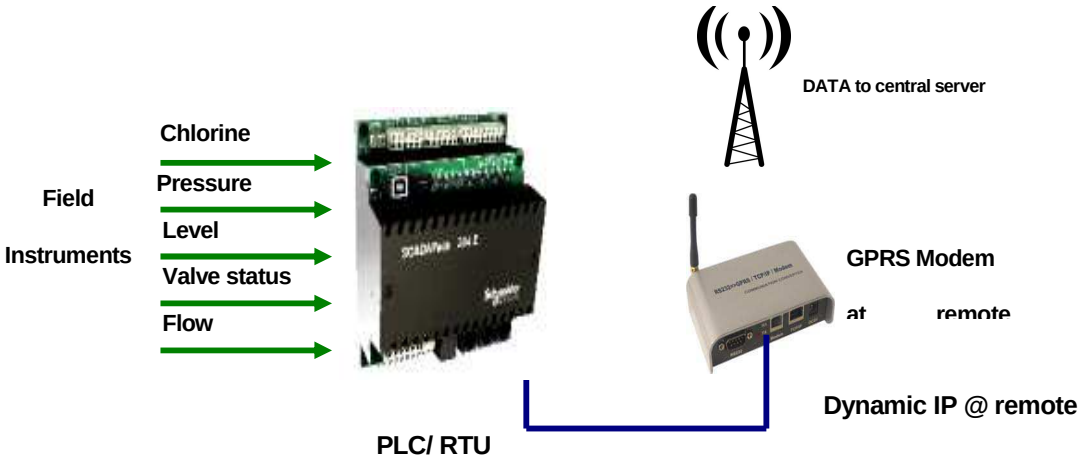
This volume is Volume I.

4. Proposed Solution

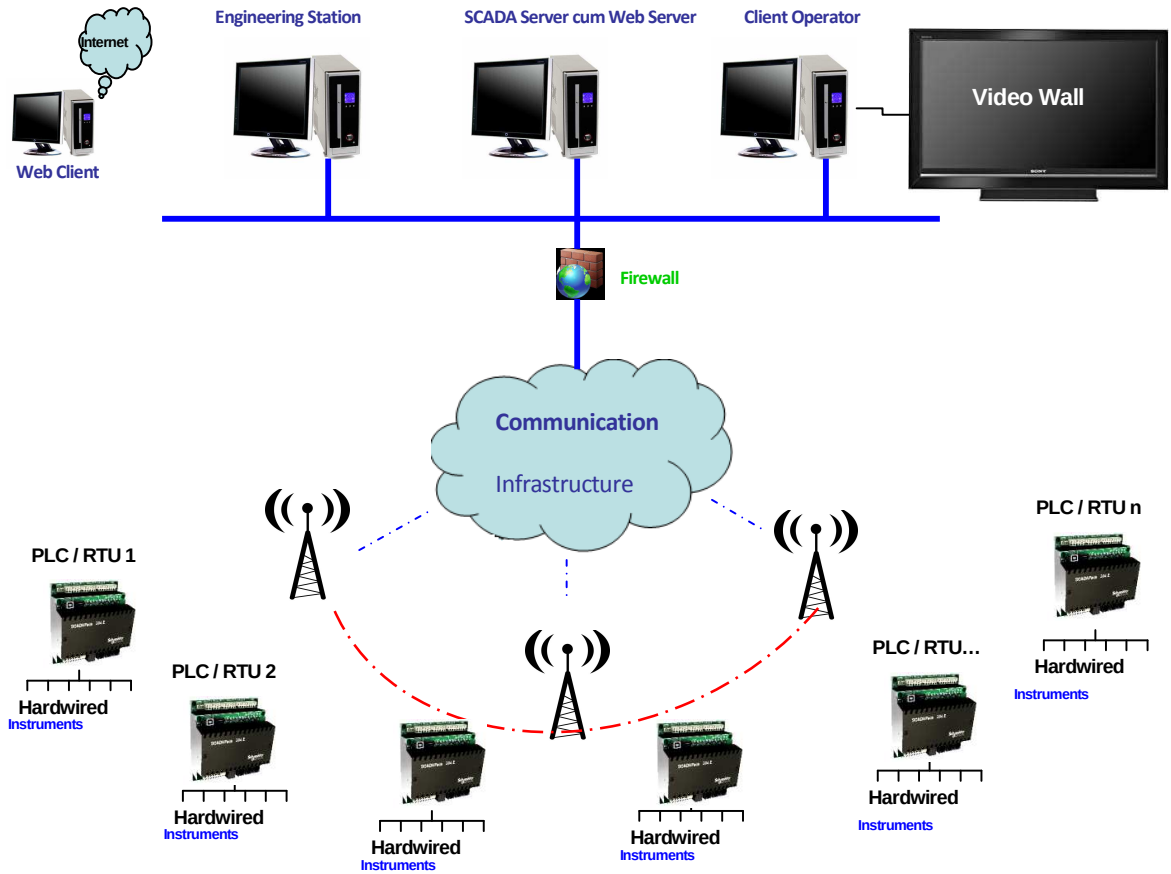
The CMS project is a project for providing various measurements of water quantity, quality and energy consumed and making the information available at right places at right time. Considering the wide geographical scope and operational complexity, scope of the project is to Design, Develop, Test, Deploy, Operate and Maintain the proposed Central Monitoring System and integration with the Department's functional areas.

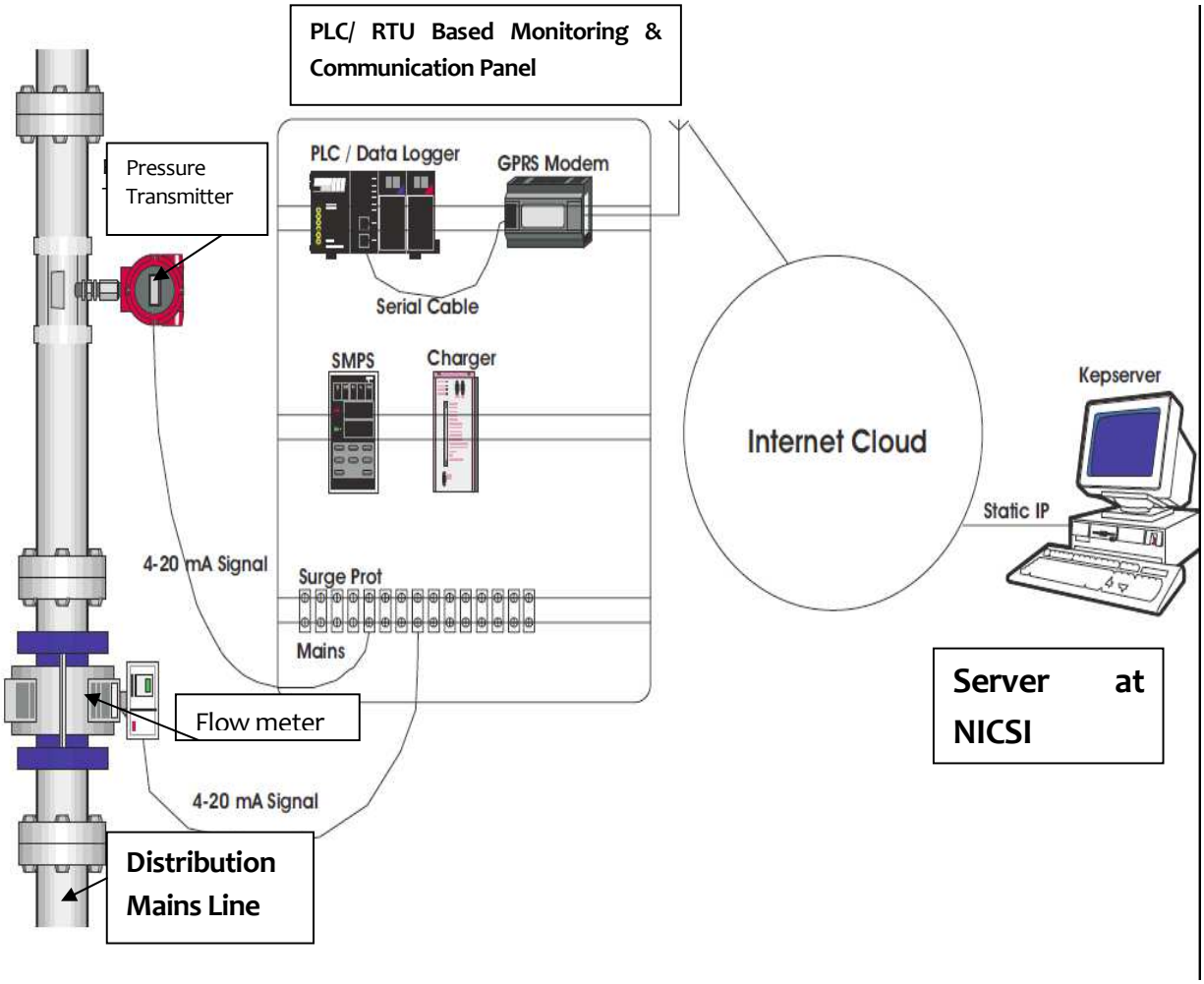
1. Central monitoring system (CMS) shall be implemented by capturing following parameters across Water and Sewerage Network of DJB.
   i) Water Network consisting of Water treatment plants, Transmission network, Underground Reservoirs and distribution network across Delhi.
      a. Water Flow
      b. Water Pressure
      c. Water Level
      d. Chlorine
      e. Turbidity
      f. Energy
   ii) Sewerage network will cover 19 No. Sewage treatment plants in Delhi.
      a. Treated water flow
      b. BOD & SS
2. Number of instruments defined in each category shall be deployed as part of the project across DJB's network. The location of the instruments is identified as part of the RFP, however, final location shall be finalized in consultation with the DJB's project in charge during implementation of the project.
3. DJB has already implemented certain instruments in the field. Details of such instruments are provided in the RFP. These instruments are to be integrated in the CMS system with GPRS connectivity from these locations as a part of this project
   a. It is also required that maintenance of these systems shall be taken over by the contractor of CMS system after expiry of current maintenance arrangement.
   b. Maintenance of 319 nos. flow meters shall be undertaken by their respective supplier till three years from September 2012. i.e. upto September 2015. Accordingly bidder has to make provision for their maintenance after September 2015 till expiry of the agreement to be executed under this RFP.
   b. Maintenance of 86 Nos. flow meters in WTPs is already expired and contractor will be required to take over the maintenance of these meters under this project.
4. DJB has also implemented certain SCADA system in the Water treatment plants and adjoining network. Bidder shall integrate the CMS to capture identified parameters for use in CMS system.
5. Bidder shall ensure integration of existing flow meters (319 + 86) on GPRS communication to the CMS during the term of this agreement.
6. The instruments shall be installed as per established engineering practices and in a RCC chamber. Chamber shall be made of RCC suitable as per site conditions.

7. The PLC / RTU and associated equipment shall be housed in all weather proof enclosure for proper safety and security. Bidder shall get the equipment insured to address any such eventuality during the term of this agreement.
8. Necessary power supply, instrumentation earthing, lightening arrestor etc. shall be arranged by the bidder at each of the field locations. Electric supply shall be made available, with support from DJB for obtaining connections from the power supply companies. The cost of all such connecttions and the running expenditures for the same shall be borne by the bidder. Within the DJB premises DJB shall provide the power supply at a single source within its premises, however, bidder will be required to make necessary arrangement to extend and integrate with CMS equipments.
9. PLC / RTUs shall have the facility for storing the data for minimum 7 days in case of operational failure.
10. PLC / RTUs shall be equipped with the facility for transferring data in Push and pull mode, through a suitable communication media (GPRS) to the central server to be located at NICSI data center. Bidder is required to provision the GPRS communication through suitable service provider/s
11. Data from each PLC / RTU shall be stored at the data center. Bidder shall ensure processing of this data to generate various MIS reports as per roles defined in the system.
12. The CMS shall be accessible through the internet as per defined policy to be finalised in coordination with DJB. Policy will cover the role based access of data and reports across the organization.
13. System shall be able to generate the alarms against predefined thresholds and depending on the classification of alarm, it shall be possible to generate SMS alert to certain mobile phone number(s). Bidder shall arrange all software/ hardware at server end for implementation of such system.
14. In addition to the standard reports, the system shall have provision to generate the customized reports as per need during the term of the project.
15. The data center will be always connected to the central control room to be established under this project. The control room will be installed at DJB head quarter. The space for the same shall be provided by the DJB. However the bidder shall be required to include all interior works required for control room environment such as false ceiling, panelling, furniture and fixtures, air conditioning etc.
16. Bidder will provide the necessary Video wall in the control room as per details provided in the RFP. Redundant communication link from NICSI data center to DJB's control room shall be provided by the bidder.

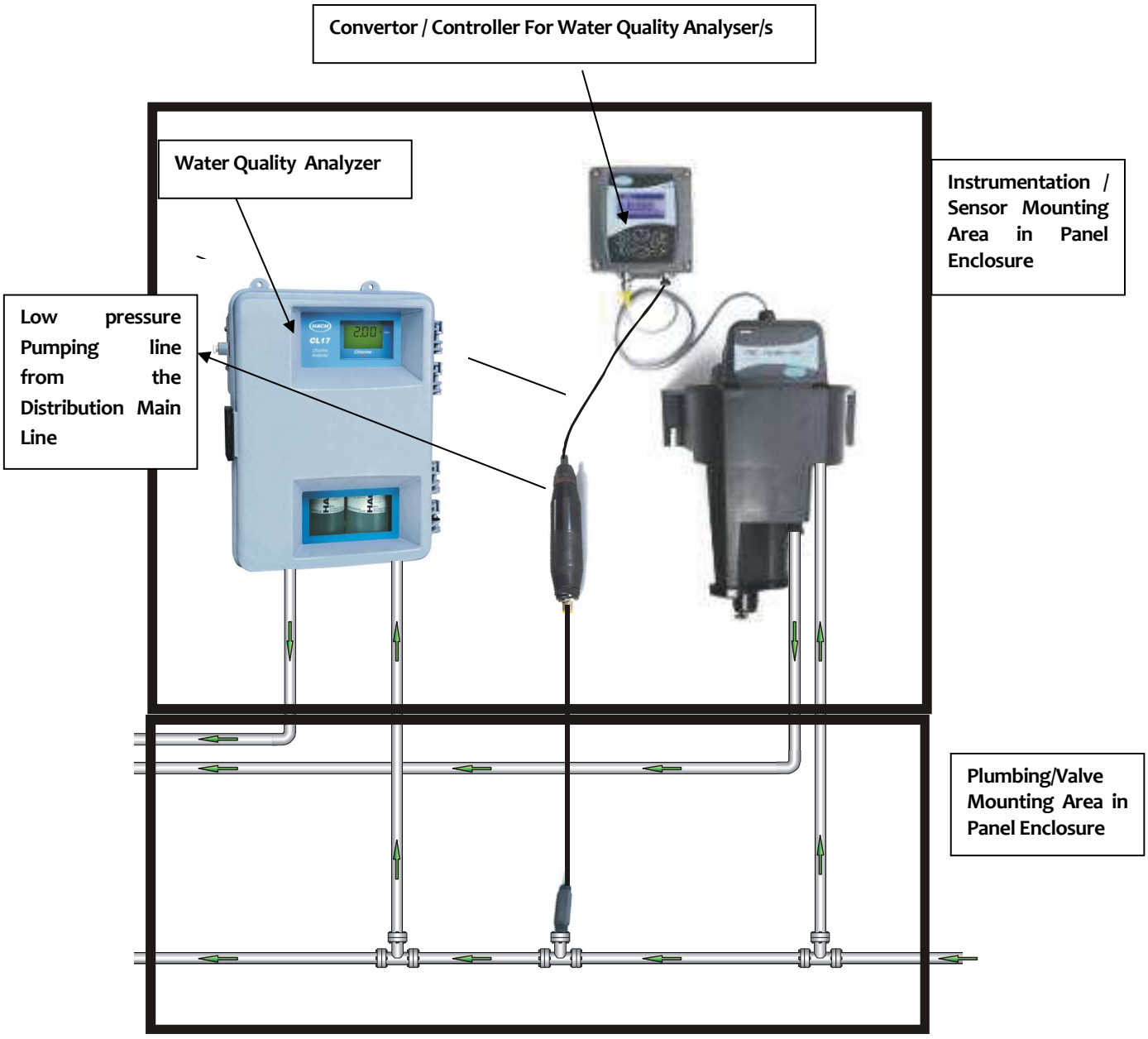


Typical System **Architecture**





Typical Field Instrumentation with RTU/ PLC Panel System Architecture



Typical Physical G.A Drawing for Water Quality Analyser/s Installation in Enclosure at Field Stations

5. Scope of work

The scope of work shall be in line with the proposed solution mentioned under sr. no. 4.0.

The following outlines the broad areas of scope of work for the Implementing Agency (IA), who is primarily a System Integrator, and the later sections highlight the detailed scope of work for IA in each of the following areas. As a broad scope the Implementing Agency will perform the following primary tasks.

a. Procurement, Installation & Commissioning of instruments (flow, pressure, level, water quality etc.), Hardware, System Software & Networking Infrastructure at all the point of interventions (at various water works and water distribution network and STPs for data collection)
b. System study and Development of SCADA software based Central Monitoring System covering Alarm monitoring, MIS Application Development and integration with web services and Role Based Access Control. MIS reports would be in any suitable format desired by DJB.
c. Trend analysis and data consolidation at Central Data Centre for Dash Board View.
d. Setup infrastructure at Data Centre at NICSI data centre and control room at DJB Head quarter, Varunalaya.
e. Application Integration with existing SCADA in operation in Water Treatment Plants
f. Training required for the project, covering all the stakeholders
g. Operation & Maintenance of the Overall System Solution (Hardware, SCADA Software, Application Software and other Infrastructure) for 10 Years from "Go-Live*.
h. Compliance with the SLAs as defined in RFP.
i. Ref. Table 1 for details

Table-1			
Sr. No.	**Service**	**Type of Instrument**	**Instrument Functions**
1	Level Measurement & Display	a) Level measuring system per compartment wise and display on local HMI b) All required erection hardwares like cables,trays, fittings, tubes, glands, clamps, supports etc.	a) Monitoring level & Local Indication on HMI through PLC/RTU
2	Pressure Measurement & Display	a) Pressure Measuring system consisting of Pressure Transmitter display on local HMI b) All required erection hardware like cables, trays, fittings, tubes, glands, clamps, supports etc.	a) Monitoring pressure & Local Indication on HMI through PLC/RTU
3	Flow Measurement & Display	a) Flow measuring system with display on local HMI b) All other peripherals required to interface the flow meter with the system.	a) Monitoring flow & Local indication on HMI through PLC/RTU
4	Water Quality Parameters Measurement & Display	a) Residual Chlorine Analyser b) Turbidity Analyser c) BOD Analyser d) SS Analyser All required erection hardware like cables, trays, valves, fittings, tubes, glands, clamps, supports etc.	a) Measure & Indicate on local HMI, Chlorine concentration, Turbidity, BOD, SS
5	To communicate with field instruments and gather the information & data	a) PLC / RTU etc. b) All required erection hardware like panel, cables, trays, fittings, tubes, glands, clamps, supports, UPS (for back up supply to local instrumentation and PLC/ RTU) etc.	a) To gather / log information & data from field instruments b) To communicate with central system via GPRS Communication c) To provide backup supply in case of power failure through UPS
6	Software and database server for monitoring, analysis, with printer etc.	a) SCADA Software, Reporting Application Software and related Operating system, database software, application software etc. b) Integration of existing Water GEMS with SCADA software and Reporting Application Software c) Suitable database server with LAN connectivity	a) Various graphics / mimic displays / trends, charts etc. for desired parameters to monitor water supply system on online basis b) GPRS telemetry system for communication with remote sites c) Communication via SMS and Emails to concerned staff

Ensure the following for the equipment supplied:

- Commitment of support for spares and services for a period of 10 years from the date of implementation.
- System administration and database administration of CMS application for 10 years from "Go-Live".
- Customize and implement a proper SLA monitoring tool in consultation with DJB for SLA Monitoring during O&M Phase.
- Provisioning of Application Software, Hardware, networking etc. for integration of any intervention with CMS during Operation and Maintenance Phase.

Instrument scales and displays shall also be based on the basic units listed.

Parameters	Units				Remarks
Length	Mm	m	Km		
Area	mm^2	m^2	Ha		
Volume	ml or cc	l	m^3		
Time	S	min	H	Day	
Mass	Mg	g	Kg	t (tonne)	
Temperature	°C				
Torque	Nm				
Speed	Rpm	spm			

Volumetric flow

	ml/s	l/s or l/h	M^3/h	Mld or l/hr	
-gases	M^3min	M^3/h			
Mass flow	mg/s	g/s	kg/m	Kg/h	
Pressure	mbar	Bars	mm	mwc	
Vacuum	mbar	mmH_2O	mmHg		
Concentration					

- solution	mg/1	%W/V or kg/m3			
		%W/W			
-gases	ml/m3	ppm			
Chemical dose	mg/1	kg/h			
Power	W	kW			
Chemical dose	mg/1	kg/h			
Power	W	kW			
Current	mA	A			
Voltage	V				
Noise	DB				
Frequency	Hz				
Turbidity	NTU				
Velocity	m3/hr/m2 or m/hr	mm/s	m/s		meters/min in case of Cranes &
Level	MTHD	m			

Reference Standard

Unless otherwise approved instrumentation shall comply with relevant quality standards test procedures and codes of practice collectively referred to as reference standard including those listed below in accordance with the requirement detailed elsewhere in this specification.

IEC 60381-1:1982	Analogue signals for process control system Specification for direct current signals
IEC 60947-4-1:2000	Specification for low-voltage switchgear and control gear contactors and motor starters. Electromechanical contactors and motor starters.
IEC 60947-4-2:1999	Specification for low voltage switchgear and control gear. Contractors and motor starters A.C. semiconductor motor control gear and starters.
IEC 60947-43:1999	Specification for low voltage switchgear and control gears. Contactors and motor starters contactors and motor starters. AC semiconductor controllers and contactors for non motor loads.
IEC 60770-1:1999	Transmitters for use in industrial process control systems. Methods for performance evaluation
BSISO 1217:1996	Displacement compressors Acceptance tests
ISO 2112:1990	Specification for amino plastic moulding materials.
ISO 6817:1997	Measurement of conductive liquid flow in closed conduits. Methods using electromagnetic flow meters
BS EN 837-1:1998	Pressure gauges bourdon tube pressure gauges dimensions metrology

	requirements and testing
BS EN 1057:1996	Copper and copper alloys. Scamless round copper tube for water and gas in sanitary and heating applications
BS EN 1092-1:2002	Flanges and their joints Circular flanges for pipes valves fittings and accessories. PN designated steel flanges
BS EN 1563:1997	Founding Spheroidal graphitic cast iron
BS EN 60529:1992	Specification for degrees of protection provided by enclosures (IP code).
BS EN 60534-1:1993	Industrial process control valves industrial process control valves control valve terminology and general considerations
BS EN 60546-2:1993	Thermocouples Tolerances.
BS EN 60634:1998	Operating conditions for industrial process measurement and control equipments all relevant parts
BS EN 60751:1996	Industrial platinum resistance thermometer sensors
BS EN 60873:1993	Methods of evaluating the performance of electrical and pneumatic analogue chart recorders for use in industrial process control systems
BS EN 61000-6:2001	Electromagnetic compatibility (EMC) Generic standard Emission standard for industrial environments.
BS 89:1990	Direct acting indicating analogue electrical measurement instruments and their accessories all parts
BS 90:1975	Specification for direct acting electrical recording instruments and their accessories.
BS 476	Fire tests on building material and structures all parts.
BS 1042-1-4:1992	Measurement of fluid flow in closed conduits pressures differential devices guide to the use of devices specified in sections 1.1 and 1.2
BS 1041-2-1:1985	Code for temperature measurement Expansion thermometers Guide to selection and use of liquid in glass thermometers
BS 1041-2.2:1989	Code for temperature measurement Expansion thermometers guide to selection and use of dial type expansion thermometers
BS 1041-3:1989	Temperature measurement guide to selection and use of industrial resistance thermometers
BS 1041-4:1992	Temperature measurement guide to the selection and use of thermocouples.
BS 1123-1:1987	Safety valves gauges and fusible plugs for compresses air or inert gas installation code of practice for installations.

BS 1203:2001	Hot setting phenolic and aminoplastic wood adhesives classification and test method
BS 1553-1:1977	Specification for graphical symbols for general engineering piping systems and plants
BS 1571-2:1975	Specification for testing of positive displacement compressors and exhausters methods for simplified acceptance testing for air compressor and exhausters
BS 1646-1:1979	Symbolic representation for process measurement control functions and instrumentation basic requirements.
BS 1646-2:1983	Symbolic representation for process measurement control functions and instrumentation specification for additional basic requirements.
BS 1646-3:1984	Symbolic representation for process measurement control functions and instruments interconnection diagram.
BS 1646-4:1984	Symbolic representation for process measurement control functions and instrumentation specification for basic symbols for process computer, interface and shared display/control functions
BS 1794:1952	Specification for chart ranges for temperature recording instruments.
BS 2765:1969	Specification for dimensions of temperature detecting elements and corresponding pockets
BS 3680	Measurement of liquid flow in open channels. All relevant parts.
BS 3693:1992	Recommendations for design of scales and indexes on analogue indicating instruments
BS 4675-2:1978	Mechanical vibration in rotating machinery requirement for instruments for measuring vibration severity
BS 4999-142:1987	General requirements for rotating electrical machines specification for mechanical performance: vibration
BS 5169:1992	Specification for fusion welded steel air receivers
BS 5169:1992	Measurement of flow of cold potable water in closed conduits methods for determining principal characteristics of single mechanical water meter (including test equipments)
BS 6004:2000	Electric cables PVC insulated non armored cable for voltage up to and including 450/750 V, for electric power, lighting and internal wiring
BS 6739:1986	Code of practice for instrumentation in process control systems installation design and practice
BS 7671:2001	Requirement for electrical installation. IEE wiring Regulations Sixteenth edition.

6. Roles & Responsibilities of Implementing Agency

In the CMS initiative of the Department following factors lend to a very unique setting, demanding the need for focussed strategy at the controlling & operational levels to drive quality and ensure commitment towards the Project. Implementing agency shall be responsible for the following activities:

1. Supply and installation of field instruments as finalized with the DJB's project manager as per the attached BOQ. The quantities mentioned in the BOQ may vary as per the overall objectives of the project. The flow and pressure instruments shall be installed using suitable RCC chambers as per site location instead of directly burying in the ground for ease of maintenance. All cables and accessories for the purpose shall be provided by the bidder.
2. Taking over the maintenance of existing flow meters (86 Nos. as in annexure I-B) to ensure their integration in the system. In case of any deficiency observed during taking over by the successful bidder the same shall be brought to the notice of the DJB for rectification
3. All field components (instruments, PLC / RTUs, UPS etc.) shall be installed in protected enclosures as per the specifications mentioned in the bid documents.
4. Design, development and implementation of SCADA based CMS including analytical and reporting tools. CMS shall be installed at the NICSI data center. NICSI data center shall provide the shared security and other facility like backup and maintenance services. Bidder is required to bear the expenses for services of NICSI and the same shall be reimbursed at actual by DJB on annual basis. The connectivity charges between the server at NICSI and the Central Control Room shall be borne by the bidder for the contract duration. Also all bandwidth, internet and other connectivity rental and usage charges shall be borne by the bidder for the duration of the contract.
5. Bidder is required to provide, install and undertake the maintenance of the servers and network components for the entire duration of the project.
6. Bidder is required to arrange for communication system from individual equipment (PLC / RTUs/ Meters) to the Data Center through the GPRS communication service provider, with alternate service providers to be used as and when needed in case of any disruption in services.
7. A Control room shall be setup at the DJB Head quarter at Varunalaya. DJB shall provide the space for the control room. Furnishing the control room as per Control Room Environment shall be the responsibility of the bidder. Supply & Installation of Video wall and associated hardware/software shall be responsibility of the bidder. Bidder shall also arrange the communication link from Data Center to Control room. All communication costs (Dedicated/ GPRS etc.) are to be included in the bid.
8. It shall be possible to access the CMS reports/status through the web. Role based access enabled CMS shall be provisioned under the Reporting Application Software.
9. The bidder shall also have the facility of integrating CMS with a suitable system for mobile alerts (SMS) in case of alarms.

Other Key Responsibilities

- Ensure that the intent and objectives of the project are fully met.
- Implementation of CMS shall be as per best practices and process innovations for service delivery in India and abroad.
- It shall ensure appropriate functionality and outcomes for systems developed and implemented.
- Shall measure the performance of the system against the defined Service Level Agreement.
- Shall monitor and report the non-technical SLAs (e.g. turnaround time for implementation of software changes, conducting field visits to various locations to measure the solution performance from a functionality, availability and performance point of view, identification of areas of improvements)
- CMS developed under this project is required to adhere to the technical standards and best practices during design, development, implementation & operations phase.
- CMS integrator shall coordinating and implementation of change & capacity building programmes, process improvement and training for successful implementation of the project.

7. Detailed Scope of Work

In continuation of the Broad Scope of Work (Sr. No.5), the IA shall also be responsible for meeting of all the functional and non-functional requirements as listed in subsequent para.

The detailed scope of work is as given below:

A. SCADA Software & Reporting Application Software

- Systems Requirement Study for best fit solution & Solution Design
- SCADA Software Application Design, Development, Implementation, Training & Documentation
- Reporting Application Software Design, Development, Implementation, Training & Documentation

The IA shall analyze the detailed functional and non-functional requirements as listed in RFP Volume I.

The system requirement specifications shall be prepared by the IA and a Formal sign-off would need to be obtained from DJB before proceeding with the Design, Development and Implementation of the SCADA Software and the Reporting Application Software.

System Design

The IA shall design the solution architecture & specifications for meeting the system requirement specifications finalized by the IA and approved by DJB. The solution design shall include, but is not limited to, the design of the application architecture, user interface, database structures, deployment architecture, security architecture and network architecture.

The IA should submit the solution design document to the Department and should obtain the sign off on the design document before commencing the development of the solution. However, IA shall be responsible for ensuring the compliance of the end product to the requirements specified in this RFP.

Software Testing

The IA shall perform the testing of the solution based on the approved test plan, document the results and shall fix the bugs found during the testing. Though the Department is required to provide formal approval for the test plan, it is the ultimate responsibility of IA to ensure that the end product delivered by the IA meets all the requirements specified in this RFP. The basic responsibility of testing the system lies with the IA. The acceptance testing by a 3rd Party agency appointed by the Department as envisaged in this RFP is for the purpose of certification. Any charges for the same shall be borne by the bidder.

Training on Application Software

- The IA is responsible to provide trainings on the CMS Solution. IA is required to train all the Department users connected with CMS Solution and the designated ones at the Department to enable them to effectively operate and perform the relevant services using the Application.
- The training content will have to be relevant to the target trainees depending upon the role played by them i.e. processing hands, technical/ administration personnel, supervisors/ managers, and senior officers.
- The IA shall also be responsible for re-training the employees / agencies who are involved in the CMS solution whenever major changes are made in the system and/or changes happen with personnel (because of fresh recruitment, promotion, transfer etc) during the full contract period.
- The training shall be conducted in full synchronization with the overall Project Implementation plan.

Documentation

The IA shall prepare/update the documents including that of Functional Requirements Specifications, Systems Requirement Specification, Detailed Design, Test Cases & Results, User Manuals, Operations Manual, Maintenance Manual, Administrator Manual, and Security Policy as per acceptable standards.

The IA shall obtain sign-off from the Department for all the documents submitted for this Project and shall make necessary changes as recommended by Department before submitting the final version of the documents.

B. Data Center

The CMS Solution will be set up on NICSI Data Center.

The IA is expected to prepare a proper plan including BOM and specifications for Hardware, Software and necessary infrastructure (like Servers, Storage and Networking) for hosting the CMS Solution at Data Centre.

Considering the future growth in CMS applications it is important that IA should plan for the Data Centre in a manner which will facilitate future expansions in the no. of users. Scalability for each Stakeholder of CMS has to be planned.

IA will be allowed to provision its Manpower (Physical access) at Data Centre for installation, Configuration and maintenance of H/W & System Software including OS during the project period, specifically during Development, testing, user Acceptance testing stage. Such permission would be granted only with due authorisation of the DJB. Additionally, VPN access for remote administration will be provisioned for the project.

IA may use the existing Enterprise Management Solution (EMS) facility available at NICSI Data Center or at DJB as part of RMS project to maintain the service levels of its Data Centre infrastructure. IA should provision

industry standard EMS for the Application Performance monitoring (based on real time end user transactions & application performance measurement), Server & Database Performance Monitoring (Availability & Performance) and for all the services of the project.

NICSI data centre would provide Rack Space as per the rate applicable for IT infrastructures that need to be provisioned by IA for the project. For each Rack Space one LAN Switch and one SAN switch would be provided, as a package.

NICSI / NIC shall provide following product and services at DC sites

- Hosting space for DC
- Shared SAN storage and tape library back-up from NICSI/NIC as per the sizing requirement by Bidder
- Replication software, Back up Software (File System)
- Core Switch, Load Balancer, SAN Switch
- Shared firewall and IPS
- The power and network will be made available as part of the DC services
- The VPN access will be provided for remote administration of server
- 24x7 Help Desk support to the DJB and its representatives
- Connectivity between DC In the event of any collocated hardware related incident, the NICSI/NIC help desk will inform the personnel identified as Administrator.

Bidder is also expected to provide connectivity to Data Centre from its GPRS/ other service provider and to DJB HQ. In such case bidder will ensure that all necessary components to extend the desired connectivity to the control room is included in the bid.

Bidder shall include all the components (other than mentioned above) that are required to make the solution complete.

- Bidder shall design a suitable replication strategy and an effective model for replication of the databases on the SAN storage.

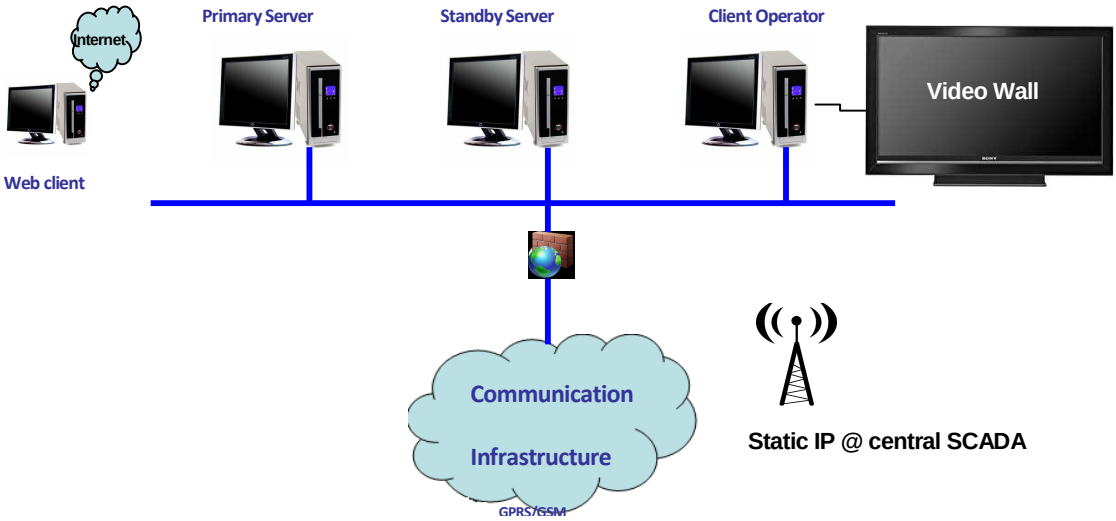


Fig: Schematic for central location

Expectation from Bidder for DC

- The installation, configuration and maintenance of system softwares and application will be the responsibility of the Bidder
- The maintenance of Bidder's hardware colocated at NICSI will remain Bidder's responsibility
- Bidder needs to be get security audit of the Application before moving the application to production environment. The application may be audited by the list of companies for the said purpose at CERT-in website. Any charges for the same shall be borne by the bidder.

Assessment, Procurement and Installation of IT Infrastructure, field instruments

IA shall assess the infrastructure requirements (including Servers, Storage, Networking and Security) for operationalization of the CMS system and to provide the functionalities to all the stakeholders, in full conformity with the SLAs.

Important: All system software licenses would have to be taken in the name of the Department.

For all software products it is necessary for bidders to certify that proposed infrastructure shall be sufficient to meet the performance requirements and have provision for future scalability requirements of the project. Addressing any performance issues / degradation during O & M phase shall be the responsibility of IA at no additional cost other than what is specified in the commercial proposal.

Procurement of IT Infrastructure and field instruments

The IA shall procure & supply the IT Infrastructure for the system as proposed by them in their technical proposal. The IA shall ensure that all the equipment supplied to the Department is **brand new and is free from any defect of any sort.**

IT Infrastructure and field instruments Installation

The IA shall be responsible for operationalization of the CMS system from end to end, which includes installation of IT Infrastructure, field instruments, ensuring capturing real time process data and connecting to the CMS databases. The IA shall deploy the application software at the Data Centre and shall ensure that the application software services are made accessible to the CMS solution users.

Connecting all locations on the CMS solution network

The IA shall connect all the field locations, point of intervention on CMS solution network to the Data Centre in line with the architecture and specifications and shall ensure that the access to CMS portal is provided to all the users. The scope of work for IA also includes procurement of necessary Internet bandwidth for hosting the CMS Portal and to provide access for the Stakeholders to the relevant functionalities.

Warranty

The IA shall provide comprehensive warranty for 3 years & subsequent Maintenance support for a period of 7 years (total of 10 years) for all components supplied for the CMS system as per the contract.

The IA shall repair / replace any parts / components of the CMS Infrastructure supplied for this project if the components are defective and during the entire warranty period IA shall apply all the latest patches/updates for all the software components after appropriate testing.

Documentation

The IA shall undertake preparation of documents including that of Infrastructure solution design & architecture, configuration files of the Infrastructure, user manuals, Standard Operating Procedures, Information Security Management procedures as per acceptable standards.

The IA shall take sign-off on the documents, including design documents, Standard Operating Procedures, Security Policy & Procedures from DJB and shall make necessary changes as recommended before submitting the final version of the documents.

C. Operations & Maintenance of entire CMS system environment

The IA shall be required to provide operational and maintenance services for CMS system including, all the software and hardware components. This section discusses the Operations & Maintenance services to be provided by IA with respect to SCADA softwrae, Application Software & supporting IT Infrastructure Management and field instruments at the intervention points.

Operations & Maintenance of Application Software

Maintenance includes, but is not limited to production monitoring, troubleshooting & addressing the functionality, availability & performance issues and implementing the system change requests.

The IA shall keep the application software in good working order; meeting the requirements defined by the Department, perform changes and upgrades to applications as requested by the Department, within the overall scope of the quality and quantity of functionalities to be delivered under this RFP.

The following is the broad scope for maintenance and support functions with regard to the software:

- Compliance to the Functional Requirements specified in Volume I of the RFP
- Compliance to Service Levels specified in RFP.

The IA shall ensure compliance to uptime and performance requirements of CMS Solution as indicated in the SLA in RFP Vol 3 and any updates/major changes to the software shall be accordingly planned by IA for ensuring adherence to the SLA requirements.

Application Software Maintenance

The IA shall rectify all the errors/bugs/gaps/ **modification on account of rule/acts/policy change of Government** in the functionality offered by CMS solution at no additional cost during the operations & maintenance period.

Software Change & Version Control

All planned changes to application systems shall be coordinated within established Change Control processes to ensure that:

- Appropriate communication on change required has taken place
- Proper approvals have been received
- Schedules have been adjusted to minimize impact on the production environment

The IA shall define the Software Change Management & Version control process and obtain approval for the same from the Department. For any changes to the software, IA has to prepare detailed documentation including proposed changes, impact to the system in terms of functional outcomes/additional features added to the system. IA is required to obtain approval from the Department for all the proposed changes before implementation of the same into production environment and such documentation is subject to review at the end of each quarter of operations & maintenance support.

Maintain configuration information

Maintain version control and configuration information for application software and any system documentation

IT Infrastructure, field instruments Maintenance & Operations

- Overall monitoring and management of the systems implemented for CMS in the data Centre, which includes administration of Data Center Infrastructure (Web/application servers, database server, and storage), Network and all other services ancillary to these facilities to ensure performance and availability requirements of the Project.
- Ensuring compliance to the uptime and performance requirements, including data backup for CMS Solution as indicated in the RFP.
- Perform the patch management, testing and installation of software updates issued by the OEM/vendors from time to time. These patches/updates before being applied on the live infrastructure of the data Centre shall be adequately tested. Any downtime caused due to updates & patches shall be to the account of the IA and it shall not be considered as 'Agreed Service Down-Time'.
- Ensure overall security of the solution including installation and management of Antivirus solution for protection of all the servers and systems implemented for the project, application of updates/patches etc. The antivirus patches have to be updated and applied from time to time, after appropriate testing of the patches in the staging area.

D. Field Instruments Design Requirements

Instruments mounted in field and on panels shall be suitable for continuous operation. All electronic components shall be adequately rated and circuits shall be designed so that change of component characteristics shall not affect plant operation.

Apparatus mounted in panels shall be suitable for continuous operation at the maximum internal panel temperature expected in service and due account shall be taken of heat given off by other equipment. All electronic components shall be adequately rated and circuits shall be designed so that change of component characteristics shall not affect performance. In the selection of solid state equipments, special consideration shall be given to the effects of heat and the need for artificial cooling. The air temperature range within which such apparatus is designed to operate without effect on performance shall be stated.

All I&C equipment shall be new, of proven design, reputed make, and shall be suitable for continuous operation. Unless otherwise specified, all instruments shall be tropicalised. The outdoors equipment shall be designed to withstand tropical rain. Wherever necessary space heaters, dust and waterproof cabinets shall be provided. Instruments offered shall be complete with all the necessary mounting accessories. All instruments should be designed for ambient temperature of 50 Deg Centigrade.

All instruments of submersible type shall be protected to IP-68 of IS: 13947, Part-I.
Unless otherwise stated, field mounted electrical and electronic instruments shall be weatherproof to IP-65 of 15:13947 Part-I.
The degree of weather protection for panel mounted instruments shall be IP-52 of 18:13947, Part-I.
Field cabinets and enclosures shall be IP55 gasketed with multi-point latching doors.

All the instrumentation to be supplied under this contract for measuring flow, level and pressure, residual chlorine, water pH, turbidity, energy , rpm, vibration etc. shall be of robust design, inherently free of faults and requiring as little maintenance and adjustments as possible for effective and reliable operation.

Instruments, supports etc. are all to be of materials resistant to or protected from the temperature and humidity to be encountered in the atmosphere present in the tropical climate.

The unit of flow meter shall be in litres/sec. and the integration shall be in cubic metres. Ranges shall be selected to show normal plant operation between 50% and 75% of the full scale reading.

Instruments are to be of a type which will maintain reasonable accuracy without adjustment. Normally accuracy shall be within plus or minus 1% of the full scale deflection throughout the full range of measurement, unless otherwise specified.

All necessary sensors, transmitters / converters, PLC / RTUs, indicators, cabling, etc. for the instrumentation system shall be provided as required by the manufacturer.

Instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks and all necessary accessories as per site requirement.All work shall be in strict accordance with codes and reference standards as described above.

Unless otherwise stated, overall accuracy of all measurement system shall be ±1% of measured value, and repeatability shall be ±0.5%.

Unless otherwise specified, the normal working range of all indicating instruments shall be between 30% and 80% of the full scale range.

The instruments shall be designed to permit maximum interchangeability of parts and ease of access during inspection and maintenance.

The field instruments i.e. the instruments mounted outside the control panel shall be mounted at a convenient height of approximately 1.2m above grade platform.

Lockable enclosures shall be provided for the field mounted instruments.

All field instruments and cabinet/panel-mounted instruments shall have tag plates/ name plates permanently attached to them.

All wetted parts of the sensors shall be made of non-corrosive material capable of working with chlorine content of 5 ppm.

The performance of all instruments shall be unaffected for the ±10% variation in supply voltage and ±5% variation in frequency simultaneously.

The transmitters shall be provided with on-line test terminals. Zero and span adjustments shall be provided for all instruments.

Access ladders/ platforms shall be provided for maintenance and operation of all instruments.
Local indicators shall be provided for each sensors, and other primary device.

On return of power after an electrical power failure, all instrumentation and controls shall function automatically without any reset action required by personnel. The Contractor's attention is drawn to the requirements of installations which require to be "FAIL SAFE".

Test Equipment

Test equipment shall be provided, together with items such as instruction manuals, carrying / storage cases, unit battery charger where applicable, special tools, calibration fixtures, cord extenders, patch cords and test leads, which are not specified but are necessary for checking field operation of equipment supplied under this Contract.

1.5.1 One hand held pressure calibrator
1.5.2 One portable (DMM) digital multi-meter with rechargeable battery and charger and test leads, and carrying-case.
1.5.3 One toolkit consists of screw driver, testers etc.

Instrumentation Circuit Routes

Signal cables shall not be run in the same conduits or duct as power cables. Installation in rigid G.I. Class B Pipe / MDPEconduit or steel trunking shall be provided wherever required in view of site conditions .

Signal cables which are not completely enclosed in G.I. Class B Pipe / MDPE conduit shall be separated by at least the necessary distances as per norms from LV power cables and HV cables.

All cables running from the field instruments to the PLC / RTU panel shall be a single, Continuous length, without joints, except at marshalling boxes. The boxes shall have terminal blocks with 20 percent spares in addition to terminals for all wires including spare wires. Special care shall be exercised to carry earthing lines through marshalling boxes and control panels.

Installation

Instrumentation and necessary equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment shall be determined in the field. Exact locations shall be

approved by the DJB during construction. Contractor shall furnish all labour and materials necessary to complete the work in the approved manner.

All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, and adaptors.

Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

The screen on each process instrumentation cable shall be continuous from source to destination and be earthed as directed by the manufacturer of the instrumentation equipment but in no case shall more than one earth point be employed from each screen.

Tests

Test plan shall be submitted for approval as part of the project plan. Furnish the services of the servicemen, all special tools, calibration equipment and labour to perform the tests. Certified copies of the tests shall be furnished in duplicate to the DJB .

Following installation, check-out and final adjustment of all the instruments, a performance check shall be made on each. All status and alarm switches as well as all monitoring and control functions shall also be checked. Each device installed must be signed -off by the DJB as acceptable. Testing shall be done from the signal source to the final element or device including all field wiring.

If, during running of the tests, one or more points appear to be out by more than the specified amount, adjustments or alterations shall be made as necessary to bring equipment up to specification performance. Following such adjustment, the tests shall be repeated for all specified points to ensure compliance.

8. GENERAL CONDITIONS FOR WORK

01] Engineer / Engineers-In-Charge:

The term shall mean the person or firm appointed by the owner, who is authorized representative to undertake the duties and powers assigned to the Engineer by the DJB and by these specifications acting directly or through authorized representative. The contractor will be notified in writing the name of the Engineer which shall generally be the Executive Engineer or Project Management Consultant appointed by DJB, New Delhi.

02] Engineer's Representative:

The term means any resident engineer or assistant to Engineer, appointed by the DJB or the Engineer to perform the duties set forth by engineer.

03] Tenderer:

A person or association of persons, firm, DJB or Organization submitting tender for the work.

3.1] Contractor:

Is the person or partnership of persons, firm or DJB or organization identified as such in the contract agreement and is referred throughout the contract documents, as if, singular in number and masculine in gender. The tern contractor means the contractor or his authorized representative.

04] Contract Documents:

The contract document consist of the contract agreement, the notices, the instructions, the contractor's tender, the tender security, work order, the bonds, the drawings, the specifications and the agenda.

05] Contract Agreement:

The contract agreement represents the entire and integrated agreement between the parties hereto and supercedes all prior negotiations, representations or agreements either written or oral.

5.1] Acquaintance with Site and Work Conditions etc.:

The contractor shall study the site and general conditions in respect of approaches, labors, Water Supply, climate, quarries and the data included in the tender papers, get it verified from the actual inspection of site etc. before submitting the tender. In case of doubt about any item or data included in the -tender or otherwise, it shall be got clarified in pre-tender conference. Once the tender is accepted, it

shall be -concluded that the contractor has verified and made himself conversant -with all the details required for completing the work as per conditions and specifications.

Contractor shall make his own arrangement for approaches, roads for conveyance of materials etc., No extra claims shall be entertained due to non availability to such roads, approaches, for conveyance of materials equipments.

5.2] Machinery Required :

All machinery required for executing the work shall be arranged by the contractor. Department shall not take any responsibility for providing such machinery, even on rental basis. No concreting shall be permitted unless centering and reinforcement is approved by the engineer in charge.

5.3] Supervisory Staff:

The contractor shall have a well qualified experienced resident Engineer, who will be well versed with design and installation aspect of Instrumentation, PLCs and all allied electro-mechanical works, to be in day to day charge of the work and he shall be authorized to receive instructions from the Engineer-in-charge, of the work .Instructions and orders given to the resident Engineer shall be deemed to have been given to the contractor. For this purpose the contractor shall communicate to the department, name, qualifications and experience of such Engineer to be appointed for execution of the work.

06] Program of Execution of Work :

The contractor shall furnish in duplicate, to the Engineer in charge within fifteen days from the date of issue of work order a program indicating close progress of work to be achieved for completion within tendered time limit. **The whole work is to be executed in such a manner so that regular pumping is not affected. In case shut down is necessary, prior permission from Engineer in charge shall be necessary. Intimation for shut down shall be well in advance i.e. not less than 10 days. Necessary care shall be taken to minimize the period.** The progress schedule shall be in the form of bar charts, statement, forms, periodical out turn of quantities. Should the program be found defective in any respect or impracticable, the same shall be modified as required. Should the actual progress of work lag behind at any stage, revised program by accelerating the progress to be achieved shall be drawn up keeping the target of completing the scheme unaltered.

07] Bill of Quantities:

The Bill of quantities shall contain items of the Works relating to each component of the scheme to be carried out by the Contractor

The Bill of Quantities will be used to calculate the Contract Price. The contractor shall be paid for the quantum of work done at the rate mentioned for each item in the Bill of quantities.

08] Change in the Quantities:

If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item/ items, the rates as in the agreement for the relevant items shall be paid as per the actual quantity. DJB is not bound for the consumption of all the items given in bid document.

09] Additional Items:

All items are to be included in the price bid. However, payments for any additional item identified after signing of contract which is not mentioned in the bid, shall be finalized based on the market rates with due approval of Engineer – in -charge.

10] Tools and Plants:

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

11] Information and Data:

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

12] Coexistence with other Contractors:

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

13] Right of Way and Facilities:

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

14] Drawings and Design Submitted With the Tender:

Acceptance to the tender shall not mean approval to design or P & I drawing, enclosed by the tenderer while submitting his offer. All tender, drawings will be treated as tentative. Deficiencies if any found a from a functional, technical and departmental obligatory requirement, points of view shall have to be rectified and made good in detailed working drawing as pointed out by DJB without any extra claim.

The tenderer shall submit detailed Specifications for the Instrumentation, PLC / RTUs, and softwares including all required accessories. Reference of I.S. and/or other authoritative literature with extract of relevant parts signed by the tenderer shall be submitted by the tenderer in support of other factors considered in specification and design calculations. He shall submit detailed working drawings like P & I diagram, Instrumentation diagram, wiring etc. for each unit. Detailed specifications of each instrumentation, PLC / RTUs, and communication systems in triplicate shall be submitted to the Executive-Engineer

14.1] The design, supply, install, testing, training & commissioning of the various instrumentation shall be based on prevailing relevant I.S. as specified and equivalent British, German or American standards, recognized reference books, and shall be as per, standard Engineering code of practice, and shall be such as, to meet functional, technical, structural and aesthetic requirements.

14.2] Any modification, alteration in design, calculations and detail drawings, to be carried out as a result of compliance of scrutiny, remarks of the competent authority, shall be carried out and submitted a fresh, by the contractor, if called upon to all above concerned authorities in the manner indicated in (I) above without claiming any extra cost.

14.3] The actual execution of work shall be started by the contractor only after receipt of the technical approval to the above work plan, detailed design drawings, specifications etc. from the competent authority.

14.4] Normally a period of about 30 days would be required for scrutiny of, and getting approval of the competent authority, to the design and detailed drawings from the date of receipt from the contractor. The contractor shall be fully responsible for the delay that would be caused in scrutiny of and giving approval to the design and drawings due to their being incomplete, shabby and haphazard manner, without illustrative dimensioned sketches in the design and due to non submission of extracts of reference books (duly signed by tenderer) called for. No extra time limit shall be granted on account of reasonable time required in carrying out the scrutiny as mentioned above by the department and due to improper designs and drawings submitted by the contractor.

15. Responsibility of Contractor for Design Drawing & Work:

Even-though the design and drawings are approved by the competent authority, the Contractor shall be fully responsible for the technical and arithmetical correct-ness and soundness of the design plan and drawings and for the safety of works executed on the basis of such approved design and drawings and to the damages or failure of the works. It shall have to be done by the contractor entirely at his cost.

16. Discrepancies and Omissions:

The tender drawings and specifications shall be considered as explanatory, of each other and together shall form the technical requirements and stipulations of tender documents. Detailed drawings shall have preference over small scale drawings. Similarly detailed specifications shall have preference over general specifications. Should any discrepancy arises to the meaning, intent or interpretation of any specification or drawing the decision of the Engineer in charge shall be final and binding on the contractor.

17. Inspection-And Testing:

All instrumentation, PLC / RTUs, etc. complete irrespective, whether specified or not, shall be tested at manufacturer's works calibration check and test certificates for all the instrumentation shall be furnished along with testing procedures followed. Tests shall be witnessed by the Third party and certificate for the same shall be submitted to DJB.
Cost for all such tests including all incidental expenses shall be borne by the contractor and cost for all such tests shall be deemed to have been included in the tendered rates.

18. Factory Test, Site Test and Fee:

The Contractor shall make all necessary arrangements for to and fro travels for DJB Engineers/Officers for pre-delivery inspection in India and Abroad. The entire traveling cost including ticketing, boarding and lodging of the members of the DJB team shall be borne by the Contractor as per RBI Guideline(for overseas visit) and no claim, whatsoever on this ground, shall be entertained by the Engineer-in-Charge. The Contractor shall keep a provision in the programme for 4 weeks notice for inspection in India and 12 weeks notice for testing/inspection overseas."

19. Fees Payable to Third Party:

All fees payable to Third Party for inspection and testing (factory and site) shall be borne by the DJB. Date for such inspection will be fixed by the contractor ' in consultation with Engineer-in-charge.

The Third party testing does not relieve the contractor of his liability for satisfactory performance of equipment and in such case the defective equipment shall have to be replaced by the contractor without any extra cost.

20. Quality of Material and Equipments:

All Instrumentation- PLC / RTUs, software, etc. complete shall be of best quality confirming to relevant Industry / International standards. All mechanical, Electrical & other Instrumentation shall be of approved makes, best quality and of CE, UL mark only, where available & acceptable. These shall be got approved from the Engineer-in-charge before erection and use.

21. Cost of Repairs:

Loss or damage to the Works or materials to be incorporated in the works between the Start Date and the end of the Defects Liability periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions

22. Change in Site Alignment or Orientation or Modification:

No compensation shall be paid on account of change in site, alignment or orientation of the proposed work. The department reserves the right to modify the layout, design and any part thereof, if considered necessary.

23. Water for Construction etc.:

The contractor shall make his own arrangement, at his cost to get water for construction. Department shall Issue only recommendatory letters in this respect, if requested by the contractor in writing.

24. Electric Power Supply:

Electric power supply required by the contractor for the purpose of execution of work and installation of instrumentation shall have to be arranged by himself at his cost and department shall not take any responsibility in this respect, except giving recommendatory letter.

25. Use of Sites:

The contractor shall specifically keep the department informed about the temporary sheds/accommodation done by him at site of work; where on the NAME BOARD of company/ contractor shall be fixed. No unauthorized persons/vehicles shall be allowed there unless otherwise required for execution of works.

The responsibility of the temporary sheds, their occupants, their safety/dismantling when done with, shall be the contactor's liability. Excavated materials shall be the property of the department and will be disposed off as per directions of Engineer-in-charge.

26. Foundations:

Foundations shall be designed considering bearing capacity and as approved by the department.

27. Tender to Be Strictly According to Tender Conditions & Specification: And Pre-Tender Conference :

It should be clearly noted, that the tenderer has to strictly comply with the conditions and specifications laid down in the tender and no variation or deviations are permissible. The basic principles mentioned in the specifications and conditions of the tender shall be retained. On no account variations in conditions and specifications shall be carried out.

28. Accidents on the Work :-

The contractor shall be fully responsible for any accident that may occur to the labour on his work on duty and report the same to the Enqineer-ln-Charge and concerned Government Authority and shall pay all necessary compensation as per rules, failing which it would be paid by the department and the same shall be recovered from the contractor with interest.

29. Rate Inclusive Of All Taxes Duties etc. :

All the taxes and duties such as S.T./C.S.T., turn over tax/sales tax on works contract, Octroi, excise duty etc., levied by the State and Central Government and local bodies at prevailing rates applicable on the date of receipt of tender shall be fully borne by the on contractor and shall not be reimbursed to him on any account. The tender rates quoted by the contractor for the items shall be taken as inclusive of all such taxes and duties. Tax concession / exemptions if any available for the project, Contractor shall be responsible to obtain the same, on behalf of DJB , New Delhi which shall transfer all the concessions to the Contractor, only after actual receipt of concession. DJB shall not be responsible for delay or non-receipt of concession from respective Governments, Departments for what so ever reasons.

30. Trial Run, Commissioning of the system:

On completion of trial run, commissioning of all equipment shall be taken up. Commissioning period shall be of 4 weeks. During commissioning, the contractor shall be responsible to deploy all required qualified, skilled and unskilled personnel full time to operate, maintain and repair the equipments.

Final inspection shall be conducted after 4 weeks of trial run and commissioning, for satisfactory performance of the system and same shall be recorded & inspected by the team of three Officers of DJB and project management consultant appointed by DJB.

31. Income Tax:

Income tax 'as per applicable on gross value of each bill shall be deducted toward income tax and a certificate to that extent shall be issued by the Engineer-in-Charge.

32. No Interest on Dues:

No interest shall be payable by the Department on the amounts, due to contractor's pending final settlement of claim.

33. Completion of the Works:

The completion and delivery of the works shall be deemed to be full, complete and sufficient only when the Engineer in charge accepts the same and issues a certificate in writing viz. " Certificate of Completion " under the hand of the Engineer in charge to the effect that all the works contracted for and directed to be executed have been completed and are in a sound, satisfactory, workmanlike and complete and usable condition and the contractor has in the opinion of the Engineer in charge reasonably fulfilled and completed his contract and undertaking except so far as it relates to the operation and maintenance of the works as hereinafter provided.

34. Record Drawings and Designs :

After satisfactory completion of the work in all respect, the contractor shall submit five sets of designs and completion record drawings of each and every work as actually constructed with all dimensions and levels with the stamp 'Record Drawing' along with the specifications, operating manual and instructions etc., before finalization of the final bill without claiming any extra cost, failing which the final bill shall not be paid. The circuit diagrams of panels, layout, details of spares, makes, addresses, phone no. of firms shall also be given with illustrative technical literature of manufacturers.

9. Functional Overview of Central Monitoring System (CMS)

This section presents the indicative Functional Overview of CMS based on SCADA & Reporting Application Software with brief description of each application/services planned to be implemented through CMS.

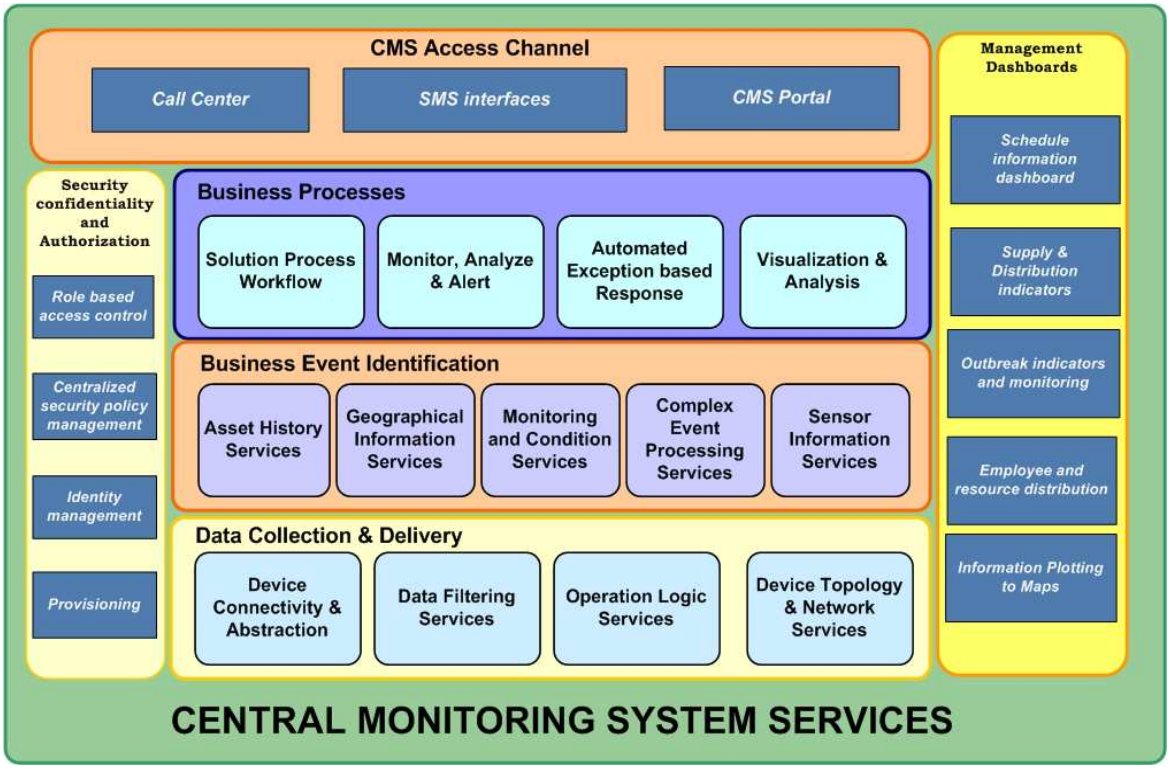


Figure 1: Central Monitoring System Services

It may be specifically noted that Supply and implementation of GIS is not part of this RFP. GIS scope is limited to the integration of the CMS with existing/proposed GIS system at DJB.

The services of the department, both information and transactional, shall be delivered to the stakeholders through multiple service delivery channels including portals (for both internal and external stakeholders, mobile communication (SMS services).

For all users / stake holders the portal is envisaged to deliver information services about the processes and allow to control based on authorization and access rights. The portal shall also facilitate transactional services both for water delivery and energy use.

The portal shall be accessed through secure intranet and all services shall be delivered through the internet. The access shall be extended through secure VPN connectivity.

The proposed system shall also provide the mobile application/SMS services for facilitating communication for alarm / alerts /intervention required.

Surveillance System

The Water Distribution Surveillance system through Business event Identification services, including Geographical Information System (GIS), shall enable capturing, tracking of information on the incidence, prevalence, and spread of functional deficiencies and enable the department for effective planning for controlling / removing such deficiencies. The system shall support fault mapping, which shall enable understanding the geographical distribution and spread of fault in the past or present. In summary, these services module will provide effective MIS on the over all system status across the distribution network both in textual and graphical form, to enable DJB staff and the senior management for effective planning of supply and distribution water and optimize energy usage.

Integrated Intelligence System Service

This will provide a comprehensive "Management Information System" which will maintain and provide critical information such as the Water Distribution Infrastructure, Supply & Distribution related information, Information about the maintenance & operation, available staff, nearest E & M centre and so on which will essentially create an effective mechanism to monitor and administer the provision of preventive E & M services. Since all the information from the different systems would get collated at a central place, department officials and staff would be able to query the system for various kinds of intelligence analytical information, thus enabling the Department to take critical decisions as well as to plan for the future.

Some of the key features of this intelligence system will be to incorporate;

Multi-Dimensional Analysis

- Data elements can be automatically highlighted (via font, weight, colour changes) based on user-defined criteria (e.g. show data field in red when Distribution% falls below 50%)
- Various Graphical displays should be available so that the information can be represented to different stakeholders. This should then also have ability for drill down to the lowest level of data capture.
- Saving of query/report output as a snapshot for future use.
- Triggering of another process based on preset conditions. (I.e. if a report is run and a specific figure goes above 80% trigger another report and notify a supervisor).
- Security access levels are applicable to reports and also enforceable with respect to report distribution.
- Audit capabilities, including logs of user activity.
- Ability to encrypt communications between the user and the data source (server). (I.e., software supports Entrust PKI)
- System should provide ability indicate Key System indices at all levels. E.g. WTP, UGR, BPS etc.
- One of the important factors coming out of the System should be the trend analysis. Trends like outages happening in a particular command area at a specific time etc will help the officials to take decisions proactively for the betterment of the delivery system.

- After the generation of the report the next thing is the distribution of the information to the key stakeholders. The ability to send a section of a report to a particular group of users is an important feature incorporated in the system. It should be able to define collaborative workgroups consisting of a subset of users. Within such workgroups, end-users should be able to publish and share their reports and views. The delivery of these reports should be decided by the stakeholder E.g. Dashboard, email or wireless device and also how the report should be delivered. E.g. HTML, PDF, TXT, etc.
- System should generate alert if exceptions are identified in the report and deliver the alert to dashboard or email or mobile device of the concerned user.
- The BI platform must be a comprehensive and integrated suite of Analytical tools designed to bring greater business insight to broadest audience of users allowing them to have web based self service access to relevant and actionable intelligence from relevant data sources (of which they have access to :

a) Ad Hoc Query Capability: BI Platform must provide an analytical tool enabling a web based ad-hoc analysis tool where end user can interact with logical view of information creating charts, pivot tables, reports, gauges, dashboards etc
b) Save and Share Capability: After end user spends time and creates, adds, deletes, changes the pivot table views, he/she should be able to save these changes and share the updated view with group of users.
c) Dashboard Capability: End users should interact with BI platform using rich, interactive, role based, easy to understand web based dashboard providing access to live reports, prompts, charts, tickers, pivot tables and graphics.
d) Multi Channel Report Publishing Capability: BI platform should provide a scalable reporting server capable of generating richly formatted reports from multiple sources (SQL server, Oracle, Informix, Sybase, Files, XML,URL), in multiple formats (Word, Excel, RTF, PDF and XML) published on multiple channels (email, webdav, print, ftp to file server).
e) Disconnected Analytics Capability: Increasingly officials are using laptops in their daily operations. The BI platform must provide an ability to download the dashboard (reports and data) on the laptop hence enabling users to work even when they are not connected to network.
f) The BI platform must enable the data centre to single, consistent logical view of information across different department specific operational systems, warehouses and multi dimensional sources. This will ensure that business user has unified view of all accessible information.

- Data capture and control
    - Integrate wide range of sensors
    - Move data intelligently
    - Execute local commands
    - Run distributed operational logic
- Manage distributed device infrastructure

- Discovery of devices and sensors
- Remote configuration of devices
- Monitoring
- Security

- Event processing and services
  - Complex event processing
  - Stream processing
  - Services including data aggregation, geographic information, identification and association, condition, command and permission, and persistence
- Process integration
  - Extend existing systems and enable new business processes
  - Monitor business processes
  - Provide information to people

Short Messaging Services

UIE applications need to have a SMS (Short Messaging Service) for the different stakeholders to get information from the UIE application. Officials will be using the SMS to get information of System healthiness central applications. The following will be functionalities required for the SMS gateway applications.

There should be an integrated SLA based policy enforcement engine. It will allow the UIE system to dynamically customize the data and access rules to fit capacity of the network nodes. Also the administrators can use the traffic management and shaping capability to increase the service and reliability

10. SCADA & Reporting Application Software

The task of the SCADA shall be to collect all process-related data from the processing units into the process database. The process database shall reflect the real-time image of the process. The collected information shall further be distributed, e.g. for displays, historical archiving, calculations, printing, reports generation and further transmission to other systems.

CMS shall primarily provide the following functions:

- Continuous system self supervision
- Display of events & alarms
- Storage of time stamped events
- Trend reports
- Display of station Network Diagram with status of all process objects.
- Alarm and event reports
- Automatic printout of fault reports
- Parameter settings of event & alarm.

CMS system should be capable of being configured to various predefined users so that each user defined in the system can be given access rights for various features. The hierarchies of authorization shold take due care of protecting the system from unnecessary configuration changes. The Suggested users are following but not limited to

- System Administration
- Engineering
- Maintenance
- Operation

The access rights shall be in the form of passwords & user ID both, Only the system administrator should be authorized to add / remove users and change access rights. It is desired that the system should prompt the password change after first log-in so that default password will be overwritten.

It is desired that the CMS software should support multiple instances of software on the same personal computer simultaneously of the same make. It is desired that the software should have the functionality to alert the system operator about the event in a specific station by pop up or colour change of the minimized software instances for a particular station

A feature of sending the SMS message to field crew is also desired. It shall able to send disturbance & fault event to the field crew. The CMS shall possess the following additional functionality.

- Features to add new graph, display& reports
- features of web view only access
- Data exporting to other system in the XML format.

11. FUNCTIONAL REQUIREMENTS OF THE SYSTEM(CMS):

System Display:

The Display system should be based on the principle of communicating to the operator through visual aids like mimics/ screen videos like Single line diagrams of individual distributors

The operator should be able to use pictures to communicate with the process and the control system:

- Pictures should visualize the controlled process with industry standard symbols and Specified colors
- The operator should be able to select the object by using the mouse and issuing the command by double click. The operator should also able to issuing the command on selected object by using the functional keys. The keys should be standard for all the installation of a specific manufacturer.
- Pictures should inform the operator about alarms and events by specified color changes
- Pictures should illustrate process data.

Trends Display:

A trend is a time-related follow-up of process data. The major parameters to be considered for trends are:

- Flow
- Pressure
- Turbidity
- Energy
- Chlorine levels
- Ph
- Ammonia
- Water Levels
- BOD, SS/SS

The trend display shall be available in graphical mode as a line graph. Trends shall be available on a two dimensional co-ordinate system that consists of horizontal time (X) axis and vertical value (Y) axis. Trends shall have minimum following characteristics

The curve can be scrolled in both direction, X and Y.

The time axes shall be scaleable on minute, hours , day and monthly basis

a) it should be possible to get the value of parameters at any instance by clicking the trend .
b) minimum eight parameters trends should be visible in one screen at one point of time sharing the same process data
c) The graphic window shall be resizable & maxim sable.

Report Display:

The system shall collect the data from the database and able to produce report & produce printout on the operators request. The system shall have the capability of displaying minimum 10 reports on a single window simultaneously The system shall able to generate reports based on the user selected values on the basis of time interval of Day/ Week/ Month/ Year

However system should be capable of generating reports on the basis of

- Predefined time intervals
- when a predefined event occurs
- Day (mean, peak)
- Month (mean, peak)
- Year (mean, peak)

System should provide functionality to produce user defined reports

Event List

The event list presents the process events from the monitored process in pre defined way whenever there is change in status or change in limiting values. Each event shall normally be presented by displaying a predefined event text line, which describes the event in the process. Event text lines shall consist of a time stamp, object identification, a single text indicating status and data value. The events should be printed with WTP/UGR ID, Distributor ID & equipment wise segregation. The events shall be presented in chronological order so that the latest event appears on the top line of the first page. The event list shall contain keys for browsing the list forward and backward. Configured of event log file for day, week, month and year wise shall be possible. Events shall be stored in the history buffer in the computer's RAM memory, and also stored on the computer hard disk. The length of the history may be 10,000 events. The 10000 events shall be stored on the basis of First in First out Principle (FIFO). User configurable prioritization of event shall be possible. The system should have the functionality for user configurable prioritization & filtration of events.

Alarm List

The alarm list shall display the present alarm situation of the supervised process. All data Acqusition & control malfunctions including no responses from field devices and Check- back –verification errors on control selections, should be reported as alarms. Each alarm message should clearly indicate the type of malfunction that caused the failure in the operation sequence. Each alarm shall have the time stamp (date & time), object identification (WTP name & Distributor name), a signal text and a text indicating alarms status. The alarms will be shown in chronological order. Alarms will have different colors on the basis of priority and operator shall be in apposition to view in archives categorywise. Occurrence of alarm will be noticed by popup in screen with sound. Alarm sound will be different on the basis of priority. The alarm data can be exported to external system as per the requirement of the operator.

System Level Functions

1. Status Supervision

The position of each equipment shall be supervised continuously. Every detected change of position shall be immediately displayed in the single-line diagram on the station CMS screen, recorded in the event list, and a hard copy printout shall be produced. Alarms shall be initiated in the case of spontaneous position changes.

The positions shall be indicated by two auxiliary switches, normally closed (NC) and normally open (NO), which shall give ambivalent signals. An alarm shall be initiated if these position indications are inconsistent or if the time required for operating mechanism to change position exceeds a predefined limit. The CMS shall also monitor the status of auxiliaries. The status and control of auxiliaries shall be done through separate one or more IED and all alarm and analogue values shall be monitored and recoded through this IED.

2. Measurements

Analogue inputs shall be connected via PLC / RTU with/without intermediate transducers. The measured values shall be displayed locally on the station CMS and in the control centre. The abnormal values must be discarded. The analogue values shall be updated every 10 minutes.

Threshold limit values shall be selectable for alarm indications.

3. Event and Alarm Handling

Events and alarms that are generated, by the IEDs, or by the sensor unit shall be recorded in an event list in the station CMS. Alarms shall be recorded in a separate alarm list and appear on the screen. All, or a freely selectable group of events and alarms shall also be printed out on an event printer. The alarms and events shall be time-tagged

4. Presentation and Dialogues General

The processor shall be a redundant with hot standby and shall provide basic functions for supervision and control of the equipments. The operator shall give commands to the equipments on the screen via mouse clicks or keyboard commands.

The CMS shall give the operator access to alarms and events displayed on the screen. Aside from these lists on the screen, there shall be a printout of alarms or events in an event log.

The following standard pictures shall be available from the CMS:

Single-line diagram showing the status and measured values Control dialogues with interlocking and blocking details. **This control dialogue shall tell the operator whether the device operation is permitted or blocked.**

Measurement dialogues Alarm list, station / bay oriented Event list, station / bay-oriented System status

5. CMS Design Principles

Consistent design principles shall be adopted with the CMS concerning labels, colours, dialogues and fonts. Non-valid selections shall be dimmed out.

The object status shall be indicated using different status colours for: Selected object under command Selected on the screen Not updated, obsolete values, not in use or not sampled Alarm or faulty state Warning or blocked Update blocked or manually updated Control blocked Normal state

1. Process Status Displays and Command Procedures

The process status of the WTP/Distribution System in terms of actual values of analog as well as the positions of valves, circuit breakers, motors, pumps shall be displayed in the WTP single-line diagram.

In order to ensure a high degree of security against undesired operation, a "select-before-execute" command procedure shall be provided. After the "selection" of a switch, the operator shall be able to recognize the

selected device on the screen, and all other equipments shall be blocked. As communication between control centre and device to be controlled is established, the operator shall be prompted to confirm the control action and only then final execute command shall be accepted**.** After the "execution" of the command the operated switching symbol shall flash until the switch has reached its new position.

The operator shall be in a position to execute a command only, if the equipment is not blocked and if no interlocking condition is going to be violated. The interlocking statements shall be checked by the interlocking scheme implemented at bay and WTP level.

After command execution the operator shall receive a confirmation that the new switching position has been reached or an indication that the switching procedure was unsuccessful with the indication of the reason for non-functioning.

7. System Supervision & Display

The CMS system shall be comprehensively self-monitored such that faults are immediately indicated to the operator, possibly before they develop into serious situations. Such faults are recorded as a faulty status in a system supervision display. This display shall cover the status of the entire WTP and Distribution Network including all sensors, IEDs, communication infrastructure and remote communication links, etc.

8. Event List

The event list shall contain events that are important for the control and monitoring of the WTP/Distribution System. The event and associated time (with1 ms resolution) of its occurrence has to be displayed for each event. The operator shall be able to call up the chronological event list on the monitor at any time for the whole WTP/Distribution System or sections of it. A printout of each display shall be possible on the hard copy printer. The events shall be registered in a chronological event list in which the type of event and its time of occurrence are specified. It shall be possible to store all events in the computer for at least one month. The information shall be obtainable also from a printed event log.

9. Alarm List

Faults and errors occurring in the WTP/Distribution System shall be listed in an alarm list and shall be immediately transmitted to the control centre. The alarm list shall substitute a conventional alarm tableau, and shall constitute an evaluation of all station alarms. It shall contain unacknowledged alarms and persisting faults. The date and time of occurrence shall be indicated.

The alarm list shall consist of a summary display of the present alarm situation. Each alarm shall be reported on one line that contains:

The date and time of the alarm The name of the alarming object A descriptive text The acknowledgement state.

Whenever an alarm condition occurs, the alarm condition must be shown on the alarm list and must be displayed in a flashing state along with an audible alarm. After acknowledgement of the alarm, it should appear in a steady (i.e. not flashing) state and the audible alarm shall stop. The alarm should disappear only if the alarm condition has physically cleared and the operator has reset the alarm with a reset command. The state of the alarms shall be shown in the alarm list (Unacknowledged and persistent, Unacknowledged and cleared, Acknowledged and persistent).

Filters for selection of a certain type or group of alarms shall be available as for events.

10. Object Picture

When selecting an object such as a valve or other equipment in the single-line diagram, the associated bay picture shall be presented first. In the selected object picture, all attributes like Type of blocking Authority Local / remote control etc., shall be displayed.

11. Control Dialogues (In future)

The operator shall give commands to the system by means of mouse click located on the single-line diagram. It shall also be possible to use the keyboard for command activation. Data entry is performed with the keyboard. Dedicated control dialogues for controlling at least the devices shall be available:

12. User-Authority Levels

It shall be possible to restrict activation of the process pictures of each object (bays, apparatus...) within a certain user authorisation group. Each user shall then be given access rights to each group of objects, e.g.: Display only Normal operation (e.g. open/close) Restricted operation (e.g. by-passed interlocking) System administrator

For maintenance and engineering purposes of the station CMS, the following authorisation levels shall be available:

No engineering allowed Engineering/configuration allowed Entire system management allowed

The access rights shall be defined by passwords assigned during the log-in procedure. Only the system administrator shall be able to add/remove users and change access rights.

13. Reports

The reports shall provide time-related follow-ups of measured and calculated values. The data displayed shall comprise: Trend reports:

- Day (mean, peak)
- Month (mean, peak)
- Semi-annual (mean, peak)
- Year (mean, peak) Historical reports of selected analogue
- Values:
- Day (at 15 minutes interval)
- Week
- Month
- Year

It shall be possible to select displayed values from the database in the process display on-line. Scrolling between e.g. days shall be possible. Unsure values shall be indicated. It shall be possible to select the time period for which the specific data are kept in the memory.

Following printouts shall be available from the printer and shall be printed on demand:

i. Daily voltage and frequency curves depicting time on X-axis and the appropriate parameters on the Y-axis. The time duration of the curve is 24 hours.
ii. ii. Weekly trend curves for real and derived analogue values.
iii. Printouts of the maximum and minimum values and frequency of occurrence and duration of

maximum and minimum values for each analogue parameter for each circuit in 24 hr period.

iv. Provision shall be made for logging information about breaker status like number of operation with date and time indications.

v. Equipment operation details shift wise and during 24 hours.

vi. Printout on adjustable time period as well as on demand.

vii. Printout on adjustable time period as well as on demand.

viii. Reports in specified formats which shall be handed over to successful bidder.

14. Trend Display (Historical Data)

It shall be possible to illustrate all types of process data as trends - input and output data, binary and analogue data. The trends shall be displayed in graphical form as column or curve diagrams with a maximum of 10 trends per screen. Adjustable time span and scaling ranges must be provided.

It shall be possible to change the type of value logging (direct, mean, sum, or difference) on-line in the window. It shall also be possible to change the update intervals on-line in the picture as well as the selection of threshold values for alarming purposes.

15. CMS (Human Machine Interface)

The VDU shall show overview diagrams (Single Line Diagrams) and complete details of the network with a colour display. All event and alarm annunciation shall be selectable in the form of lists. Operation shall be by a user friendly function keyboard and a cursor positioning device. The user interface shall be based on WINDOWS concepts with graphics & facility for panning, scrolling, zooming, decluttering etc.

16.1 Software Requirements
CMS Software

CMS software can be divided into three categories:

a) Operating system software
b) Application software that includes any application loaded on the computer (SCADA Software)
c) Configuration file(s) for the settings, displays, and database of the CMS application (Reporting Application Software

Note that the CMS computer may have other applications that also have configuration files.

The CMS application typically runs on computers requiring the latest version of Windows, Linux, or some other operating system. Design tradeoffs can occur when certain requirements are made. For example, the Designer/Specifier may require a certain operating system to meet a corporate standard, which may limit CMS selection. The behavior of the operating system software during and after power failures may help to prevent unexpected CMS performance and must be determined prior to deployment.

In addition to the CMS software, the Designer/Specifier should also consider other software applications to be loaded on the computer. Examples of such applications include software that configures WTP/Distribution System devices, monitors network traffic, retrieves data from WTP/Distribution System devices, views different files, web browsers, and other applications that may be important to personnel working in the WTP/Distribution System. These applications may or may not be directly linked in the CMS application.

The Designer/Specifier should also consider whether the actual configuration files should have backup files located on the WTP/Distribution System computer or if the files should be stored elsewhere. Due to availability, security, and redundancy, this determination may not be trivial and should engage all of the impacted parties.

Issues:
Patches and updates to all CMS software will be issued at various times during the life of the system. Coordination of the various updates is essential and may require a maintenance contract or licenses that the Designer/Specifier should include in the CMS specification. This may increase software costs. The Designer/Specifier may require that all vendors provide copies of all CMS software. The Designer/Specifier should consider whether multiple copies are required, which may increase software costs due to licensing issues. The Designer/Specifier should also address process issues that most likely should not be included in the CMS specification. The Designer/Specifier should provide a means to provide a version control process that records all CMS software. These records should include compatibility relationships between the various software (which versions inter-operate as a complete CMS system). A backup process should also be put in place.

1.SCADA Software Specifications:

1. Architecture

The SCADA architecture shall provide the following:

- Client / Server architecture based on TCP/IP networking and report-by-exception (RBE) technology
- Standalone single server operation.
- Symmetric main-standby & capacity for triple standby server functionality.
- Additional servers for client load sharing and remote locations.
- Permanent Standby Server designed to be placed outside corporate firewalls providing a read-only access to the server while ensuring corporate security.
- Fully automated data transfer between servers to provide complete server redundancy. This transfer shall include configuration, real-time data, historic data and event lists. Database updates shall be on an incremental basis with tuneable parameters
- A scalable fully distributable architecture providing:
  - Unlimited number of server systems.
  - Unlimited number of display clients.
- Where multiple servers are deployed, the system shall be capable of being configurable from a single client.

- All redundancy shall be handled by the database, with the operational state of systems preserved through a server changeover. The system shall not rely on driver redundancy for data transfer when providing redundant server. The system shall present a uniform view of data including communication status after a fail over.
- Forced changeover between main and standby allowing seamless changeover between main and standby servers without shutting down either server.
- Clients to connect to a synchronizing server as soon as the configuration and current data in the database has synchronized. Incomplete data sets as per clients request on event or trend provide indications that the synchronization is still in progress to ensure that conclusions are not drawn from incomplete data sets.
- Configurable compression of data communications between client/server and server/server to allow optimisation of communications performance over WAN networks.
- Change reporting on Client/Server and Server/Server links rather than polled communication to permit operation on WAN networks.
- Capable of operating Client/Server and Server/Server links over low to medium speed channels depending upon database size.
- Application shall be native 32-bit and 64-bit versions and supported on Windows® Server and Workstation operating systems including Windows 2000, Windows XP, Windows 2000 Server, Windows 2003 Server, Windows 7 (32 and 64 bit) and Windows Server 2008 R2 and later.

2. Database

The SCADA database shall be of true relational database design and optimized for real-time SCADA operation. The database shall be object oriented and organized in a hierarchical structure. It shall support user-created "Templates" that allows management of common configuration from a single point in the database. Instances of templates shall be used for repetitive, standard configuration.

Templates of standard configuration shall support multiple object types including, but not limited to:

- Point / Tag objects
- PLC / RTU or PLC / RTU objects
- Mimics or Graphic display objects
- Trend objects
- Logic programs
- Schedules
- Link objects

The SCADA database shall allow users to extend the database schema to store custom data, in either the configuration or data stream. These changes can be performed online without need for server restart.

3. Operator Interfaces

- SCADA software shall provide the ability to support multiple local and remote display clients.

- Display facilities shall be available via LAN, WAN and dial-up connection.
- Display clients shall be supported as Rich Clients without the requirement of a database resident at the display node.
- Rich Clients shall support database management and configuration changes.
- Rich Clients shall support multiple monitors (multi-head display), allow logon for all heads from a single location. The system should also provide navigation facilities such that displays on each head can be controlled from any head. (yoking)
- Integrated Web Sever capability shall be available, providing all display and operational facilities of the Rich Client without the need for additional software to be installed.
- Web Clients shall allow users to view Mimics, Trends, Database Objects, Reports as well as perform control functions using a standard web browser.
- Changes made to the SCADA server shall require no additional steps to be performed in order for those changes to be available to Rich Clients and Web Clients.
- Each full function Rich Client shall be configurable to connect to one, or multiple server systems
- Full function display clients shall automatically fail-over & reconnect to a redundant server node when server change-over occurs.
- Current generation Windows® look and feel shall be provided by the SCADA system operator interfaces, including provision for "favourites lists" comprising links to any server object. This includes, but is not limited to: Mimics, Graphs, List Queries

4. Mimics / Graphics

SCADA system Mimics shall support a wide range of graphical facilities. Scalable Vector Graphics are required in order to permit operation of the SCADA system with different resolution clients operating simultaneously. Fixed resolution bitmap graphics are not acceptable.

Mimics shall be multi-layered, object oriented and permit mimics to be embedded in other mimics. Other objects that must be available for embedding in a mimic include:

- Button objects
- Hyperlinks
- Disk images (e.g. JPG, motion JPEG)
- Remotely updated images
- Hyperlinks with embedded queries (for generating filtered lists directly from a mimic)
- Object menus

Graphical facilities within a mimic must also be object oriented including the ability to manipulate attributes of embedded objects in real time, supporting animation including but not limited to:

- Fill factors
- Fill colour
- Rotation
- Position

- Line thickness
- Text attributes
- Transparency
- Alpha blending
- Multi-rate Flashing

A suite of Graphical Symbols shall be provided for integration with configuration templates and embedding within other mimics.

Import of mimics shall be supported from DXF format, including integration of multi-layered DXF drawings in to native SCADA mimics.

Adding Custom database fields dynamically to Metadata where the server does not have to be restarted after adding or modifying.

Mimics shall support the ability to specify OPC data source information to display directly on the mimic. This permits data from other systems to be seamlessly integrated in to the SCADA display.

Other facilities required to be supported by mimics includes:

- Context sensitive object menus available from mimic
- Accept an alarm from a mimic
- Issue a control from a mimic
- Operator Notes (as a native feature)
- ToolTips
- Hyperlinks to external documents (e.g. HTML, PDF, MS Office® suite documents)

Objects embedded and displayed on any mimic shall be viewable through both the full function client and web client displays.

5. Start-up

The SCADA system shall startup unattended, and without compromising system security. The SCADA server process shall operate as a Windows® Service. The SCADA server shall start without the requirement for an HMI client to start. Windows® logon shall be available prior to display client staPLC/ RTUp which must provide additional security.

Shutting down a display client (including on the server node) shall not affect other users or the server. Administrative privilege shall be required to shutdown a SCADA server.

6. Configuration

The SCADA software shall provide full seamless On-line configuration of all database parameters including but not limited to:

- Communication channels

- PLCs and PLC / RTUs
- Points / Tags
- Sequences
- Schedules
- Alarm redirection
- Mimics / Graphics
- Trends/graphs
- Reports

Configuration changes shall be capable of being made from local and remote workstations using Rich Clients, with appropriate privilege. Configuration changes are to be applied to the Main SCADA server and seamlessly applied to Standby server and other SCADA server nodes such as user performance sharing SCADA nodes.

Further, configuration changes made to mimics and other display objects shall be immediately available to local and remote Rich and Web display Clients without any manual intervention. Changes should be updated automatically in local caches where appropriate. This facility shall be a native feature of the product and not require external scripts or customisation.

All aspects of the look and feel of the SCADA system, including default field values, shall be configurable. It is not acceptable for colour regimes, communication parameters and other aspects of the system to be hard-coded.

It shall be possible to add user defined fields to the SCADA database. These fields should be accessible both internally and externally to the SCADA system; being exposed via OPC, ODBC, OLE Automation, XML/SOAP, etc.

The SCADA server shall provide detailed diagnostics concerning its internal operation. The diagnostics shall be available through capture to a log file as well as online locally on a server and remotely via Telnet and Web interface.

The SCADA software shall provide the ability to perform a complete audit trail of all database changes down to the individual property level of objects to ensure complete system integrity and safe system operation. These details shall be provided as a built-in integrated part of the system and shall include, but not be limited to the following:

- Time of change
- Object on which change was performed
- Property of the object that was modified
- Property value before and after the change
- User that made the change
- Reason for the change

Stored configuration records should be maintained in the historic database for a configurable time period, support redundant SCADA server configurations and allow access from standard database interfaces such as queries and simple mechanisms for displaying and filtering the configuration records

7. Alarm Management

The alarm system shall provide facilities where actions can be triggered by alarms. These facilities shall be provided as a built-in integrated part of the system and shall include, but not be limited to the following:

- Configuration criteria for alarm actions
- Escalate Alarm priority
- Delivery of alarm to users via SMS
- Delivery of alarm to users via E-mail
- Trigger other actions including sequences

Integrated paging facilities shall be provided without the need for additional software. The paging facilities shall include calendar operation for roster based user lists with flexible interface for reconfiguration of alarm management.

Tracking of alarms shall provide as a minimum:

- Alarm activation including point name, state, timestamp, priority
- Alarm de-activation
- Alarm acceptance including time, user responsible, optional comment
- Custom alarm fields for display of additional or operations specific information

Where a full function Rich Client is connected to multiple SCADA systems, alarms from all systems shall be combined and filtered, based on user privilege and areas of responsibility.

System administrators shall be able to configure user accounts with default filters so tha operator alarm lists can be confined for users to those areas where they assume responsibility.

Full function Windows & Web clients shall provide indication of alarm condition, with the ability to change alarm tone, color, and other attributes based on alarm priority.

Full page and window display of the current alarm list to be shown. It shall also be possible to modify the background color of alarm lists.

Alarm display, acceptance, query and comment entry shall be available via an integrated product Web interface.

Alarm limit time profiles allowing analog setpoint levels to vary over the course of a day to account for conditions at the site.

Consequential alarms to allow one (or more) alarms to be suppressed as the result of another alarm occurring. Suppressed alarms will be received and processed by the SCADA Server and recorded in the event journal for

future auditing, however the operator shall not be forced to take an action on an alarm where the cause is known.

8. Event Journal

The system shall provide, as a built in feature and without the requirement for custom or external software, facilities for event logging. These facilities shall be separate from the alarm list and include the capability to insert user comments at any place in the event list.

Event lists shall be obtainable through an SQL-like query or filtered through user entry on a forms-based display.

Event data is to be stored in a time-series relational database. Each event record shall comprise a timestamp, responsible user, point name, message, and reason for event log.

The event journal shall support the following:

- ODBC / SQL interface to event data
- Filter and browse via full function display client
- Filter and browse from Web client interface

9. Historical Data

The SCADA system shall provide a built in data historian with the following facilities as standard features. These shall be provided without the addition of external software modules:

- Time-series relational database
- ODBC / SQL interface to historical (trend) data
- Historical data to be stored with time-stamp, point quality, alarm status
- Historic storage is to be based on configurable criteria including time between samples, alarm state change
- Compression capability

Historical files supporting fixed interval sampling only will not be accepted.

Where historic data can be retrieved through communication devices such as PLC / RTU/PLC / RTUs, the historic data sub-system shall natively provide the capability to backfill this data in to the historian.

No loss of data or gaps in data as a result of communication or server failure shall be accepted. The vendor must demonstrate its ability to ensure data integrity and history data recovery.

An API shall be included to provide interface capability with the SCADA database. This shall be based on OLE Automation and/or .NET

The historic data subsystem shall provide fixed and user configurable views of the historic data tables. These views are required to provide SQL pre-processing and present historic data in aggregate format.

The SCADA server shall provide Historian functions including the capability to validate historic data prior to exposing it externally to the SCADA system, selectable archiving rates, point-by-point storage compression regimes, annotation on history samples for tracking comments on operational conditions, modification of historic data for normalization and correction (tracks previous value and modifying user and is subject to user privilege), auditing of modified or annotated history.

10. System Security & Access

The SCADA system shall provide a high level of inherent security. To this end the SCADA software shall provide security access down to data point level, and support individual Users, User Groups and a matrix of system capability and access to any level of the SCADA database.

Full function Rich & Web client interfaces shall require explicit administrative configuration to valid connection to the SCADA server.

Web interface facilities shall provide the capability to operate the Web interface using SSL and encrypted data. The Web functionality shall be provided in an integrated way with the web server facility tightly coupled with the SCADA database. It is not acceptable for the system to utilize IIS or similar external web interfaces, or require web pages to be "published" from the SCADA system. Changes in configuration to the SCADA system shall not require additional steps in order to provide modified information to the SCADA Web interface.

The SCADA system security shall provide the ability to be integrated with Windows domains to authenticate logon attempts against a trusted domain. Validation should occur across all client interfaces, ensuring that users utilizing all types of clients are subject to the built in system security policies.

11. Open Connectivity

To provide easy access for customized reports and external data manipulation the SCADA software shall provide inherent OPC and ODBC database connectivity without the need for additional software options or modules. Integration with desktop Microsoft products is essential.

The following Open interfaces shall be provided as integrated components of the SCADA system are required:

- OPC Data Access (OPC-DA) to the SCADA server real-time and configuration database
- ODBC and OLE-DB to the SCADA server real-time database, historian, event / parameter journal and configuration database
- OPC Historic Data Access (OPC-HDA) to historian
- OPC Alarm & Event (OPC-AE) to event sub-system
- OLE Automation interface to the SCADA server database

12. Reports

An integrated reporting package shall be able to generate, print and export reports:

- Triggered by SCADA events
- On user demand
- On timed schedules

Report generation shall use latest technology in database access and be capable of combining data from multiple databases via ODBC/SQL. This shall include SCADA and non-SCADA databases.

Reports shall be able to be generated in a number of formats including:

- HTML for viewing via Web interface
- PDF format
- CSV format
- MS Office® suite format

Generated reports shall be able to be:

- viewed in Rich Clients and Web Clients
- printed on a local or network printer
- stored on disk file, locally or remotely
- e-mailed to assigned users

13. Standard Drivers

- The SCADA system shall provide native support for fully integrated Wide Area SCADA PLC / RTU protocols.
- This shall include the capability for supporting all protocols in redundant SCADA server configurations and support redundant communication paths.
- All drivers shall provide the ability to monitor communication statistics, log driver diagnostics, and provide online access to driver and channel diagnostics remotely via Telnet or similar mechanism. Captured diagnostics shall be able to be translated to HTML for analysis in clear human-readable format.
- Apart from PLC / RTU and PLC / RTU communication drivers, the system shall also support as standard the following drivers:
  - SMS (with TAP and UCP service) to mobile phones and pagers with a GSM or CDMA modem connected directly to the SCADA server.
  - – a full function system is required including calendar based rosters
  - SNMP – monitoring of network devices such as routers, computers, UPS, etc.
  - NTP – time server monitoring and alarming
  - ODBC – query data from other databases
  - Windows Performance Monitoring
  - OPC-DA driver

PLC / RTU Protocol Support

Wide area PLC / RTU protocols shall support:

- local serial port communication
- terminal server serial port communication
- Ethernet LAN communication via TCP and UDP ports
- time synchronisation
- presetting output configuration points where configured
- fully integrated incorporation of events from a PLC / RTU
- unsolicited exception reporting
- Where PLC / RTUs utilise the DNP3 communications protocol, those devices must support the DNP3 Secure Authentication standard.

All drivers shall support capability to update SCADA database point value / alarm state / point quality / timestamp. PLC / RTU protocol drivers shall support the ability the backfill time-stamped data into Event Logs, Historic Data to maintain data integrity in the event of communication failure.

The driver architecture shall support user accessible interfaces to access major driver functions. This shall include, but not be limited to:

- enable / disable PLC / RTU communications
- trigger an integrity poll
- alter communication parameters

Drivers shall maintain current state of target device information, and when used in redundant server architecture shall retain state information and be able to receive solicited and unsolicited information from the PLC / RTU immediately following a server transition. It is not acceptable for the system to indicate communication failure or not be able to receive communication from a remote device during the period of transition from one server to another.

The following protocols shall be supported and integrated with the product:

- Modbus Master serial protocol
- Modbus Slave serial protocol
- Open Modbus/TCP Master protocol
- Open Modbus/TCP Slave protocol
- OPC-DA client driver (for connection to OPC Server driver)

The OPC-DA interface shall include as a minimum, integration with SCADA database value / state / quality / timestamp data, support OPC-DA 1.0 and 2.0 specification interfaces, polled and exception modes, tag browsing.

Logic

The SCADA system shall support logic sequences with full access to all SCADA system services at run time. Programming of sequences shall be to the IEC61131-3 international standard and support as a minimum the following languages:

- Ladder Diagrams
- Function Blocks
- Structured Text
- Sequential Function Charts

Sequences shall be able to me modified and started and stopped online. Sequence changes shall be a native part of the database and replicated to redundant SCADA servers.

Special scripting languages to perform the control strategy will not be accepted.

12. PLC / RTU :

The PLC / RTU shall provide

- Functionality to map the field devices
- Provide communication connectivity to the all the slave devices through Serial Communication or TCP/IP communication.
- Provide a communication facility to the field devices through serial communication through RS232 port via a serial communication device viz. modem etc.
- Should have a ability to collect data from all connected devices, regardless of protocol and make it available to the control centers & CMS using a LAN,WAN connectivity.
- Should act as a protocol translator to ensure interoperability with the protocols defined in the communication principle section.
- Should be capable of handling real time data exchange services to publish or subscribe information for defined master and slave protocols.

Specifications for PLC / RTU

The PLC / RTU shall be non redundant, modular.
The controller shall at least include the following base I/O and further expansion shall be possible using expansion modules

The PLC / RTU shall be as per the following specifications:

Digital Inputs: 16 (24 VDC)
Digital outputs: 10 (24 VDC Transistor/ Relay)
Analog Inputs: 8 (Min.12 Bit resolution)
Communication ports: 3 Nos. One for HMI, One for Connecting Energy Meters (MODBUS) and one for MODEM/ Router.

The CPU specifications shall be as follows:

Basic CPU:

a) Communication Ports: 1 Programming Port, 1 CANopen/Profibus Port & 2 Auxiliary Ports (Protocol configurable)
CANopen/ Profibus/ Eq. Network: Max 31 Nodes (Up to 500 mtr)
Max. Units per Node: 1 Base + 3 Expansion Units
Baud Rate: Auto Baud Detection (10, 20, 50, 125, 250, 500, 1000 Kbps)

b) Operating Temperature: 0 to 550 C

c) Memory capacity: More than 16 K steps of programming.

d) Memory cassette: Shall have facility to install Flash/ EPROM cassette.

e) SCAN time: Better than 2 micro second per general Boolean instruction.

f) Relative Humidity: 5 to 90% Non-Condensing.

g) Noise Immunity: IEC 61000-4-4

h) Shock: IEC61131-2 Operating: 15g (DIN rail & Panel Mounting)

i) Vibration: IEC61131-2 Operating: 5 to 150 Hz, 1g, 3.5mm Amplitude

j) Mounting: DIN rail or Panel Mount

k) Protection: IP 20

l) Network Connections: 5-pin 5.08 mm Pitch Screw Type Open Style Connector

m) Unit Power Supply: 11 to 30 VDC Through 5-pin

n) Network Power Supply: 24 VDC, 5 A

o) Power Supply Protection: Reverse Polarity

p) Digital Inputs: 24 VDC, Sink/ Source selectable. With Input current less than 16mA.

q) Digital Outputs: Relay having capacity 230 VAC, 5A. (Optionally interposing relays can be supplied).

r) Analog Inputs: 4-20 mA or 0-10 VDC selectable with A/D conversion of min 12 bits.

s) All cards in PLCs shall be weatherproof coated.

LOCAL HMI for PLC/ RTU

The purpose of Local HMI is to indicate current status of the level, pressure, flow, energy data and water quality etc.at the field stations.
The HMI shall also act as an aid to facilitate Pop up alarms, enter time delays, and operate the necessary equipment. The HMI shall have 1 printer port and 1 USB port as a minimum.
The HMI shall be Touch screen with minimum diagonal screen size of 6"

Programming Software:

- The programming software shall allow downloading of Relay Ladder Logic and/or standard C++ programs from within one package. The software shall allow the user to develop and download the application and system configuration over communication network via radios, Ethernet, leased and dial-up lines.
- The PLC / RTU shall allow Ladder and/or C++ applications to run concurrently. Any failure in the Ladder application shall not affect other applications.

  The Relay Ladder Logic shall include the following functions:

  - Data logging function with time & data
  - Modem dialing and control.
  - Timers, counters, mathematical functions, memory functions.
  - Standard Ladder Logic functions such as coils and contacts.
  - Boolean logic functions.
  - Bit transfer functions.
  - Block transfer functions.
  - Scaling function
  - Totalizing function
  - Flow function
- On-line monitoring of Relay Ladder Logic power flow shall be included to facilitate start-up and debugging of programs.
- Relay Ladder Logic program shall be up to 12K words in size, with no fixed limit on the number of networks.
- The programming software shall support on-line monitoring and forcing of any register in the protocol database when utilizing the built-in protocol. Forcing shall write a value to the register and prevent modification of the register content by the communication protocol or the application software. A global command to remove all forcing must be included.
  In addition to forcing, the software shall be capable of writing a value to any register in the protocol database but continue to allow the protocol or application software to modify the contents of the register.
- The unit must also support IEC 61131-3 programming using Sequential Function Chart (SFC), Functional Block Diagram (FBD), Ladder Diagram (LD), Structured Text (ST), Instruction List (IL), Flow Chart (FC) languages using a separate programming tools.

Data Logging Functionality

The Controller shall support Data Logging via Removable USB Mass Storage devices which include:

- USB Flash Memory Stick
- USB External Hard Drive

Log to USB Mass Storage

- USB mass storage device remains connected to controller
- Multiple data logs may be configured to write data to USB storage (Data is buffered to non-volatile RAM and written once per minute.)
- At some point in time when the USB storage device is removed, the data continues to be logged, but is stored to internal non-volatile memory.
- When a USB storage device is re-inserted the buffered data is copied to the USB storage device.

13. GPRS MODEM Specifications

The device shall act as REMOTE MANAGEMENT DEVICE.
This shall have facility to connect PLC / RTU with central PC at head office through GPRS.

The IA shall provide any of the PSTN / Broad band with dynamic IP connection. The connection will be provided based on best available connectivity. The vendor shall provide connectivity device which will be able to incorporate any connection. The specifications for the device shall match following. Remote Maintenance PLC / RTU point to Point RAS or Internet remote access: and any PLC / RTU / device / equipment with TCP/IP Remote Service : Data acquisition (Tag names) in MODBUS/RTU, MODBUS/TCP 'Tag names' enable alarm management, Basic programming, custom Web pages, reporting… Data Logging: Internal data base for data logging 21.000 points. Retrieval of the data base with files transferred by FTP put or email attachment.
Alarms: 'Tag name' database: 128Kb. Alarm Notification by email, SMS, FTP put and/or SNMP trap.
Available standard limits to configure: Very Low, Low, High, Very High + Dead zone and activation delay.
Alarm summary and historian available in HTTP and via FTP files transfer.
Alarm cycle management: ALM, RTN, ACQ and END.
MMI HTTP: System and user defined Web site.
SNMP: 'Tag Name' read/write
FTP: Whole set of parameters are available in files
Callback: Call back on user request or on amount of rings
Direct or Internet call back (supports dynamic DNS)
Firewall IP filtering
Script Dedicated application to be programmed with the Basic language.
Router IP forwarding, NAT, port forwarding and routing tables.
Internet RAS connection (PPP), PAP/CHAP security. Data compression, ISP connection
(Internet Service Provider) primary et secondary, supports DNS.
Synchronization Embedded real-time clock, manual setup via http or automatic NTP setup
File Management FTP client and server for configuration and data transfer.
Web Site Security: DAA and session control. HTML standard supports the entire PDA browsers.
SSI technology (Server Side Include) and BASIC scripted ASP (Active Server Pages).
Maintenance SNMP V1 with MIB2 and/or via FTP files
Material ARM processor @75Mhz, 8Mb SDRAM, 8Mb Flash, Din Rail Mounting
Power supply 12 - 24VDC +/-20%, SELV; consumption: 3-6 watts
1x SUBD9 serial port: RS232, RS422 or RS485, 1,5kV isolation

1x RJ45 Ethernet 10/100 baseTx; 1,5kV isolation
1x digital input: 0/24VDC; 3,5kV isolation
1x digital output: open collector 200mA@30VDC; 3,5 kV isolation
Embedded modem: PSTN or GSM/GPRS
Operating Temperature range: 0° to 50°C, 80% humidity (no condensation).

Monitoring & Communication Panel Detailed Description

1.0 PANEL DETAILS

Enclosures and mounting boards

Enclosures shall be any form of board, cabinet, panel, desk, box or case used to protect, contain or group instrumentation, telemetry or control equipment. All equipment in or on enclosures shall be arranged logically and, as far as possible, symmetrically, with projections kept to a minimum. Each enclosure and board shall be designed on ergonomic principles and shall permit in-situ and safe access for any normal adjustment, maintenance and servicing. The tops of plant-mounted enclosures shall be sloped downwards from front to rear.

The minimum degree of protection shall be IP 54 in purpose designed control rooms and IP 65 for other outdoor locations. Enclosures for use outside buildings or in places where splashing may occur shall have a minimum rating of protection to BS EN 60529:1992, IP 55 and have tops which project sufficiently to protect the vertical faces of the enclosure and any component mounted thereon from splashing, inclement weather and direct sunlight. Also, when enclosures for use outside buildings are located where exposure to direct sunlight will give rise to high top-panel surface temperatures such that the internal temperature rises above the manufacturer's recommendation (normally 40°C), the enclosure shall include a sun shield fitted to the top of the enclosure.

Fixing arrangements for surface-mounting enclosures shall be external to the enclosure and shall ensure that the rear face of the enclosure is not in contact with the surface to which it is fixed.
Enclosures shall have hinged access doors, fitted with recessed lockable handles. Doors shall be of rigid construction and provided with close-fitting flexible seals in recesses to prevent the ingress of liquids, moisture, dust and vermin. Hinges shall be of the lift-off pattern and one hinge shall engage before the other for ease of fitting. Wherever necessary, removable access covers secured by quick-release fasteners shall be provided to ensure ease of maintenance for all installed apparatus. Mounting plates, brackets and racks shall be provided for all other internal equipment which shall be hinged or otherwise arranged with quick-release fasteners or captive screws to give quick and easy access to equipment, securing screws, terminals and wiring.
Enclosures for two or more devices with electrical circuits shall have gland plates and terminal blocks as specified elsewhere.

Each enclosure shall be designed for the safe testing and servicing of equipment with the power on. Each part which may be live under any circumstances shall be so covered or insulated so as to prevent inadvertent contact.

1.2 Panel design and construction

Unless otherwise specified, all instrument panels, instrument cubicles, control panels, control consoles and desks, associated equipment and terminal racks, telemetry and electronic equipment racks and the like shall be free-standing, floor-mounted units and shall conform to the requirements of this part and will hereafter be referred to as panels. The design and dimensions of control consoles and desks shall be determined according to their intended function but shall be in accordance with the requirements of the Specification Drawings. The height shall not exceed 1400mm above the finished floor level.
Unless otherwise specified or shown in the Specification Drawings, the height of panels shall be not greater than 2130mm overall (excluding lifting devices) above finished floor level.
The clearance between the extremities of apparatus mounted on the internal walls shall allow safe and unobstructed access to all terminals and to parts requiring maintenance. Panel layout drawings shall normally include a list of all instruments, accessories and components contained therein. If the drawings have insufficient space for the list, a separate schedule of instruments, accessories and components shall be provided and the panel drawing shall contain a cross reference to the contents list and an indication of the panel location of each item on the list.

1.3 Panels — minor

Panels for installation on the Plant which contain relatively few items of equipment, or where so specified elsewhere, shall be classed as minor panels and shall be constructed generally as specified in the preceding clause and comply with this Clause. Panels shall be fabricated from sheet steel or other approved material less than 2.5mm thick suitably braced to form a robust and rigid structure. Exterior corners and edges shall be rounded to give a smooth overall appearance and assembly bolts, screws or rivets shall not be visible on the front face. The design shall be such as to ensure adequate ventilation and air circulation where required, without permitting the entry of vermin. Openings for cables shall be made vermin-proof. Doors shall be hinged and shall be provided with close-fitting flexible seals in recesses to prevent the ingress of liquids, moisture, dust and vermin. Where surface-mounted panels are provided, the fixing shall prevent the ingress of moisture and the rear of the enclosure shall be not less than 10mm from the wall.
Lifting eyebolts shall be removed, issued to the Purchaser and subsequently replaced with bolts after installation. Panels shall be extensible, and symmetrically arranged as far as possible with projections kept to a minimum. Where two or more panels are fitted together, they shall form a flushfronted continuous panel of uniform height. Front door and top cover dimensions shall match.

The arrangement of equipment within each enclosure shall be such as to permit easy access for installation and maintenance. No instruments, relays or other components shall be mounted on rear access doors or removable covers.

1.4 Panels — composite

In situations where space limitations preclude the use of separate instrumentation, control and automation (ICA) and switchgear panels and, at the sole discretion of the Engineer, ICA equipment may be combined within a single enclosure subject to the following conditions:

i. the observance of all other clauses herein relating to enclosures, mounting boards and minor panels;

ii. the written assurance of each supplier of ICA equipment that the proximity of the switchgear will have no detrimental effect on the life or performance of any ICA component;

iii. the total segregation of ICA equipment and switchgear including the glanding and termination facilities;

iv. the absence of any voltage exceeding 250V ac or 50V dc from any compartment containing ICA equipment;

v. the use of the full height of the panel (excluding the busbar chamber and cable space) for any ICA equipment compartment.

1.5 Panel protection

Adequate facilities for isolation and protection by miniature circuit breaker or fuse for each instrumentation and control circuit and sub-circuit shall be provided and shall be so arranged that any interruption causes minimum disruption of plant, operates the appropriate alarm and cannot result in any unsafe operating condition. All fuses shall be of the cartridge pattern and main fuses shall be of the high rupturing capacity type. Fuse and solid-link carriers and bases shall be of plastic-moulded insulating material of an approved make. Ceramic materials will not be accepted. Live connections shall be efficiently shrouded and it shall be possible to change fuses with power on without danger of contact with live metal. The fuses shall be rated to give maximum protection to the equipment in circuit and the rating shall be permanently inscribed on the fuse label and on the fuse carrier. Unless necessary for the protection of particular equipment, miniature circuit breakers used for individual circuits in a panel or control desk shall not trip on over-voltage or under-voltage.
Bases for solid links shall not be interchangeable with those for fuses. Fuses and links in the same circuit shall be mounted opposite each other in separate adjacent rows and shall not alternate in the same row. At least 10% and not less than two unallocated miniature circuit breakers or fuses and links shall be provided in each panel distribution board. Miniature circuit breakers and fuses of similar size and rating shall be of the same make and type.

At least 10%, and not less than two, spare fuses and links of each rating shall be provided and fitted in clips inside the panel. Each instrument requiring a power supply shall be individually wired and protected so that, in the event of a failure in one circuit, the remainder are unaffected. Power supply circuits shall be of sufficient rating that any protective device may operate without reducing the voltage at the terminals of any other component to an unacceptable level. Remote alarms shall be operated on failure of the electrical supply to a panel or to anyinternal sub-circuit.

Clearly identifiable, switched socket outlets of 15A minimum rating to comply with IS 4615, supplied at the main cabinet operating voltages shall be fitted within the panel at the rate of one for each operating voltage per metre of panel length; for a panel whose length is less than one metre, one switched socket outlet for each main operating voltage shall be provided.

1.6 Panel isolation

Circuit breakers for panel power supplies shall be mounted near an access point and in positions where they may be operated easily from a standing position. Plug-in isolating links or devices of an approved type shall be provided in any circuit that may still be live when the power supply isolators are in the ‘off’ position, as, for example, in circuits controlling equipment whose power supply is independent of the panel. Such links or devices shall be properly screened and, if not incorporated in or adjacent to their associated outgoing terminals, shall be labelled with suitable warning notices.

1.7 Panel terminal blocks

External wiring for panel power supplies shall be terminated on the appropriate isolator. Signal cables from analysers, meters, transmitters may be terminated at their appropriate instruments. A terminal block shall be provided as the interface between the corresponding conductors of each internal and external wire and each internal and external connection except those listed above. Terminal block rows shall be spaced apart and arranged to permit convenient access to wires and terminals and to enable ferrule numbers to be read without difficulty.

Other circuits shall be grouped on the terminal blocks according to the classification given in the clause for 'Panel internal wiring' which shall be clearly marked along the corresponding section of each terminal board. Groups of different voltages on the same board shall be separated by insulated barriers.
All connections shall be made from the front of terminal blocks and no live metal shall be exposed at the back. All terminal blocks shall be of the type which clamps the wire securely and without damage between two plates by means of a captive screw and which permits removal of any terminal without disturbance to adjacent terminals.

All steel parts shall be zinc-plated and passivated with a yellow chromate layer. Terminal blocks for power supplies for equipment external to the panel shall permit the isolation of the item of external equipment without affecting the operation of any other circuit within or outside the panel. No more than one core of external cables, or one internal wire shall be connected to any terminal. If terminal blocks are used as common points for two or more circuits, individual terminals with the appropriate number of permanent cross-connections shall be provided. The lengths of exposed cable cores shall be sufficient to reach any terminal in the appropriate row or rows. The cores shall be formed into a neat loom and a separate loom shall be provided for each cable. Identification ferrules as specified in the clause for 'Panel wiring identification and termination' shall be fitted on each core of all external cables and on each internal wire.

The size of the terminals shall be appropriate to the size and rating of the cable cores which will be connected to them but shall not be smaller than Clip on type SAK2.5 or equivalent unless otherwise agreed with the Engineer. Each row of terminal blocks shall contain at least 25% spare terminals over the number required for terminating all cores of external cables in that row. Unless otherwise specified or shown in the Specification Drawings, each external cable shall contain at least 20% spare circuits, with a minimum of one spare circuit.

Terminal blocks shall be numbered consecutively in a sequence different from that used for identifying wiring. The terminal numbers, voltage grouping and terminal board layout shall correspond precisely with wiring diagrams so that quick and accurate identification of wiring can be made.

All the terminal boards shall be provided with covers of transparent insulating material that does not sustain combustion and shall be sectionalised where possible to give access to groups of terminals without uncovering all boards. Terminals which may be live when the panel is isolated from its main supplies shall be suitably labelled to minimise the risk of accidental contact.

1.8 Panel internal wiring
Panel circuits shall be segregated into the following categories:-

Group 1: Power control and very-high-level signal wiring (above 50V):

1.1 ac power supplies;

1.2 dc power supplies;
1.3 ac current signals above 50mA (such as CT circuits);
1.4 ac voltage and control signals above 50V (such as PT circuits).

Group 2: High-level signal wiring (6V to 50V dc):

2.1 signals from conventional electronic transmitters and controllers (such as 4mA to 20mA);
2.2 circuits to alarm annunciators and other solid-state devices (excluding those in categories 2.1, 2.5, 3.1, 3.2 and 3.3);
2.3 digital signals;
2.4 emergency shut-down and tripping circuits;
2.5 on/off control circuits;
2.6 intrinsically safe circuits;
2.7 speech-frequency circuits.

Group 3: Low-level signal wiring (5V dc and below):

3.1 Signals from analytical equipment and strain gauges.

For Group 3 wiring, internal connections to the instruments shall be made by one of the following methods:

(a) the twisted, screened conductors of the external cable shall be led direct to their appropriate instruments via ducting systems installed for this purpose during construction of the panel;

(b) the conductors of the external cables shall be terminated on terminals segregated from all other categories and the connections to the appropriate instruments shall be made using twisted pairs with individual screening installed for this purpose during construction of the panel. Internal wiring for all circuits in Group 2 except those sharing a common connection shall be multi-stranded, twisted pair, 0.75mm^2 minimum copper conductor with HPDE or PVC-insulated cable of adequate grade and rating in accordance with BS 6004:2000. Wiring for circuits in other Groups or sharing a common connection shall be run in stranded, 1.0mm^2 minimum copper conductor with 250V grade, PVC-insulated cable of adequate grade and rating. Wiring sheath colours shall be black for ac circuits, and grey for dc circuits (excluding thermocouple circuits) and blue for Group 2.6 circuits. Circuits supplied at 240V, between 240V and 110V dc, shall also be physically segregated from each other and from other circuits. Access to wiring and components of circuits having voltages exceeding 240V shall not be possible unless and until the circuit has been isolated.

Separate ducts, trunking, cable looms, tray work and the like shall be provided within the panel for each category with at least 150mm between parallel paths of Group 1 and those of any other Group. Intrinsically-safe circuits and their terminals shall be segregated from other circuits and terminals.

All wiring shall be neatly and securely fixed by insulated cleats, bunched and secured by approved plastic strapping or run in approved insulated wiring trunking or non-corrodible flexible tubing. Not more than 75% of the capacity of trunking, ducts, looming, or tubing shall be used. Insulated earth wiring shall be so arranged that access to any equipment or connection point or the removal of any item of equipment is unimpeded. Wiring for future equipment shall be secured and terminated on terminal blocks. Lacing for wiring looms shall be of rot-proof cord or plastic strips. Inter-section wiring in multi-section cabinets shall be via a terminal block in each section.

1.9 Panel wiring identification and termination

Identification ferrules shall be fitted at both ends of each wire. The numbers or letters used shall correspond with the appropriate wiring diagram. The ferrules shall be of plastic insulating material with permanent black characters on a colour-coded background for numbers and on a white background for letters, unaffected by oil or water. They shall be so arranged that they can be read logically from left to right when viewed normally.
The system of wire identification shall be such that wires in the same circuit on opposite sides of a terminal shall have the same reference, and this system shall be continued through all external cabling.
Terminal ferrules (spade, tongue, crimped connections) shall be provided on each conductor.

1.10 Panel earthing

A continuous copper earth bar of not less than 25mm x 6mm cross section shall run the full length of each panel and shall be securely fixed and bonded electrically to the main frame. The cable gland-plates and the earth bar shall be provided with suitable brass terminals of not less than 6mm diameter for connecting the metal cladding or armouring of all incoming and outgoing cables to the station earthing system.

A second continuous copper earth bar of not less than 25mm x 6mm cross section, electrically isolated from the steelwork of the panel and metal cladding and armouring of cables, shall be provided for earthing the signal earth connection of each instrumentation and control device and the screen(s) of each instrument cable not earthed elsewhere to the station instrumentation earth plate. The earth bar shall have sufficient brass terminals as specified above for each instrumentation and control device and the screen of every shielded cable plus 25% spare terminals.

In multi-section panels, each earth bar shall be electrically bonded to the corresponding bars in the adjacent section(s). Instrumentation and instrument cable screen earthing shall comply with BS 6739: 1986, Section 10, unless otherwise stated in this clause.

1.11 Panel lighting

Each panel shall be adequately illuminated internally, as evenly and as free from dazzle as possible, fixed fluorescent lighting controlled from totally-enclosed light switches and by totally-enclosed door-operated switches positioned so as not to interfere with access. There shall also be one installed inspection lamp per three metres of panel length or part thereof with adequate flexible connection cable to reach any point in the panel. The control switch for an inspection lamp shall form part of the lamp assembly. Lighting circuits shall be fused independently of any instrumentation and control circuit and designed to allow lamps to be replaced safely and shall be fed from a distribution board and circuit breaker connected on the live side of the main panel ac supply circuit breaker.

1.12 Panel ventilation

Each panel shall be provided with ventilation fans as required to ensure that equipment within the panel is maintained within manufacturer's recommendations, with due regard to the environment in which the panel will be mounted. Fans shall be controlled by a suitably-labelled enclosed switch mounted internally in an accessible position. Fans shall be mounted with their axes horizontal and shall be arranged to draw clean air into the panel. Air entries shall have filters which can be renewed from outside the panel and shall be designed to prevent the entry of rain, spray, injurious fluids, sand or dust.

1.13 Panel labels

Labels shall be provided for every panel to describe the duty or otherwise identify the panel and its sections and every instrument, component and item of equipment mounted internally and externally. Where applicable, front-of-panel labels shall be as shown in the Specification Drawings. Wording shall be clear, concise and unambiguous and shall be subject to review by the Engineer before manufacture. Each label shall be permanently secured to the surface near the item to which it refers. Externally-fitted labels shall be of perspex or other approved transparent plastic, with letters and numbers rear-engraved and filled with black. The rear surface of each perspex label shall be finished with a coat of paint of the same colour as the panel external finish. Instrument duty labels fitted externally shall be below the item to which they refer. Embossed tape or similar adhesive labels will not be approved.

Laminated materials or rear-engraved and filled plastic shall be used for internally-fitted labels, which shall be white with engraved black letters. Labels conforming with the requirements of the preceding paragraphs or other approved means shall be provided:
i. to describe or identify circuits or circuit components;
ii. to identify dc polarity;
iii. to warn or remind about dangerous or potentially-dangerous circumstances;
iv. wherever elsewhere specified.

Unless otherwise specified, all engraving shall be in plain block letters, 4mm high. The minimum practicable number of different sizes shall be used. Manufacturers' nameplates shall not be fitted on panel external surfaces.

1.14 Panel finish

For control and instrument panels a hard, smooth, durable finish, free of blemishes, shall be provided. Before painting, all external welds and any rough areas shall be smoothed, and all surfaces shall be thoroughly cleaned and free from scale, contaminates, corrosion or grease. If rust-proof or Zintec steel has not been used in the construction, the panel shall be treated with a passivating agent such as phosphoric acid.

All internal surfaces shall have a minimum of three coats of paint of which the first shall be an approved anti-rusting priming coat and the final coat shall be an opaque gloss white enamel. All external surfaces shall have not less than five coats of paint of which the first shall be an approved etch-priming coat, and the second and third suitable undercoats, all of which shall be rubbed smooth when dry before application of the next coat. The undercoats shall be easily distinguished in shade or colour from the priming and finishing coats. The two final coats shall be of stove enamel paint, gloss or semi-matt finish, to a colour and finish to be advised by the Engineer.

Stoving shall be carried out in accordance with the recommendation of the paint manufacturer. The overall dry film thickness (DFT) shall be between 85 and 120 microns.

Nuts, bolts, washers and other fixing devices which may have to be removed for transit or maintenance purposes shall be galvanised or otherwise finished to an approved standard. A 500ml tin of matching touch-up paint shall be provided and packed with each panel. The colour of glass reinforced plastic panels shall be to the approval of the Engineer.

Panel Enclosure with necessary arrangements for plumbing and protection shall be provided to accommodate the turbidity / residual chlorine / BOD / SS analysers to ensure isolated mounting and protection for the same.

The monitoring and communication panels shall be further enclosed in a protective enclosure suitable for external site mounting to ensure the protection and outdoor operations of the same.

Locking arrangements shall be provided for the external enclosure

14. FULL BORE ELECTROMAGNETIC FLOWMETER & ACCESSORIES SPECIFICATIONS

General

The Electromagnetic Flow Meters shall be installed in RCC chambers/open pits or buried for indication of flow rate and total consumption of water in a transmission or distribution pipe network of city's water supply system.

The Electromagnetic Flow meters shall withstand maximum working temperature of about 60^{0} C and working pressure of 10 kg/cm2 (1.0 Mpa), unless specified otherwise.

Electromagnetic Flow Meter

Full bore electromagnetic flow meters should be designed, manufactured and calibrated according to ISO standard. The flow meter shall be capable of measuring bi-directional flow.

General Specification

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. The meter shall be manufactured to highest standard available for mag-meters. The meter shall be equipped with minimum six digit digital totalizers, reading in units of kiloliters and shall be accurate within 0.5% of true flow. The accuracy should be inclusive of linearity, hysterisis, repeatability, temperature and pressure effects. The meter assembly shall operate within a range of 0.3 m/sec to 4 m/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. The internal and external of the meter tube shall be blasted to near white and lined with hard rubber preferably by SBR or EPDM. Meter tube shall have a constant nominal inside diameter offering no obstruction to the flow.

Coil Housing shall be fabricated from stainless steel 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.

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 revere directions.

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

The converter shall be compatible with Microsoft Windows and other software programs with built in terminal communication capabilities of RS 485, HART or other protocols for interface. The converter shall be remotely mounted up to 200 m from the sensor, and shall be supplied with all calibration complete for desired requirements.

Converter shall be supplied with a programmable low flow drop out and empty pipe zero return. The signal converter housing should be die-cast aluminum with glass window. The converter cum transmitter should be fully programmable from the front facia. The programming should be user friendly, self-prompting menu driven.

Volumetric/ gravitational (weight) Testing of all meters must be performed and approved prior to shipment. The complete meter assembly and signal converter must be wet accuracy tested and calibrated as a unit near minimum, intermediate, and maximum specified flow ranges of the meter (full range of flow). The volume of water used to conduct the test must be shown on a shipping tag attached to the meter.

The overall uncertainty of the calibration rig should be at least three times better than the uncertainty of the full bore electromagnetic flow meter. The competent authority such as NABL or FCRI must certify the test facility. The testing facility shall be duly accredited in accordance with **ISO 17025 standards.** All the meters shall be calibrated for a minimum of 3 point.

Supplier should have in-house calibration facility and should give calibration certificate for all the flow meters. The flow meter should have grounding rings only. Calibration of each Meter shall be tested at in house facility of manufacturer for the sizes for which manufacturer has this facility. The Flow test lab of the manufacturer must be certified by National accredited agency such as NABL or FCRI .

In case the Bulk Water Meters are to be imported by the bidder the charges for the inspection of flowmeters shall be to the bidders account. This would include the air charges and stay for minimum of four people.

If manufacturer has no in house facility for calibration than each meter shall be tested from FCRI. Supplier must have test facilities, spare parts, and personnel to maintain, instruct, train or whatever is necessary to assure that meters shall be maintained throughout the guarantee/maintenance contract period.

The Bidder should submit data sheet of Electromagnetic Bulk flow meter to be supplied along with the proposals. After award of contract, the contractor shall submit the work plan, quality plan and different check lists to SE PIU concern for approval and after approval 3rd party inspection will be called.

Technical Specification

A) Process Liquid			
a.	Liquid Type	:	Potable water/raw water
b.	Type of solid	:	Silt particles
B) Operating Condition			
a.	Operating pressure	:	Max. up to 1.0 Mpa
b.	Operating temperature	:	0^{o} C to 50^{o} C.
C) Flow Sensor			
a.	Type	:	Pulsed DC excitation
b.	System	:	Separate with cable output
c.	Power supply	:	240 V AC, 50 Hz
d.	End Connections	:	Flanges of Carbon Steel
e.	Flange Rating	:	PN10 – Up to size 1200mm PN 6 -from 1300mm to 2000mm
f.	Electrode material	:	SS 316 (Stainless steel) /Platinum /Tantalum
g.	Meter tube	:	SS 304 (Stainless steel)
h.	Electrode type	:	Round head electrodes (Bullet nose)
i.	Lining material	:	Hard Rubber / Neoprene
j.	Protection category	:	IP 68
k.	Measuring accuracy	:	**+/-0.3%** of Measured Value
l.	Coil Housing	:	SS 304 with fully welded construction

m.	Connection / Junction Box	:	SS 304
n.	Earthing	:	Grounding Rings in SS 316, or earting electrodes
o.	Fluid conductivity	:	> 20 µ Siemens/cm
p.	Marking	:	Direction of flow with arrow, size, Sr. no, make

D) Flow Transmitter/Converter

a.	Type	:	Microprocessor based, Modular Design, remote mounting
b.	Display language	:	English
c.	Ambient temperature	:	-2°C to +60°C
d.	Display	:	Min. 2 line back lit LCD for indication of actual flow rate, forward, reverse, sum totalizes
e.	Outputs	:	One Current output (4 – 20 mA), One scaleable pulse output, One Status output
f.	Protection Category	:	IP 65
g.	Enclosure	:	Die Cast Aluminum with polyurethane finish with glass window
h.	Programming	:	Through Key /keypad on front facia /optical touch key without opening the display Cover
i.	Power Supply	:	240 V AC, 50 Hz
j.	Cable Gland	:	½" NPT (4 glands of double compression type)
k.	Mounting	:	Wall mounted
l.	Interface	:	RS 485, based on EIA R 422/485 standard, or HART
m.	Power failure mode	:	Provision of RAM/PROM to store parameter entered and measured flow data during power failure
n.	Max. Separation	:	Up to 200mtrs. between sensor & transmitter without any signal boosters
o.	Terminals	:	Shock – Hazard – protected push lock terminals

p.	Error Identification	:	0/3.6/22 m Amp
q.	Interchangeability	:	Fully interchangeable with all sizes of flow sensors
r.	Safety classification	:	General purpose certification

Signal Cable

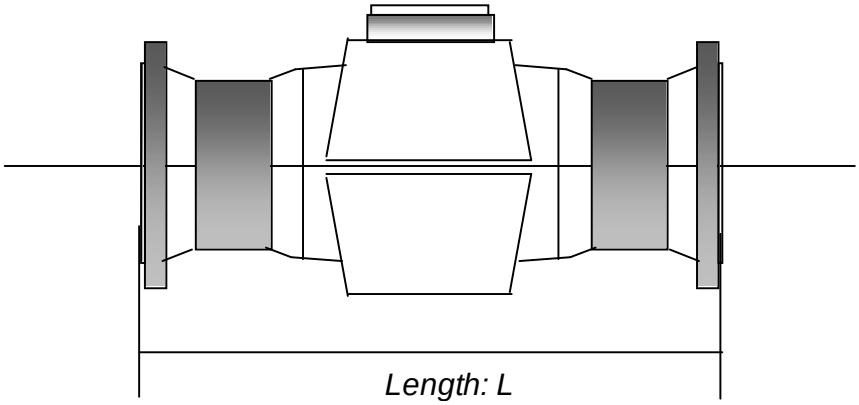
The cable should be capable of transmitting low signal voltage U (milli volts, pico watts) via a armored shielded cable from the primary head to the signal converter. The cable should be resistance to interference from external magnetic fields. The cable should be suitable for laying underground and under water installation.

Meter size

Meter size is designated by the nominal diameter (DN) of the flange.

Overall length

For each meter size designation, fixed overall length and tolerance shall be generally as per ISO-13359. The length includes lining if it covers the flange face but excludes accessories such as gaskets, grounding and protection rings.



Connections

The Flow meter shall be provided with flanges at both ends, the internal diameter of which shall be equal to the nominal size of the meter. The dimensions and drillings of the flanges shall be in accordance with IS 1538.

Rubber Gasket

If rubber gasket is required, it shall be flat rubber gasket of 3/6 mm dual thickness of SBR material and shall be suitable for making flange joints. The quality of flat rubber gasket shall be as per IS: 5382 and drilling of holes shall be as per IS: 1538.

Nuts and bolts

Nuts and bolt shall be of best quality carbon steel, machined on the shank and under the head and nut. Nuts and bolts shall be electro-galvanized. Bolts shall be of accurate length so that only one thread shall show through the nut in the fully tightened condition. Nuts and bolts shall conform to IS: 1363 and IS: 1367.

Material Supply

All the Flanged meters shall be supplied with one rubber gasket per flange and the required number of nuts and bolts as per the meter size. Matching pair of grounding rings shall be supplied with all the meter tube.

Quality control tests

All water meters of the same size and class manufactured by the same firm under similar condition of production from the material of the same batch, components from the same source, shall be considered as a lot for quality control inspection. However, the maximum size of a lot shall not be more than 25 meters.

The sampling procedure and scale of sampling for visual inspection and other test shall be as per Table-4 given in IS: 779.

The sample meters from a lot shall be inspected for workmanship to ensure that meter is free from any damage, cracks, imperfections and other defects and uniform in dimensions.

Acceptance Tests

The flow meter having satisfied for quality control requirements shall be tested for lot acceptance.

The following acceptance tests shall be conducted in accordance with IS : 779 and IS : 2373.

- Pressure tightness (Hydrostatic test).
- Metering accuracy.

In addition, to above tests manufacturer shall furnished a material certificate for meter tube, coil housing, connection flange and electrode, if required the material may be tested at approved laboratory for reconfirmation. If desired, the calibration and other test shall be witnessed by the Purchaser or their authorized representatives.

Packing

All the flow meters shall be packed in polyethylene bags. Smaller size meters shall be packed in cardboard boxes. The larger size bulk flow meter shall be packed in separate wooden crate, according to the size. Rubber gasket and nuts, bolts etc. shall be supplied in separate jute bags.

Flanged CI Specials

All flanged Specials: The cast iron flanged specials (flanged spigot, flanged socket, flanged tapers, flanged tees, bends, blank flanges, etc) shall be manufactured and tested according to IS: 1536, 1537 and 1538 respectively. The flange dimensions shall conform to IS: 1538 (part-I to XXII).

The specials shall be internally and externally coated with hot applied (dip) bituminous paint.

All flanged specials shall be used for nominal pressure of 16 kg/cm2 .

Flanged specials shall be supplied with the required bolts, nuts and rubber gaskets. The nut & bolts shall be supplied in jute bag; rubber gasket shall be supplied in a polyethylene bags.

Double flanged pipes: The dimension and mass of pipes shall be in accordance with IS: 7181. The permissible tolerance on mass of Pipe shall be +8, -5 % for diameter up to 150 mm and +,-5% for diameter above 150 mm. Tolerance on external diameter of barrel and wall thickness shall conform to IS: 7181.

The working length of double flange pipes shall be 0.5m, 1 m, 1.5m, 2m and 3.0m. The pipes shall be straight and permissible deviation from straight line shall be in accordance with IS: 7181. The pipes of heavier mass than the maximum shall be accepted provided they comply in every other respect with the requirement of IS : 7181. The pipes shall be supplied with the required bolts, nuts and rubber gaskets. The flanges and their dimensions of drilling shall be in accordance with IS: 7181.

The working pressure for the double flanged pipes shall be 16 kg/cm2. The pipes shall be tested hydrostatically at a specified pressure in accordance with IS: 7181. The pipes shall not show any sign of leakage, sweating or other defect of any kind. The factory test pressure for pipe sizes up to and including 300 mm shall be 25 kg/cm2 and for pipe sizes over 300 mm up to and including 600 shall be 20 kg/ cm2

The pipes shall be internally and externally coated with hot applied (dip) bituminous paint in accordance with IS: 7181.

Dismantling pieces: The flexible dismantling piece shall be manufactured from cast iron in such a way that it will allow dismantling of water meter without stress to the joints of the attached pipe. The dismantling pieces shall provide minimum clearance of +/- 25 mm (total clearance 50 mm). The pressure class of the dismantling piece shall be suitable 16kg / cm^2 pressure rating.

The dimensions of the dismantling pieces shall be suitable to fix with a water meter for diameter from 100 mm to 1200 mm with flanged joint. The drawing of the dismantling pieces shall be submitted for approval before production and supply of the product.

Supply: All the CI Flanged fittings shall be supplied with one rubber gasket per flange and the required number of nuts and bolts.

Rubber rings for Tyton joints: The rubber shall be free from extractable substances which impart taste, odour or toxicity to water. The rubber or its compound shall not content toxic materials, such as compounds of mercury, antimony, manganese, lead or copper.

The rubber rings shall be vulcanized from Styrene-Butadiene rubber (SBR) or .Ethylene Propylene (EPDM). The colour of material shall be black.

The rubber ring shall be long term termite resistant.

The sealing ring shall have no detrimental effect on the properties of the pipe and shall not cause the test assembly to fail the functional requirements The rings shall be homogeneous, free from porosity, grit, excessive blooms, blisters, or other visible surface imperfections. The fin or flash shall not exceed 0.4 mm and width 0.8 mm.

Rubber rings shall be made of a properly vulcanized virgin rubber compound containing no scrap or reclaim.

The surface of the rubber rings shall be smooth, free from pitting cracks, blisters, air marks, and other imperfection that may affect its behaviour in service. The body of the rubber ring shall be free from porosity and air pockets.

The rubber rings shall be suitable for the Tyton joints of DI pipes. They shall be of SBR/EPDM quality rubber conforming to IS: 12820 and IS: 5382. The type and hardness shall be according to table 1 of IS : 5382:

Part of the rubber rings	Type of rubber	Hardness IRHD
Bulb	2	50 + 5 1 -4
Heel	5	80 +1- 4

Packing: All the rubber rings shall be packed in polyethylene bags. Several PE bags shall be packed in separate jute bags, according to the size.

Specials for Ductile Iron pipes

Types of specials: The following types of DI fittings shall be manufactured and tested in accordance with IS: 9523 or BS: EN 545.

- flanged socket
- flanged spigot
- double socket bends (90° , 45° , 22 ½ °, 11 ¼°)
- double socket branch flanged tee
- double socket taper
- Double flange taper
- All the fittings shall be of class K-12.

Supply: All the DI fittings shall be supplied with one rubber ring for each socket. The rubber ring shall conform to IS: 12820 and IS: 5382 as described in the preceding clause. Flanged fittings shall be supplied with one rubber gasket per flange and the required number of nuts and bolts.

Specials for AC pipes

CI detachable joints for AC pipes : The CID joint shall be manufactured and supplied in accordance with IS: 8794. The rubber ring used with this joint shall conform to IS: 5382.

Supply: CID joint suitable for jointing AC pipe of class 10 and class 15 in accordance with IS: 1592 shall be supplied. All the joints shall be supplied with nuts, bolts and rubber rings.

Packing: All the CI pieces of the joint shall be packed and supplied in jute bags. The rubber rings shall be packed in polyethylene bags and supplied in a jute bag.

CI specials for AC pipes: All the CI specials (bends, tapers, flanged spigots, plane end tees, etc.) shall be designed, manufactured and supplied in accordance with IS : 5531.

The CI specials shall be suitable for AC pipe of Class 10 and Class 15 pressure rating in accordance with IS : 1592. The flanged spigot shall be supplied with nuts and bolts and a rubber gasket.

MS Specials for Mild Steel or Pre-stressed Concrete Pipes: Specials and fittings for MS/PSC pipes shall be

made out of steel plate fabricated to the required dimensions and given a coating of cement mortar inside and outside and shall be as per the specification below:

These specials shall be suitable for fixing pre-stressed concrete pipeline.

The specials such as bends, tapers, tees, and branches shall be fabricated by cutting steel plates of 8 mm thickness and shall be manufactured with flanged spigot and flanged socket type joints with rubber ring, suitable for jointing with pre-stressed pipe, as per specifications. The joint shall be roll-oil or confined type.

The steel for fabricated steel plate fittings is cut, shaped and welded so that the finished fitting has the required shape and interior dimensions. Adjacent segment shall be joined by means of lap or butt-welding.

The steel used for manufacturing of specials shall conform to IS : 226.

The specials shall be lined inside and outside with 25 mm thick cement mortar, reinforced with 50x50 mm weld mesh of specified gauge. The cement mortar inside shall be 1: 1.5 (1 part cement: 1.5 part sand) and cement mortar outside shall be 1: 2 (1 part cement: 2 part sand)

All the specials shall be tested for hydrostatic pressure before using as per clause 8 of IS : 7322. In case of specials manufactured at site, they shall be tested by penetration oil or other approved means.

The Bidder is fully responsible for any defect in manufacturing not conforming to IS Specifications. All the defective specials shall be replaced by the Bidder free of cost

For all other specifications, the IS 7322 or relevant amendments are binding.

NUTS & BOLTS

Nuts, bolts & washes shall be of best quality carbon steel of SS-316, machined on the shank and under the head shall be accurate length so that only one thread shall snow through the nut in the fully tightened condition MOC will be as under.

Bolts: SS 316

Nuts: SS 304

Washes: SS 304

RUBBER GASKET

The flat rubber gasket shall be 3/6 mm dual thickness of SBR material and shall be suitable for making flange joints. The qualities of flat rubber gasket shall be as per BIS: 5382.

GI PIPE

The galvanized iron pipes and fitting (tees, socket, elbows, union, and end plug) shall be supplied as per requirement in accordance with BIS: 1239 part-I and part-II. The GI **pipes** class B shall be used as a conduit pipe for signal/power between primary head and signal converter. The nominal dia may be 20mm or 25mm as per requirement.

SPECIALS AND FITTINGS

It is proposed to install the meters on the existing trunk mains of various pipe material such as pre-stressed concrete pipes (PSC),Cast iron (CI),Ductile iron (DI),Mild steel (MS)etc. All the meters shall be installed using MS fitting only, with proper protection from corrosion by applying two coats of epoxy paints followed by primer coat .The total thickness of the paint shall not be less than 400micron. The entire flange fitting shall be installed with a proper rubber gasket for water tight joints. Tapers to be provided may be centric or eccentric as per site requirement. The angle of tapers should not be more than 4 degree on each side. Minimum of thickness of MS pipe & tapers will be as under.

150mm to 500mm: 6mm
600mm to 1000mm: 8mm
1000mm to above: 10mm.

INSTALLTION

The contractor is to plan the final location for installation of meters on individual's sites. As per the recommendation of the manufacturer He shall prepare the proposal in accordance to the spefications of the equipment and submit the details to the Engineer in charge for, written approval. this should include the details of the proposed fitting required , the proposed layout and the time required for completing the work and the shutdown required or not . The installation shall be taking into account the following.

1. The effect of created in the flow due to pumping and valves are very pronounced and do not settle down in the short distances. It is desirable to locate the meter as far away from a pumping station as possible (preferably over 50 D away . the distance from an interfering valve also be kept as far as possible more than 10 D or as decided by engineer in charge.
2. The meter should always be full of water. Therefore if a meter is to be installed on a tank outlet, the meter should be before the control valve. It should also be ensured that the pipe flows full at meter site. In case of meter on tanks on hills, it would be best to find the site downstream in plain ground. The downstream pipe should be ascending up to keep the meter full all the time. Suitable site to house the flow recorder should be selected in consolation with engineer in charge.

3. During the site investigation if any pipe is found to be empty or half filled then suitable arrangement is to be provided by the contractor to have full flow in the pipe.
4. It is desirable and advantageous to prepare the assembly of meter and pipe fittings in advance which shall be inserted at pre-selected locations in the system to minimized disturbance of supplies and also to ensure high degree of workmanship and installation.
5. The shut down for installation of flow meter will be given as per convenience of the dep't. Timely completion of the work will be essence of the work. As such schedule of installation and testing, which is required for shut down shall be drawn in such a way that the work is completed in time. Please note that no shut down will be given in summer month i.e. April to June.

ELECTRICAL INSTALLATION

The signal converter shall be installed remotely and mounted on the panel in a suitable location directed by the engineer-in-charge.

Single phase AC connection shall be made available, for powers supply the signal converter and the sensor. All other necessary fixtures including wiring with proper cable conduit safety fuses and other items necessary for the installation of EMF shall be provided by the Bidder to the entire satisfaction of the engineer-in-charge and no payment shall be made on this account.

GI pipes shall be used as a conduit for connecting cables between signal converters and the sensor. First few feet of the conduit must be run in flexible conduit near sensor terminal box and at the signal converter. The signal converter is fitted with face sealing cable glands. Only 15mm NPT glands and double compression adapters may be used.

Only the specified signal cable recommended by the manufactures shall be fitted. The conduit entry shall be sealed to prevent moisture entering the terminal box via the conduit.

LAYING OF WATER ASSEMBLY

Cutting of pipes shall be necessary for laying and fixing of meter assembly on the existing pipes. For this purpose, a trench of sufficient width, depth and length shall be excavated for the underground pipelines which may be under the roads. The roads are under the jurisdiction of MCD/PWD. After cutting the road the same has been made good in original shape.

In case the permission is required from MCD/PWD it shall be the responsibility of the contractor to get the same however the department will assist. Any amount if to require may be deposited by the contractor & the same shall be reimbursed by the department in next running bill.

The existing pipe shall be cut and dismantled as per the requirement without damaging the extra length of the pipes. In case the extra length of pipe has been damaged by the bidder has to replace the same to make it operative with extra cost.

REFILLING

Refilling of the trenches shall proceed with the soft material free stone & hard substance; compaction of the same shall be done as per CPWD specification. Soft material free from stones or hard substance shall first be used & hand pressed under & around the pipes to half of their height. Similar soft material shall then be put in to a height of 30cm above the top of the pipe & this will be moistened with water and well rammed. Filling in the remainder of the trench shall be done with excavated earth. All lumps and clods exceeding 8cm in any direction shall be taken against the floatation of the pipeline due the entry of large quantities of water into the trench causing on uplift of the empty or the partly filled pipeline. Upon completion of the backfill, the surface shall be restored fully to the level decided by Engineer-in-Charge.

TESTING AND COMMISSIONING

On completion of the installation of the meter, the field tested meter shall be carried out to commission at the earliest without the loss of time. The contractor should submit certificate after completing the field testing stated as under and duly signed by the engineer-in-charge. The date of receipt of commissioning certificate shall be treated for commencement of warranty period,

(a) Check converter and display
(b) Check on current and frequency outputs.

14.1Pressure Measuring System

a) Pressure measuring system shall consist of pressure transmitter and digital pressure indicator and any other items required to complete the pressure measuring system.
b) Pressure transmitter shall be rugged in construction and shall be suitable for continuous operation. Pressure transmitters shall be designed for operation over 130% of full range. It should be SIL 2 certify. It should have HISTOROM for storing of history data.
c) Pressure transmitter shall be suitable for field mounting. They shall provide 4-20 mA and digital output proportional to pressure. Transmitter output shall be isolated and shall be suitable for transmitting over long distance. Pressure transmitters shall have high degree of weatherproof protection as specified in technical particular. Pressure transmitters shall have LCD display to indicate pressure.
d) The Contractor shall mark the exact location of pressure measuring point on the pipe line. The contractor shall provide all the hardware items including nuts, bolts, pipes, valves, gaskets etc. required for the work.

1	Accuracy	+/- 0.075 % of Calibrated Range with facility for range selection
2	Display	Indicating Type, LCD (backlit) with bar graph
3	Mounting	Field
4	Range ability	100:1
5	Sensing Diaphragm	SS316L

6	Fill Fluid	Silicone oil
7	Environmental Protection	IP-68
8	Operating Temperature Ambient	-40 to 85 deg c
9	Protection	IP68
10	Mounting	As per site conditions
11	Programme	Local / Through key pad
12	Output	Digital

14.2 On Line Turbidity Measuring System

a) Turbidity measuring system shall consist of turbidity detector assembly, turbidity transmitter, digital turbidity indicator and any other item required complete the turbidity measuring system.

b) Turbidity detector shall operate on Nephelometric measurement principle. Turbidity detector shall have ratio metric measurement system and shall be suitable for insertion/flow through type mounting. It shall be possible to calibrate the turbidity meter at site, with a formazine standard or a glass tube.

c) Turbidity detector shall be rugged in construction and shall be suitable for continuous operation. It shall have an integral bubble trap arrangement and ultra sonic cleaning facility.

d) Turbidity transmitters shall be suitable for field mounting and shall accept inputs from turbidity detector. They shall provide digital output proportional to turbidity. Transmitting output shall be isolated and shall be suitable for transmitting over long distances. Turbidity transmitters shall have LCD display to turbidity.

Detailed Specifications :

INSTRUMENT RANGE	0.02-100NTU/FNU OR 0.02–1000NTU/FNU
SAMPLE FLOW	0.1 LIT/MIN TO 1 LIT/MIN
ACCURACY	<10NTU: 0.0001NTU <40NTU: +/- 2% OF READING OR 0.02 NTU WHICHEVER IS GREATER >40NTU: +/-5% OF READING
RESPONSE TIME	Less than 5 sec
DISPLAYED RESOLUTION	0.0001 NTU
DISPLAY TYPE	MULTI LINE LCD
CALIBRATION	REUSABLE CALIBRATION CUVETTES (WITH TRACEBLE LIQUID STANDARD)
ENCLOSURE PROTECTION	IP66
ENCLOSURE MATERIAL	ABS
WETTED PARTS	NYLON, GLASS, SILICON, PP, SS 304
OUTPUTS	1X 4-20MA CURRENT OUTPUT BI DIRECTIONAL RS485 MODBUS 2X RELAY FREELY PROGRAMMABLE
POWER SUPPLY	110 -240 V AC 50/60 HZ 80VA
APPROVALS	CE/ETL CERTIFICATION MEASUREMENT AS PER ISO7027 & US EPA 180
MOUNTING	BYPASS/WALL MOUNTING

14.3 On Line Residual Chlorine Measuring System

a) Residual chlorine (Rc) measuring system shall consist of Rc transducer, Rc transmitter, digital Rc indicator and any other item required to complete the Rc measuring system.

b) Rc transducer shall be rugged in construction and shall be suitable for continuous operation. Rc transducer shall work on Amperometric / Colorimetric / Potentiometric principle.

c) A sampling system containing situated sampling pump and other accessories shall be provided to extract samples from the reservoir. The sample water will be connected to a field mounted cabinet containing Rc analyzer equipment and Rc transmitter. In such a case the sampling system shall be part of residual chlorine measurement system.

d) Rc transmitter shall be suitable for field mounting and shall accept input from Rc sensor. They shall provide Digital output proportional to input. Transmitter output shall be suitable for transmitting over long distance. Rc transmitters shall have LCD display to indicate instantaneous Rc in water.

On-line Chlorine Analyzers

INSTRUMENT RANGE	0.03-5 PPM
RESOLUTION	0.01 PPM
ACCURACY	+/- 0.05 PPM or better
RESPONSE TIME	90% in 60 seconds
UNIT DISPLAYED	PPM
TEMP UNITS	°C, °F
SAMPLE CONDITIONS	
PROCESS TEMPERATURE	-5 TO 70 DEG C
INLET PRESSURE:	4 BAR
FLOW RATE:	> 30 Lit/Hr
MINIMUM CONDUCTIVITY	>150 MICRO S/CM

SAMPLE CONNECTIONS	DN 6/8 TUBE FITTINGS
SENSOR	
ELECTRODES	AMPEREOMETRIC / COLORIMETRIC / POTENTIOMETRIC FREE CHLORINE SENSOR
MEMBRANE/ELECTROLYTE	NOT REQUIRED
SELF CLEANING	AUTOMATIC SELF CLEANING SENSOR
CALIBRATION	PROCESS CALIBRATION
TRANSMITTER	Microprocessor based
NO. OF ANALOG OUTPUTS:	3 CURRENT Outputs HART COMPATIBLE
DISPLAY	GRAPHIC 128X64 PIXELS
OUTPUT SELECTIONS	0-20 mA, OR 4-20 mA
ALARM OUTPUTS	3 relays (NO/NC) FULLY PROGRAMMBALE
PH COMPENSATION	AUTO/ MANUAL COMPENSATION
POWER SUPPLY	100--230 VAC 50/60 HZ OR 24VAC/DC
OTHER FEATURES	CALIBRATION LOG, STATUS LOG,TEMPERATURE COMPENSATION

17.6 Specifications for Bio Chemical Oxygen Demand (BOD, SS) measuring instrument:

Light Source	Tungsten lamps with narrow-band interference filters
Light Detector	Silicon photocell
Power Supply	External 12 VDC power adapter or built-in rechargeable battery
Auto-off	After 10 min. of non-use in measuring mode; after 1 hour of non-use in calibration mode with last reading reminder
Environment	0 to 50°C (32 to 122°F); RH max 90% non-condensing

Dissolved Oxygen (% Saturation)	**Sensor Type**	Polarographic or Galvanic
	Range	0 to 500% air saturation
	Accuracy	Accuracy 0 to 200% air saturation, ± 2% of the reading or ±2% air saturation, whichever is greater; 200 to 500% air saturation, ± 6% of the reading
	Resolution	0.1% or 1% air saturation (user selectable)
Dissolved Oxygen (mg/L)	**Sensor Type**	Polarographic or Galvanic
	Range	0 to 50 mg/L
	Accuracy	0 to 20 mg/L, ± 2% of the reading or ±0.2 mg/L, whichever is greater; 20 to 50 mg/L, ± 6% of the reading
	Resolution	0.01 or 0.1 mg/L (user selectable)
Temperature	**Range**	-5 to 55°C (0 to 45°C; DO compensation range for mg/L)
	Accuracy	± 0.3°C
	Resolution	0.1°C
Barometer	**Range**	400 to 999.9 mmHg
	Accuracy	± 5 mm Hg within ± 5°C temperature range from calibration point
	Resolution	0.1 mm Hg

Multi Parameter Specifications

Parameter	**Measurement Range**
Ammonia HR	0 to 100 mg/L
Ammonia LR	0.00 to 3.00 mg/L
Chlorine, Free	0.00 to 5.00 mg/L
Chlorine, Total	0.00 to 5.00 mg/L
COD HR	0 to 15000 mg/L
COD LR, EPA	0 to 150 mg/L
COD LR, ISO	0 to 150 mg/L
COD LR, Mercury-free	0 to 150 mg/L
COD MR, EPA	0 to 1500 mg/L
COD MR, ISO	0 to 1000 mg/L
COD MR, Mercury-free	0 to 1500 mg/L
Nitrate	0.0 to 30.0 mg/L

Nitrogen, Total	0.0 to 25.0 mg/L
Nitrogen, Total HR	10 to 150 mg/L
Phosphorus, Reactive	0.00 to 5.00 mg/L
Phosphorus, Reactive HR	0.0 to 100.0 mg/L
Phosphorus, Total	0.00 to 3.50 mg/L
Phosphorus, Total HR	0.0 to 100.0 mg/L
Phosphorus, Acid Hydrolyzable	0.00 to 5.00 mg/L

Specifications for Suspended Solids (SS) measuring instrument:

Range:	100 – 10,000 up to 800 – 80,000 mg/l
Instrument Ambient Conditions:	
Temperature:	-10 to 50°C
Humidity:	0 to 100%
Input Power:	Switch selectable 115/230 VAC, 60/50 Hz
Outputs:	Four isolated 4 – 20 mA per analyzer 600 ohms maximum Four Relays with programmable hysteresis 10A resistive @ 250 VAC RS-485 & Modbus (Standard) Profibus DP (Optional)
Readout Device:	Harsh environment, four line, 20 Character backlit LCD digital display
Calibration:	Push-button for In-Situ calibration to a known value for TSS
Enclosure:	NEMA 4X (IP65) Fiberglass
Weight:	2.5 - 3.0 kg
Response Time	30 sec. to 1 min. (max.) depending on homogeneity of

	slurry
Pressure	60 p.s.i.g. (4bar) 400 kpa

Note: All water quality parameter monitoring instruments shall be mounted in a common enclosure at the individual sites to ensure the safety and security of the same at sites

14.4Electric Power / Energy Meters:

1	Nominal Voltage Input	Between 57.8V and 550V
2	Accuracy Range	50 – 115% of nominal voltage
3	Measured Parameters	Voltage, Amps, System Frequency, Power Factor, Active Power Per Phase Watts & Total Watts (W, kW & MW) Reactive Power Per Phase VAR & Total VAR (VAR, kVAR, MVAR) Apparent Power Per Phase VA & Total VA (VA, kVA & MVA) Active Energy Per Phase & Total Active Energy for Import & Export. (Separate) (Wh, kWh, MWh & GWh) Reactive Energy Per Phase & Total Reactive Energy (VARh, kVARh, MVARh & GVARh) Apparent Energy per Phase & Total Apparent Energy (VAh, kVAh, MVAh & GVAh)
4	Isolation	Auxiliary transformers for safety Isolation of system CTs & PTs
5	System	Single Phase - 3 phase 4 wire balanced-unbalanced load
6	Output	Digital

7	Accuracy	Active Energy : Class 1.0 (IS 13779) Reactive Energy: Class 2.0 Apparent Energy: Class 1.0

14.5 Lightening Protective Unit (LPU)

Two numbers of lightening protection units shall be provided for each signal loop. The lighting protection unit shall be suitable for withstanding the surge arising out of high energy static discharge / lightening strikes and prevents the instrument from any damage. LPU shall provide three stages of protection through a gas discharge tubes, quick acting semiconductor like Tranzorb, zener diodes, varistors and an automatic disconnect and reset circuit. LPU shall be a passive unit and shall require no power for its operation. During a lightning strike it shall clamp on the allowable voltage and pass the excess voltage to the ground. LPU shall be of self resetting type to minimize the down time of the measurement loop. LPU shall have a weather proof casing and shall be suitable for field/back of panel mounting. LPU provided shall be suitable for connecting in 24 V/48 V DC signal lines. There should be total isolation between input, output and ground terminals.

Panel Specifications:

1	Type	Wall Mounted with transparent hinged door
2	Material	CRCA sheet steel
3	Cable Entry	Bottom Entry
4	Protection	IP 68 Degree Enclosure
5	Junction Boxes	IP-68 type

14.6 INSTRUMENT POWER SUPPLY CABLES AND INSTRUMENT SIGNAL CABLES

a. Contactor shall include in his scope the supply, laying of instrumentation signal and power supply cables and associated civil / mechanical work required for completing the system.
b. Cables shall be capable of satisfactorily withstanding without damage, transportation to site, installation site, and operation under normal and short circuit conditions of the various systems to which the respective cables are connected when operating under the climatic conditions prevailing at the site as indicted in this specification.
c. Cable joints in instrument signals and power supply cables shall not be permitted.
d. Cables shall have satisfactory performance when laid on trays, in trenches, conduits, ducts and when directly buried in the ground.
e. Cables shall be capable of operating satisfactorily under a power supply system voltage variation of # 15%, a frequency variation of # 5.0%.
f. The cable shall comply with the following requirements
    - Cores Identification : By printed numerals.

- Core wrapping : By non hygroscopic material by taping or by extrusion
- Rip Cord : Non metallic rip cord under the core wrapping.
- Drain wire : A tinned copper drain wire of minimum 0.5 mm 2 Cross Section in contact with each cabling element

g. Armouring : Galvanized steel strips.

h. Insulation Resistance : Minimum insulation resistance per km shall be as per IS –1554 (Part- I)

i. Mutual capacitance : Mutual capacitance unbalance between any pair of conductors shall be as per IEC 189 Part I & II.

j. Capacitance Unbalance : The capacitance unbalance between any two pairs shall not exceed 400 pF for 500 meters length of cable.

k. The construction, performance and testing of cables except as modified above shall generally comply with the following standards:

1. IEC-189 - Part - 1 (Low frequency cables and wires with PVC insulation and sheath. General test and measuring methods)
2. IEC – 189- Part –2 (Low frequency Cables in pairs, triples, quads and quintuples)

l. PVC Cables shall be tested in accordance with IS 154. the tests shall include:

- Construction tests,
- Insulation resistance test, and
- High voltage test

m. The contractor shall furnish technical data of each type and size of cable giving the current rating, derating factor, dimensions, bending radius, etc.

14.7 LAYING OF CABLES

a) Power supply and instrumentation cables shall be laid separately. In outdoor areas, the cables shall be directly buried, as per "Installation Practice for directly buried cables". Each instrumentation and power supply cable shall be terminated to individual panel/terminal box. Identification of each cable shall be by proper ferrules at each junction as per cable schedule to be prepared by Contractor.

b) Cable shall be laid in accordance with layout drawings and cable schedules which shall be prepared by Contractor and submitted for Engineer's Representatives approval.

c) All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient amount for the final connection of the cable to the terminals on either end. Various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. A loop of 1 meters shall be left near each field instrument before terminating the cable.

d) Cable shall be complete uncut lengths from one termination to the other.

e) All cables shall be identified close to their termination point by cable numbers as per cable interconnection schedules. Identification tags shall be securely fastened to the cables at both the ends. The cable route shall be covered by concrete tile inscribed "DJB Cable"

f) The cable shall be bent on a large radius. Cables installed above ground shall be run exposed on walls, ceilings, structures and shall run parallel or at right angles with beams, walls or columns.

g) Cable shall be rigidly supported on structural steel and masonry, using individually cast or malleable iron galvanized clips, multiple cable supports or cable trays. Instrumentation cable shall have armour on the full length.

14.8 Communication Cables

1	Type	2 Pair, 22AWG
2	Operating Temp	60 Deg.C
3	Voltage	300 V RMS
4	Conductor	Annealed & Tinned Copper
5	Size	7 / 0.25mm
6	Insulation	Foam PE, 0.4mm (min)
7	Twisted pair	65mm lay length
8	Screen	Aluminium, 100% Cover, 0.008mm (min) thick
9	Drain Wire	0.35sq.mm.
10	Braiding	0.1mm, Annealed Copper
11	Sheath	PVC, black, 0.8mm
12	HV Test	1 KV ac/min
13	Capacitance	Between Conductors: 36nF/KM Conductor to sheath 69 nF/KM
14	Impedance	120 Ohm @ 1MHz.
15	Attenuation	16.5dB @ 1 MHz.

14.9 Video Wall

Sr. No.	DESCRIPTION
1	A Large Screen Graphics Wall in Control Room ▪ Display of important data, graphics & video coming from the PC, Workstation or video source etc. ▪ To provide real time clear luminous view to share information between decision makers.
2	**General Features**
2.1	The Large Screen Graphics Wall shall be installed in the Control Room. The overall screen size shall be 50" diagonally as a minimal.
2.2	The overall resolution of the graphics wall shall be min. 5,600 x 2,100 pixels.
2.3	The whole screen of the Large Screen Graphics Wall should behave as a single logical screen and the control of the same should be from a dedicated Graphical Control Unit (Controller) having a Keyboard & mouse with a required cable extension. However as option should be possible to control the Graphics Wall from a WIN PC / WS on LAN.
2.4	The complete system is interfaced on 10/100/1000 MBPS LAN. Also the system should have possibility to connect RGB & Video available in the Control Room to the Graphics Wall by adding optional cards in the Controller.
2.5	The Large Screen System should have the functionality to pre configure and save various display layouts to be accessed at any given point of time with a simple mouse click.
2.6	The system should be configured such that any of the operators sitting on the same Ethernet should be able to work on the Large Screen sitting at his own position with his own local keyboard & mouse.
2.7	The system should be capable of showing the UNIX applications using the X emulation.
2.8	The offered system is able to work in 24/7 days environment and is of industrial nature.
3	**The Rear Projection Module**
3.1	The Graphics Wall would be made up of multiple rear projection modules stacked up in 2 rows and 4 columns to achieve a display wall.
3.2	The rear projection modules must be based on Single Chip DLP, 0.9" SXGA^{+}, ±12° tilt LVDS Dark metal, Rear Projection technology.
3.3	Each of the Rear Projection Module is 50" diagonal as (minimal) with a resolution of 1400x1050 pixels and offers 16.7 million colors.
3.4	The replacement of defective lamp should be possible during operation of projection module without loosing the picture on the screen and without disturbing operators i.e. lamp should be hot swappable. Also the replacement of the lamp should be possible without

	opening the back covers and taking out the projection engine out of the projection modules
3.5	The brightness uniformity will be >95%.
3.6	The contrast will be 1600:1 (Typical).
3.7	The luminance on each rear projection module is 225 cd/m2 (typical) using single lamp at 6500K-colour temperature.
3.8	Each of the Rear projection modules should have an optical dimming arrangement to adjust the brightness of individual projection module automatically to have a completely uniform graphics wall without compromising the contrast & colors.
3.9	The half gain angle of the screen used is ± 35° horizontal as well as vertical. The gap between the two adjacent screens should be less than 0.8 mm.
3.10	The input to projection module will be Digital (DVI) to have a flicker free image on the Large Screen Graphics Wall. The connection between the controller and the rear projection modules should be completely digital to avoid any external noise interference.
3.11	The system should be designed such that the expansion is possible on top as well as on sides.
3.12	The system should have rear access only for the maintenance purposes to avoid any misalignment of the screens in the front.
3.13	Each of the projection modules has power consumption less than 190 W (with single lamp) & 285 W (with dual lamp).
3.14	Each Rear Projection module should be equipped with dual lamp system to offer redundancy at the lamp level. The average lamp life is 10,000 hrs (typical). Irrespective of the system is running from single lamp or dual lamp the brightness should be constant. The system should be capable of automatic detection of lamp failure and automatic lamp switching after lamp failure.
3.15	Replacement of Color wheel cartridge should be easy and quick without taking out the projection unit
3.16	Lateral colour shift should be <½ Pixel using the special lens design to get the completely uniform picture.
4	**Display Controller**
4.1.1	In an industrial 19" rack mounted casing based on PIV 3.6 Ghz (Min.)
4.1.2	The min. memory of 1GB (standard) expandable upto 3 GB
4.1.3	The unit should be equipped with a 48X DVD ROM Drive.
4.1.4	The hard Disk should be of 80 GB, 7200 rpm.
4.1.5	The display controller should have dual redundant hot swappable power supply.
4.1.6	Should have 10/100/1000 Mbps Ethernet port for LAN connection.
4.1.7	Supplied with a Keyboard and mouse with 20 m cable extension.
4.1.8	Based on WIN XP.
4.1.9	Digital Graphics Outputs to be connected to 6-rear projection modules. However the same should be expandable up to any nos. of projection modules.
4.1.10	The controller should be able to take 4 analog video inputs (VHS / SVHS) to show 4

	simultaneous videos in scalable and re-positionable windows all over the complete display wall. It should also be able to take two RGB inputs, each upto a resolution of 1280 x 1024 pixels or a single input upto a resolution of 1600 x 1200 pixels.
4.1.11	The system should have future expansion possibilities to add more standalone RGB, Video and Streaming Video inputs.
4.2	The complete solution i.e. the projection modules, display controller and the wall management software should be from the same OEM to overcome any compatibility issues.
4.3	Manufacturer owned local after sales support office and sales support organization in India is must to provide an uninterrupted service in any situation.

15. Other Functional Requirements

1. Inspection

Bidder shall provide facilities for inspection of the components of the equipments / system during all stages of installation / trial to check the conformity to specifications.

2. Tools and test equipment

A complete set of tools and test equipment shall be supplied by the bidder to enable erection, dismantling or testing to be carried out on any part of equipments / system during the life period of the system. The list of such tools and test equipment shall be submitted at the time of bidding. The cost of tools and test equipments is deemed to be included in the offer.

2. List of Applicable codes and Standards

1. Bureau of Indian Standards (IS I)
2. British Standard Institution (BSI)
3. International electrical and electronic Engineers (IEEE)
4. American National Standard Institution (ANSI)
5. Electrical Safety:
    a. UL508
    b. CSA C22.2/14
    c. EN61010-1 (IEC1010-1)
    d. International Electro technical Commission (IEC 950: 1950)
    e. AS/NZS3260-1993
    f. All European Community (CE) electrical safety directives
6. Flammability- constructed of materials with a UL 94v flammability rating
7. EMI Emissions
    a. FCC part 15, ICES-003 Class A, En55022
    b. AS/NZS3548-1995 EMI emission standards
    c. All European Community (CE) EMC immunity directives
8. EMC Immunity
    a. EN50082-1 (IEC801-2,3,4) Emc immunity Standards
    b. All European Community (CE) directives
9. Surge Withstand- IEEE-472 (ANSI C37.90) surge withstand standard
10. Vibration: IEC68-2-6Vvibration Standard
11. International telegraph and telephone consultative committee (ITU- T)
12. International radio consultative committee (CCIR)
13. Telecommunication Industry Association (TIA)
14. International Organization for Standardization (ISO)

Only instruments of **international** quality standards and of reputed manufacturer will be permitted. The bidder may refer the DJB list of approved makes for the various equipment to be supplied in this contract

The bidder shall carry out detailed survey of the installation sites. The maximum shut down periods for installation of electromagnetic flow meters on existing pipe lines including dewatering of pipe , excavation , cutting of existing all types of pipe lines, welding , providing necessary fittings and specials for all the type of pipes, preparation of assembly consisting of meters and necessary fittings , installation of the meters at site will be as under

The department agrees to shut down a pipe line for a maximum period of 16 hours. The contractor has to install the number of meters as specified in the tender on a particular pipe line in a single shut down by engaging different groups of work force at each site. The maximum number of installation on a single pipe line is 4 nos. In a sense all the 4 meters are to be installed in a span of 16 hours by engaging different gangs of field staffs.

- The CMS system shall be used initially for Data Acquisition only. However, the same shall be extendable at a later date to remote operation of pumps, valves etc. This extension capability shall be built into the present system. However the care should be taken in system design in such a way that failure of individual component or sub system shall not cause failure of the entire system. For critical system components, some back up arrangement shall be provided. Extensive care should be taken in system design for data security from physical destruction as well as unauthorized data access.
- The CMS system be of 2500 physical I/O points and shall be scalable (extendable) to other remote stations and additional parameters without any need to change the Application software.
- All required software licenses such as System software, operating System , Applications etc. and / or computerized maintenance management system shall be provided and the systems shall be real time database system integrated with information management. The software shall be customized as per requirement including creation of all required reports. The Bidder shall furnish the complete details regarding the software packages and functions envisaged in the RFP.
- Energy meters for major feeders shall be integrated with CMS system to get all power parameters into the system.

16. Training

The proposed Project aims to change the current manual systems either in partial or in full capacity to a computerized system. The DJB understands that this change would require a lot of efforts from the department. To help the department officials to implement the desired changes the DJB understands that there is a need to have proper "Training Strategy" at all levels.

Introduction of change needs to be accompanied by efforts to communicate the change implication to all the stakeholders. This will include communication to stakeholders both inside as well as outside the department on how to avail services in the proposed system; the employees should be skilled to deliver the services in an altogether new way, etc.

A well-calculated and well-designed strategy has to be followed for ensuring smoother transition of employees into their new roles. It is necessary to formulate a training strategy and to plan appropriate interventions for training and stakeholder communications.

16.1 Training Requirements

Based on the band created the training plan is proposed to capture the need and requirement of skill and capacity enhancement of the identified stakeholders. Also, at the same time based on the functional change in the working of government officials, a need assessment was taken up to identify the training need requirement at the various levels. The table below describes the key functional roles for the identified bands along with trainings identified

Table 1: Training Requirements

Band	Key Role in the Project	Trainings	No of days
G1	Act as sponsors of change Decision regarding deployment of resources Overall strategy acceptance of project	Process Training: Overview of Re-designed processes and envisioned To-be scenario	1
		Application Training: Training on using the Centre Level Applications and Executive Dashboard (spread across two days)	2
G2	Look after implementation of project Act as a sponsor of change for the	Process Training: Re-designed processes and envisioned To-be scenario	1
		Application Training: Training on using the application for MIS reports, Executive	2

Band	Key Role in the Project	Trainings	No of days
	respective functional areas	Dashboard and approvals for the respective agencies	
		Change Management & HR Training: Training on handling issues related to change management.	1
G3	Assist the team in implementation of initiatives Will act as the trainers for lower level employees (band G4)	Process Training: Training on re-designed processes and envisioned To-be scenario and the process to be followed for the transition	3
		Application Training: Training on using the application for MIS reports, monitoring and regulation etc.	4
		Training of Trainers: trainers who can guide and update people working	2
		Awareness Workshop: To generate awareness about the project	1
G4	Responsible for executing proposed process and technology changes	Basic Computer Training	1
		Process Training: Training on re-designed processes and envisioned To-be scenario	3
		Application Training: Training on data entry and use of the application for day to day working Awareness Workshop: To generate awareness about the project	

16.2 Training Plan

Based on the roles and responsibilities of the System related employees at various levels, the training plan is proposed to capture the need and requirement of skill and capacity enhancement of System related officials. Also a need assessment was taken up to identify the training need requirement at the various levels.

Table 2: Training Plan

Training Module	Band G1	Band G2	Band G3	Band G4
Awareness Workshop			☑	☑
Basic Computer Training		☑	☑	☑
Process Training	☑	☑	☑	☑
System Application Training	☑	☑	☑	☑
Training of Trainers			☑	

***** Training should cover all working level staff, refresher training at least once in each quarter for 50% staff in batches, IA to Supply comprehensive, exhaustive User manual and provision conducting training programme at DJB premises.

17. SCHEDULE – SERVICE LEVEL METRICS FOR THE CMS

Service Level Metrics			
Sl No	**Service Level Metric**	**Performance Standard**	**Measurement Method**
Deployment & Provisioning of CMS Services (Pre Go-Live) These Service Level Metrics are to ensure the timely provisioning of the CMS Solution infrastructure by the Implementation Agency (IA) and acceptance of the solution by DJB. In case of a violation in the metrics, the IA is liable for penalties. The penalties associated with the violations will directly be applied to the actual payments made to the IA as per the Agreement.			
(1)	Successful Deployment, and Acceptance of the CMS Solution Infrastructure, and Provisioning of the process flow & services through the CMS System	The IA will deploy and provision the CMS solution as per the specifications and timelines laid out in the Agreement Delay of every additional week beyond due date specified in the Agreement due to reasons attributable to IA will result in a penalty of 0.5% of the Performance Bank Guarantee amount on pro-rata basis subject to an overall limit of 10% of PBG amount.	The IA is responsible for the demonstrable and successful provisioning of all the services, as defined in the Agreement, namely: SCADA & Reporting Application Software CMS Platform consisting of the System and the Shared Services Infrastructure, and Integration with the identified services. The IA shall have completed the quality assurance, user acceptance, and performance testing of the CMS solution before 'Go-Live' Provisioning.
(2	Successful Deployment, Acceptance, and Provisioning of the additional services during the Rollout Phase	The IA will deploy and provision additional services as decided by the Project Governance Structure during the Rollout Phase. Delay of every additional week beyond the agreed upon date for provisioning of additional services	The IA is responsible for the demonstrable and successful provisioning of the additional services planned during the Rollout Phase. The IA shall have completed the quality assurance, user acceptance and performance

Service Level Metrics			
Sl No	**Service Level Metric**	**Performance Standard**	**Measurement Method**
		due to reasons attributable to IA will result in a penalty of 0.5% of the Performance Bank Guarantee amount on pro-rata basis subject to an overall limit of 10% of PBG amount.	testing of the additional services before 'Go-Live' Provisioning.
Service Management (Post Go-Live) These metrics are related to the delivery and quality of IT services providing day-to-day operation and support of the CMS infrastructure for the agreed project period, ensuring that these services are in alignment with the Agreement provisions.			
Availability: These metrics related to the Availability Management are to ensure uninterrupted operation of the CMS infrastructure			
(3	Availability Key personnel identified by DJB	IA shall ensure continuation of Key personnel engaged for the project. Any replacement shall be with written consent of the DJB	The IA shall ensure continuation of the team for larger interest of the Project. Assessment to this compliance will be the sole responsibility of DJB
(4	Availability of other CMS Infrastructure Components	The CMS infrastructure components shall be available 99% of the time (16:00 Hrs working period, 6:00 Hrs to 22:00 Hrs) for the entire calendar month. Failure to meet the above availability requirement due to reasons attributable to IA in any given month will result in a penalty payment of 0.1% of the PBG amount for non compliance in each month to an overall limit of 10% of PBG amount. Some Specific Exclusions:	The IA will set-up automated methods and tools for measurement of CMS services and infrastructure availability on a weekly basis, and reporting on a monthly basis. The availability reporting will include all incidents of scheduled and unscheduled outages. (To be calculated on total number of scheduled trip for the month and number of scheduled trip not completed or / and no. of delayed trip; for the failure attributable to

Service Level Metrics			
Sl No	**Service Level Metric**	**Performance Standard**	**Measurement Method**
		1. GPS Devices not functioning due to tampering of the device 2. GPS / GPRS connectivity / coverage not available in the area 3. Authorisation and Access Control system not functioning due to tampering of the system. 5. Downtime of third party services i.e.; power, lease line, GPRS.	IA). DJB should have access to all tools and logs used by IA for service monitoring and reporting. In case of failure DJB can permit IA to maintain the uptime through replacement of subsystem / component / service for waiving of penalty
Performance These metrics are for ensuring that the CMS infrastructure and supported applications meet the existing and future performance, scalability and capacity requirements of DJB.			
Service Desk & Incident Management These metrics are related to the 'situation management' of all major production incidents occurring during the operations of the CMS. The service level metrics in this Schedule shall be subject to the severity levels defined hereunder:			
(5	Responsiveness and mobilization of the concerned team for the resolution of Reported Outages and Critical Service Incidents	The Service Desk will respond to critical service incidents as per the Severity Level defined under measurement method and update status every 1hour.	The IA will set-up a Service Desk with contact telephone numbers and emails provided to DJB. Service Desk functions will include assistance in technical matters pertaining to CMS, problem resolution and performance issues. The responsiveness and resolution for CMS availability will be as per the availability metrics defined above. The IA will also implement an incident and problem management

Service Level Metrics			
Sl No	**Service Level Metric**	**Performance Standard**	**Measurement Method**
			mechanism (appropriate software and database for same to be provided) with priorities assigned to every incident raised. All the service incidents reported, response times, resolution times and status updates will be measured and reported monthly. Incident reports will be created that track actions with timestamps. These will be measured against the time thresholds. DEFINITION OF SEVERITY LEVEL Severity Level and their time to acknowledge and respond is defined below- 1. **Severity Level 1:** The entire CMS system is down, In this case the maximum time to acknowledge the issue is 30.00 Min (between 6:00 Hrs to 22:00 Hrs.) and maximum time to respond is 1:00 hrs (between 6:00 a.m to 10 p.m.). In case the problem is reported during lean period (22:01 Hrs to 5:59 Hrs) downtime will be calculated from the next day. This unplanned downtime will not be considered as a part of the SLA down time. 2. **Severity Level 2:** Services to more than 50% and up to 75% of the CMS system are affected. In this case the maximum time to acknowledge the

Service Level Metrics			
Sl No	**Service Level Metric**	**Performance Standard**	**Measurement Method**
			issue is 30:00 Min (between 6:00 Hrs to 22:00 Hrs) and maximum time to respond is 2 hrs (between 6:00 Hrs. to 22:00 Hrs). In case the problem is reported during lean period (22:01 Hrs to 5:59 Hrs) downtime will be calculated from the next day. This unplanned downtime will not be considered as a part of the SLA down time. 3. **Severity Level 3**: Services to more than 25% and up to 50% of the CMS system are affected. In this case the maximum time to acknowledge the issue is 30:00 Min (between 6:00 Hrs to 22:00 Hrs) and minimum time to respond is 3:00 hrs (between 6:00 Hrs to 22:00 Hrs). In case the problem is reported during lean period (22:01 Hrs to 5:59 Hrs) downtime will be calculated from the next day. This unplanned downtime will not be considered as a part of the SLA down time. 4. **Severity Level 4**: Services to up to than 25% of the CMS system are affected. In this case the maximum time to acknowledge the 30:00 Min (between 6:00 Hrs to 22:00 Hrs) and maximum time to respond is 4:00 hrs (between 6:00 Hrs to 22:00 Hrs). In case the problem is reported during lean period (22:01 Hrs to 5:59 Hrs) downtime will be calculated

Service Level Metrics			
Sl No	**Service Level Metric**	**Performance Standard**	**Measurement Method**
			from the next day. This unplanned downtime will not be considered as a part of the SLA down time.
Change Management : These metrics are necessary for tracking and reviewing all change activities related to the CMS environment from time to time, ensuring quality of the system is maintained			
Service Continuity These metrics are necessary to ensure that critical CMS components and services can be recovered within required and agreed time lines as per the Service Continuity plan			
(6	Time taken for re-establishment / replacement of services and/or components in case of failure	In case of a failure, the services will be re-established / components replaced as per Service Continuity Management Plan developed by the IA.	The IA is responsible for developing and implementing a Service Continuity (Business Continuity Plan) Management plan to ensure that critical CMS components and services can be recovered within required and agreed time scales. It will provide appropriate contingency management plans containing appropriate resilience strategies, recovery and crisis management, based on minimum service requirements, following an interruption to the CMS service delivery. The Service Continuity (Business Continuity Plan) Management will be approved by DJB.
(7	Time taken to exercise Business Continuity Plan(BCP)	Contingency measures in place as per BCP	
Security Management			

Service Level Metrics			
Sl No	**Service Level Metric**	**Performance Standard**	**Measurement Method**
These metrics are necessary to ensure proper security management of the CMS infrastructure, as per ISO17799 standards			
(8	Security compromises and exploited vulnerabilities or threats and resolutions, in relation to the CMS solution infrastructure	All security related exploits and resolutions must be captured through the ISO17799 compliant ISMS.	The IA will design and implement appropriate ISMS (Information Security Management System) for the CMS in accordance with the code of practice for information security management provided in ISO 27001. The ISMS shall be approved by the CMS Acceptance agency before "Go-live". As part of implementing the ISMS, the IA will provide an analysis of the risks and vulnerabilities to which the CMS will be subjected to and the counter measures proposed. Security related exploits & resolution etc. will be measured on a weekly basis and reported monthly. Every breach of security, and every attempt to breach security or exploit a vulnerability or risk, will be reported in the Service Management process.

Penalty, if any, shall be calculated on monthly basis.

Annexures

Annexure-I Existing Flow meters to be integrated with CMS Solution

IA need to integrate them with the proposed CMS, though it needs to be maintained from September 2015 till the end of the CMS contract.

Sl No.	Sl. No. (DJB)	Location	Size (mm) Flow meter / Line
1	1	Near OHT sector-3 Rohini	350/500
2	2	Near Avantika BPS	300/400
3	3	Sector-1, Over head tank, Rohini	200/300
4	4	Western Yamuna canal, sector-17, Rohini	200/300
5	5	Western Yamuna canal khera khurd	200/300
6	6	Western Yamuna canal khera khurd	500/600
7	7	Prehladpur near tube well no. 2	150/200
8	8	Avantika BPS	150/200
9	9	BPS, C-block mangolpuri	200/300
10	10	Near Nla P-1 Block Sultanpuri	150/200
11	11	Hansaraj bhalla jwalapuri rohtak road	200/250
12	12	Bharon enclave Peeragarhi ring road	500/600
13	13	Supplementary drain, sultanpurmangla village	200/300
14	14	Punjabi basti, outer ring road, Mangolpuri	500/600
15	15	DTC depot nangloi rohtak raod	200/300

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16	16	madhuban chowk	700/800
17	17	Outer ring road near west enclace (for karala)	300/450
18	18	Near jhang society sec 13 inside b/wall	700/800
19	19	Near Jhang Society secto 13 Rohini	500/600
20	20	Canara apartments, Sector -13, Rohini	300/400
21	21	Near UGR sector-11, Rohini	500/600
22	22	Near UR sector 11, Rohini (for sectro-17)	600/700
23	23	Near UGR sector-11 Rohini (for Staff Qtrs sector -5)	150/200
24	24	Shalimar Bagh / Singlepur OHT	300/400
25	25	Shalimar village	400/600
26	26	Pitampura	400/500
27	27	Multan nagar	150/200
28	28	prembari bridge	150/200
29	29	Vaishali xing / ashiana chowk	400/700
30	30	ashok vihar	500/800
31	31		
32	32	ashok vihar / lawrance road - I Block green belt	400/700
33	33	Pitampura	500/700
34	34		
35	35	Saraswati vihar	600/800
36	36	a) shakurpur village	200/300
37	36	b) shakurpur village	200/300

38	37	Shakurbasti near railway crossing	400/600
39	39	Near Lawrence road UGR	800/900
40	40	Near Lawrence road UGR/BPS	1000/1100
41	41	oppodite fire station WPIA	500/600
42	44	Near Gate of Chattarshal Stadium	250/250
43	45	In front of Alpna cinema	200/200
44	46	Near Camp Chowk	500/600
45	47	Azadpur Red light	500/600
46	49	Saraj Kale Khan	200/300
47	51	Railway station Nizamuddin	200/200
48	55	Indira Gandhi Stadium	150/150
49	56	Near Round about crossing of DBG. Rd. & Rani Jhansi Rd	500/600
50	57	Pahari Deeraj BPS	300/350
51	58	Pahari Deeraj BPS	350/375
52	59	Pahari Deeraj BPS	400/450
53	60	Pahari Deeraj BPS	250/250
54	61	Pahari Deeraj BPS	200/200
55	62	Subhash park BPS	EE © I
56	63	36" Dia C.I. Water line As Dbgupta road	800/900
57	64	30" Dia C.I. Water line As Dbgupta road	700/750
58	65		

59	66	Do	350/400
60	67	BPS Ldgah	400/600
61	68	Ramjas tank	300/400
62	69	Thansingh Nagar BPS	350/450
63	70	old rajuender nagar	200/300
64	72	Jhandewalan BPS	600/750
65	73	Palam reservoir	500/800
66	74	R-Block rajunder nagar reservoir	200/300
67	75	Near Rajdhani college raja garden	300/375
68	76	Near Sluice Valve Varunalaya-II	300/400
69	77	At Pharganj & Multani Dhanda Chowk	400/525
70	78	Near PNB Pharganj	300/350
71	79	Near PNB Pharganj	150/200
72	80	Central Verge Faij Road Crossing	150/200
73	81	Sadar Thana chowk	200/300
74	82	BPS Ldgah	300/400
75	83	At Kutab Road	200/300
76	84	At Kutab Road	150/225
77	85	At Kutab Road	150/175
78	86	Ridge reservoir	150/225
79	87	Do	300/400
80	88	Water emergency old rajindra nagar	900/1100

81	89	Prasad nagar OHT?BPS	200/200
82	90	Than Singh Nagar BPS	150/250
83	91	At pusa road	150/150
84	92	Near m-Block OHT DISTT park Vikas puri	600/700
85	94	Inside khayala pump house	1000/1200
86	95	Outer ring road near keshopur STF QTRS	200/250
87	96	Near Janak puri P/H	150/200
88	97	Opp. Bharti college	150/200
89	98	Inside Khyala P/H on subhash nagar main	700/900
90	99	Near Raja Garden	600/750
91	100	Near Pocket A&B vikaspuri	150/150
92	101	check post ganesh nagar	700/800
93	102	At Mayapuri chowk naraina main	500/600
94	103	Near Ramesh Nagar Drain	600/750
95	104	Near Ramesh Nagar Drain	500/600
96	105	Near F-Block OHT vikaspuri	400/500
97	108	To RWS from Tilak NGR	200/300
98	109	At Lajwanti garden	200/300
99	110	Punjabi bagh (East) Xing	300/400
100	111	Ring Rd, Xing near Nagafgarh area to words moti NGR. Side	500/600
101	112	Do	500/600

102	113	Ramesh nagar Xing Nagafgarh rd.	900/1000
103	114	Moti nagar chowk	500/600
104	115	Opp natraj nagafgarh road	200/300
105	116	bali nagar nagf road	200/300
106	117	Ramdhan	600/700
107	118	marble ring road	700/800
108	119	B-1 rajouri garden nagf road	800/900
109	120	Desu office mayapuri chowk	350/450
110	121	inside peeragarhi P/H pashim vihar	1000/1200
111	122	Near GH-4 Meera bagh Petrol pump paschim vihar	200/300
112	123	Infront of gali-17 water emergancy outer ring rd. pashim vihar	500/600
113	124	Multan nagar red light Rohtak	150/200
114	125	Near peera garhi DTC bus depot outer ring	350/450
115	126	Near SGS flats madi pur rohtak rd	150/200
116	127	Aggarwal sweet bunglow	150/200
117	128	Naraina road	150/200
118	129	Patel nagar BPS	400/500
119	130	Patel nagar, near Taxi stand	150/200
120	131	Thansingh nagar	350/450
121	132	Thansingh Nagar BPS	200/300
122	133	Anand parvat industrial area nai basti	400/500

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123	134	Harijan Basti Nehru Nagar	150/200
124	136	Inside the WTP Nangloi	400/500
125	137	Near petrol pump meera bagh outer ring road (Paschim vihar)	150/200
126	138	Inside the WTP Nangloi	150/200
127	139	Near Dustbin & petrol pump, sunder apts (GH-10) ring road	300/450
128	140	Near gate no. 8 Bhera enclave outer ring road	150/250
129	141	Near B/wall of B-2 block UGR p/h Janakpuri	600/750
130	142	Uttam nagar (water line to Chanakya place)	300/400
131	143	Uttam nagar (water line to Uttam nagar)	300/400
132	144	Inside Khyala BPS	700/900
133	145	Inside panchwati UGR Vikaspuri	300/450
134	146	Near Najafgarh Drain bridge	400/600
135	147	Inside budella UGR	400/500
136	148	Near FG-1 Vikaspuri	150/300
137	150	DDA flats, Manasarovar park, shahdhara	150/150
138	151	DDA flats GTB enclave block F	150/150
139	152	DDA flats, GTB enclave block-E	150/150
140	153	DDA flats GTB enclave block ABC	150/150
141	154	dda flats "A/B" pocket, dilshad garden	150/150
142	155	Dilshad garden pocket D	150/150
143	157	DDA flats PKT -Q dilshad garden	150/150

144	158	Near bus stand, Old seemapuri	150/250
145	160	"C" block seemapuri	150/150
146	161	Block-A, New seemapuri	150/150
147	162	behind bhajanpura police station	500/600
148	163	behind bhajanpura police station	500/600
149	164	Shahadara O.h.T.G.T. Road	400/500
150	166	DDA Flats Loni road	150/200
151	167	Majnu Tilla at DDA park Opp. Mall road Flag staff UGR	200/250
152	168	LG main from jeet garh at under boundary of DDA park	250/350
153	169	Flag staff main	250/300
154	170	At DDA park opp 16A, Ajpur road	400/600
155	171	Do	300/450
156	172	At pul Bangas for Nawab Ganj	150/200
157	173	Hindu Rao UGR	200/300
158	174	At Jeet Garh under Boundary	200/300
159	175	At Kela Ghat Kirlokri main & Duplicate main	200/373
160	176	Gulabi Bag reservoir	500/600
161	177	Shivaji Rd to Kishan Ganj	150/200
162	178	Do	150/200
163	179	Pulbangas	200/300
164	180	Bhadurgarh road	150/150
165	181	Sheesh Mahal Shivaji rd.	150/150

166	182	At new Subhash Park UGR Under Boundary	200/250
167	183	At new Subhash Park UGR Under Boundary	150/150
168	184	At new Subhash Park UGR Under Boundary	500/600
169	185	At new Subhash Park UGR Under Boundary	300/375
170	189	UV- Block Shalimar Bagh	800/900
171	192	Welcome Janta colony	150/150
172	193	Shyamlal college	300/400
173	194	Drain no. 1 Gokulpuri shahadara	150/200
174	196	Dilshad garden oht	300/450
175	200	Khajuri red light	1500/150
176	201	Bhajanpura petrol pump	150/100
177	202	Khajuri pusta	500/600
178	203	U. P. irrigation office	300/400
179	204	Khajuri pusta	150/200
180	205	yamuna vihar UGR	400/450
181	207	Near Nanakpura Gurdwara, Moti bagh	300/450
182	208	Near petrol pump & canara bank moti bagh fly over, R.K. Puram sector-12	500/675
183	209	Water Emergency, Sector-7 R. K. Puram	400/450
184	211	Near CNG Filling station, outer ring road Sector - '3, R.K. Puram	300/450
185	217	Naraina UGR (Krishan kunj)	200/250
186	230	BPS Mayur Vihar phase-1 Pkt-V	150/150

187	234	Near SPS at preet vihar (inlet)	500/600
188	236	Near UGR Mandawali (outlet)	600/750
189	237	Near Noida Crossing (inlet)	500/600
190	238	near UGR trilokpuri	500/600
191	239	Dilshad garden pocket I	150/200
192	240	Opp. Block B market, Vivek vihar	150/250
193	242	opp. Fire station, laxmi nagar	600/750
194	244	B &D block, mayur vihar phase-2	200/300
195	245	A-2 mayur vihar phase – 3	200/300
196	246	B-2 mayur vihar phase -3	200/300
197	247	Trilokpuri block -23 UGR	900/1100
198	248	LIG flats chilla village, Mayur vihar phase-1	200/200
199	249	Over head TANK, Pkt-I Mayur phase -1	200/300
200	250	Pocket -IV, Mayur vihar phase -1	200/300
201	252	E-block mayur vihar phase -2	200/200
202	253	Gopalpur near Nalla	200/300
203	254	Mukerjee NGR stand	300/400
204	255	Hakikar NGR Gate No 1	200/300
205	256	Opp. Hudson lane ring road	500/600
206	257	Right side of R/Road	350/450
207	258	Near waxirabad	350/450
208	259	Malkaganj crossing	500/675

209	260	Suraj Mal vihar	900/1100
210	264	Mandawali Fazalpur BPS	900/1100
211	265	Mandawali Fazalpur BPS	900/1100
212	266	Shastri Park BPS	700/800
213	267	Shastri Park BPS	600/700
214	270	Baljeet nagar	500/600
215	271	Baljeet nagar	350/450
216	274	Rohini Sector-IX BPS	900/1200
217	275	Rohini Sector-XOX	800/900
218	276	Najafgarh water tank	500/600
219	277	Najafgarh water tank	600/700
220	278	Deer park to Munirka	500/600
221	279	Kalkaji UGR	200/250
222	280	Kalkaji UGR	200/250
223	282	Kalkaji UGR	300/450
224	285	Kalkaji UGR	500/600
225	New List	Thansingh Nagar BPS (Inlet)	200/300
226	149(A)	KG-1, Vikaspuri	150/100
227	149(B) Additional	KG-1, Vikaspuri	150/100
228	216a	Naraina UGR (inderpuri Main)	200/300
229	216b (Additional)	Naraina UGR ("C" block main)	200/300

230	218a	Todapur BPS	150/150
231	218B	Naraina UGR (Todapur Main)	150/250
232	71A	Rajinder nagar ("R" block) BPS	200/200
233	71b	Rajinder nagar (pusa)	150/150
234	74B (additional)	Rajindra nagar ("R" block) BPS	150/150
235	Additional	BPS Ldgah	200/300
236	Additional	At new Subhash Park UGR Under Boundary	200/250
237	Additional	Kalkaji UGR	200/200
238	Additional	Govindpuri, Near Gali No. 13	150/150
239	Additional	Govindpuri, Near Boy's school	150/250
240	Additional	Munirka DDA Flats	200/250
241	Additional	Saket-Direct supply	500/600
242	Additional	shivam enclave BPS Jhilmil colony	150/150
243	Additional	LIG flats jhilmil colony	150/150
244	Additional	BPS dilshad garden ABC	150/150
245	Additional	Shastri Park BPS	150/200
246	Additional	Inlet main of BUGR (from S. V.WTP)	350/500
247	Additional	Khajoori red light	400/400
248	Additional	Bhagirathi UGR inlet (from BWTP)	500/600
249	Additional	BPS "H" Block Naraina	200/200
250	Additional	Shadipur depot reservoir	200/300

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251	Do	BPS silshad garden MNO pocket	150/150
252	Do	Block 8 trilokpuri	150/150
253	Do	Kailash nagar	150/150
254	Do	"A" block vivek vihar	200/200
255	N.L. (09/11)	Lado Sarai-feeder line to UGR	500/600
256	N.L. (1/1)	Feeder line to Babaji Mehrauli	400/500
257	N.L. (15/18)	Okhala Industrial area phase - II direct supply to Okhala	500/600
258	N.L. (16/19)	Srinivaspuri UGR to To Mount Kailash, EOK Garhi	500/600
259	N.L. (17/20)	Srinivaspuri UGR to To Kailash Hills, A B C block EOK	500/600
260	N.L. (2/2)	Feeder line from Qutab to Lal tanki	200/250
261	N.L. (3/3)	Outgoing from Lal Tanki to Maidan garhi	200/250
262	N.L. (30/37)	Pocket -14, UGR Kalkaji Extension (Incoming)	200/250
263	N.L. (31/7)	Outlet from Kishan Garh UGR to Kishan Garh	150/150
264	N.L. (32/8)	Outlet from Kishan Garh UGR to Mehrauli	200/200
265	N.L. (34/21)	G- Block, Srinivaspuri UGR (outgoing)	250/350
266	N.L. (36/25)	Saidullajab	200/300
267	N.L. (4/4)	Outgoing from Lal Tanki to Mehruali	200/250
268	N.L. (46/-)	Inlet main to CT - 2 Dwarka	600/800
269	N.L. (47/-)	Outlet feeding to Madhu vihar	700/900
270	N.L. (48/-)	Outlet feeding to Matiyala	700/900
271	N.L. (5/5)	Okhla Industrial area phase-II direct supply to Okhla Phase – I	200/300

272	N.L. (6/6)	Feeder line to Kishan Garh	200/250
273	N.L. (7/9)	Saidullajab	250/300
274	N.L. 10/12	Jal Vihar Old UGR	800/900
275	N.L. 11/14	Jal Sadan, Near Canteen Block	400/500
276	N.L. 14/17	Nizamuddin Railway station -CGO tapping in UGR	400/450
277	N.L. 18/22	Excort X–ing direct supply to Maharani Bagh	350/450
278	N.L. 19/23	M-Block G.K.-II OHT	500/600
279	N.L. 21/27	Duplicate Main/G.K.(S) pump house feeder line	400/400
280	N.L. 22/28	Kilokari main/G.K. (S) pump house-Feeder line	800/900
281	N.L. 23/29	LSR feeder line to Srinivaspuri reservoir at UGR	500/600
282	N.L. 27/34	Green Park Main - Direct supply	800/900
283	N.L. 28/35	Green park main feeding to S. J. Enclave	500/600
284	N.L. 29/36	OHT/UGR Okhala industrial area phase -II feeder line	600/700
285	N.L. 8/10	Saket - direct supply	500/600
286	New List	Shubhash nagar BPS (inlet)	
287	New list	Tilak nagar (Inlet)	600/800
288	New List	F- Block krishna nagar Jal Vihar Main	700/900
289	New List	Clock tower crossing	400/600
290	New List	Than singh nagar –inlet	400/600
291	New list	Sanjay gandhi transport nagar (inlet)	400/500
292	New list	Punjabi bagh booster B/stn (inlet)	200/300
293	New list	Janank puri (inlet)	700/900

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294	New list	Janank puri (inlet)	800/1000
295	New list	Bodella (inlet)	600/800
296	New list	Bodella (inlet)	700/900
297	New list	Lawrence road BPS (inlet)	500/600
298	New list	Lawrence road BPS (inlet)	200/300
299	New list	Lawrence road BPS (inlet)	600/750
300	New list	Mangol puri (inlet)	600/750
301	New list	Kewal park (inlet)	500/600
302	New list	Holambi Kalan (inlet)	400/600
303	New list	Sector-XI rohini (inlet)	500/700
304	New list	Sector-XIX Rohini (inlet)	400/600
305	New list	Sector-XI rohini (inlet)	600/800
306	New list	Sector-XIX Rohini (inlet)	500/700
307	New list	New Faridpuri (inlet)	250/350
308	New List	Ramlila ground BPS (Inlet) (Old)	200/300
309	New List	Ramlila ground BPS (Inlet) (New)	200/300
310	New List	Ramlila ground BPS (Inlet) (Old)	700/900
311	New List	Gulabi bagh inlet	200/300
312	New List	Idgah BPS –Inlet	400/600
313	New List (1)	Khajuri red light	150/150
314	New list (13/16)	Nizamuddin railway station - NDMC tapping in UGR	

315	New List (2)	Jamulkha bagh	150/150
316	New list (24/31)	Kailash main G.K. North Pump House	
317	New list (26/33)	Deer park main G. K. North Feeding To Ugr	
318	New List (3)	Janta colony-JJ cluster east delhi	150/100
319	New List (37/30)	G.K.I./ G. K. (S) P/House- Direct supply to Panchsheel	

IA needs to operate and maintain these flow meters for next 10 years

Plant wise flow meter in operation					
Sr.No	**Plant name**	**Meter / Line name**	**Type of meter**	**Qty**	**Status**
1	Bhagirathi	Civil line-1200mm	USFM	1	
2	Bhagirathi	GK main - 1200mm	USFM	1	Ok
3	Bhagirathi	Jal vihar - 1200mm	USFM	1	Ok
4	Bhagirathi	Raw water ch 1 to 8	OCF	8	Ok
5	Bhagirathi	Raw water line-1-1500mm	USFM	1	Ok
6	Bhagirathi	Raw water line-2-1500mm	USFM	1	Ok
7	Bhagirathi	Shahadra-1200mm	USFM	1	Ok
8	Bhagirathi	Tahirpur main - 1100mm	USFM	1	Ok
9	Chandrawal 1	Hindurao-450mm	EMF	**1**	Ok
10	Chandrawal 1	Backwash-350mm	EMF	1	Ok
11	Chandrawal 1	Flag staf-600mm	EMF	1	Ok
12	Chandrawal 1	Hindurao-400mm	EMF	1	Ok
13	Chandrawal 1	LR main-600mm	EMF	1	Ok
14	Chandrawal 1	MM main-600mm	EMF	1	Ok
15	Chandrawal 1	Raw water ch 1 to 3	OCF	3	Ok
16	Chandrawal 2	48" new	UMF	1	Ok
17	Chandrawal 2	48" old	UMF	1	Ok
18	Chandrawal 2	900mm PSC	UMF	1	Ok
19	Chandrawal 2	Backwash 500mm	EMF	1	Ok

20	Chandrawal 2	Raw water ch 1	OCF	1	Ok
21	Chandrawal 2	Raw water ch 2	OCF	1	Ok
22	HP 2	Back wash filter hose north	EMF	1	Ok
23	HP 2	Back wash filter hose South	EMF	1	Ok
24	HP 2	Raw water ch 1 to 8	OCF	8	Ok
25	HP 2	Rohini main - 1000mm	USFM	1	Ok
26	HP 2	RWS main	USFM	1	Ok
27	HP 2	South delhi-1500mm	USFM	1	Ok
28	HP1	Back wash filter hose north	EMF	1	Ok
29	HP1	Back wash filter hose South	EMF	1	Ok
30	HP1	Khayala-900mm	USFM	1	Ok
31	HP1	Mangol puri 1000mmm	USFM	1	Ok
32	HP1	North west main 1100mm	USFM	1	Ok
33	HP1	Pitampura-1200mm	USFM	1	Ok
34	HP1	Raw water ch 1 to 8	OCM	8	Ok
35	HP1	West Delhi main-1100mm	USFM	1	Ok
36	Nangloi	Back wash 600mm	EMF	1	Ok
37	Nangloi	Mundka Tapping 600mm	EMF	1	Ok
38	Nangloi	Nagloi 900mm	EMF	1	Ok
39	Nangloi	Nazabgradh 1000mm	USFM	1	Ok
40	Nangloi	Pappankalan 1200mm	USFM	1	Ok
41	Nangloi	R/W inlet 1500mm	USFM	1	Ok
42	Okhala	300mm distribution	EMF	1	Ok

43	Okhala	400mm backwash	EMF	1	Ok
44	Okhala	600mm distribution	EMF	1	Ok
45	Okhala	750mm dia distribution	USFM	1	Ok
46	Okhala	750mm dia p series	USFM	1	Ok
47	Okhala	800mm dia v series	USFM	1	Ok
48	Okhala	900mm dia distribution	USFM	1	Ok
49	Wazirabad	2 no. 3rd 40 MGD plant	OCF	2	Ok
50	Wazirabad	4 no. 1st 40 MGD plant	OCF	4	Ok
51	Wazirabad	4 no. 2nd 40 MGD plant	OCF	4	Ok
52	Wazirabad	duplicate 1050mm	USFM	1	Ok
53	Wazirabad	Klokari main 1050mm	USFM	1	Ok
54	Wazirabad	PB main – 1500	USFM	1	Ok
55	Wazirabad	Triplicate main 1100mm	USFM	1	Ok
56	Wazirabad	west delhi	USFM	1	Ok
Total				**86**	

Annexure – II List of new Locations for installation of field instruments

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	CHANDRAWAL WTP I &II	2	Ridge Road Reservoir	RR-1	100	100	CI	1	1	1	1	1
2	CHANDRAWAL WTP I &II	5	N R Nagar Reservoir	NR-1	100	100	CI	1	1	1	1	1
3	CHANDRAWAL WTP I &II	6	Hindu Rao Reservoir	HR-4	100	100	CI	1		1		1
4	CHANDRAWAL WTP I &II	8	MM Reservoir	MM-4	100	100	CI	1				1
5	CHANDRAWAL WTP I &II	11	Pahari Dheeraj Reservoir	PD-1	100	100	CI	1	1	1	1	1

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S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
6	CHANDRAWAL WTP I &II	11	Pahari Dheeraj Reservoir	PD-2	100	100	CI	1		1		1
7	CHANDRAWAL WTP I &II	13	Kirti Nagar Reservoir	KN-2	100	100	CI	1			1	1
8	CHANDRAWAL WTP I &II	16	Burari	B3	100	100	CI	1		1		1
9	CHANDRAWAL WTP I &II	16	Burari	B5	100	100	AC	1		1		1
10	CHANDRAWAL WTP I &II	16	Burari	B6	100	100	CI	1		1		1
11	OKHLA	19	Sangam Vihar UGR	SV2	100	100		1		1		1
12	OKHLA	19	Sangam Vihar UGR	SV3	100	100		1		1		1
13	OKHLA	20	South of J Zone	SJ1	100	100	CI	1	1	1	1	1
14	OKHLA	20	South of J Zone	SJ2	100	100	CI	1				1

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S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
15	NANGLOI	21	Ujwah	U2	100	100	CI	1		1		1
16	NANGLOI	21	Ujwah	U3	100	100	MS	1		1		1
17	NANGLOI	22	Daulatpur	DU3	100	100	CI	1		1		1
18	NANGLOI	22	Daulatpur	DU4	100	100	PSC	1		1		1
19	NANGLOI	22	Daulatpur	DU5	100	100	CI	1		1		1
20	NANGLOI	22	Daulatpur	DU6	100	100	CI	1		1		1
21	NANGLOI	23	Najafgarh (New 1 MG Reservoir At Mohan Garden)	NG3	100	100	AC	1		1		1
22	NANGLOI	23	Najafgarh (New 1 MG Reservoir At Mohan Garden)	NG4	100	100	CI	1		1		1
23	HAIDERPUR - 1 &2 WTP Command	34	Janak Puri	JP-2	100	100	CI	1		1		1

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S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Area											
24	HAIDERPUR -1 &2 WTP Command Area	37	Khyala Reservoir Ph-II	KH,II-1	100	100	CI	1	1	1	1	1
25	HAIDERPUR -1 &2 WTP Command Area	37	Khyala Reservoir Ph-II	KH,II-3	100	100	CI	1		1		1
26	HAIDERPUR -1 &2 WTP Command Area	38	Bodhela Reservoir	BO2	100	100	CI	1		1		1
27	HAIDERPUR -1 &2 WTP Command Area	39	Bijwasan UGR	BI-1	100	100	MS	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
28	HAIDERPUR -1 &2 WTP Command Area	39	Bijwasan UGR	BI-2	100	100	CI	1		1		1
29	HAIDERPUR -1 &2 WTP Command Area	39	Bijwasan UGR	BI-3	100	100	CI	1		1		1
30	HAIDERPUR -1 &2 WTP Command Area	40	Rohini Sec 23	RS23-1	100	100	CI	1	1	1	1	1
31	HAIDERPUR -1 &2 WTP Command Area	41	Rohini CT Kriri	CT3-R2	100	100	CI	1		1		1
32	HAIDERPUR -1 &2 WTP	42	Dwarka CT-1 to 6	CT1-1	100	100	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Command Area											
33	HAIDERPUR -1 &2 WTP Command Area	42	Dwarka CT-1 to 6	CT1-3	100	100	CI	1		1		1
34	HAIDERPUR -1 &2 WTP Command Area	42	Dwarka CT-1 to 6	CT1-5	100	100	CI	1		1		1
35	HAIDERPUR -1 &2 WTP Command Area	42	Dwarka CT-1 to 6	CT1-6	100	100	CI	1		1		1
36	HAIDERPUR -1 &2 WTP Command	42	Dwarka CT-1 to 6	CT1-7	100	100	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Area											
37	HAIDERPUR - 1 &2 WTP Command Area	42	Dwarka CT-1 to 6	CT1-8	100	100	MS	1				1
38	WAZIRABAD I,II &III 40 MGD W.T.P.	55	Siraspur	SI-4	100	100	CI	1				1
39	CHANDRAWAL WTP I &II	3	Jhandewalan Reservoir	JH 1	150	100	CI	1	1	1	1	1
40	CHANDRAWAL WTP I &II	7	Flag Staff Reservoir	FS-1	150	100	CI	1	1	1	1	1
41	CHANDRAWAL WTP I &II	7	Flag Staff Reservoir	FS-2	150	100	CI	1		1		1
42	CHANDRAWAL WTP I &II	12	Idgah Reservoir	IDR-1	150	100	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
43	CHANDRAWAL WTP I &II	17	Burari TPT	BTPT-1	150	100	CI	1	1	1	1	1
44	NANGLOI	21	Ujwah	U4	150	100	PSC	1		1		1
45	NANGLOI	22	Daulatpur	DU2	150	100	CI	1		1		1
46	NANGLOI	23	Najafgarh (New 1 MG Reservoir At Mohan Garden)	NG5	150	100	AC	1				1
47	HAIDERPUR -1 &2 WTP Command Area	26	Rohini Sec 7	R 7-3	150	100	CI	1		1		1
48	HAIDERPUR -1 &2 WTP Command Area	26	Rohini Sec 7	R 7-4	150	100	CI	1		1		1
49	HAIDERPUR -1 &2 WTP	27	Rohini Sector 11	R11-1	150	100	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Command Area											
50	HAIDERPUR -1 &2 WTP Command Area	28	Avantika UGR	AV-3	150	100	CI	1		1		1
51	HAIDERPUR -1 &2 WTP Command Area	38	Bodhela Reservoir	BO1	150	100	CI	1	1	1	1	1
52	HAIDERPUR -1 &2 WTP Command Area	40	Rohini Sec 23	RS23-2	150	100	CI	1		1		1
53	HAIDERPUR -1 &2 WTP Command	41	Rohini CT Kriri	CT3-R1	150	100	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Area											
54	HAIDERPUR -1 &2 WTP Command Area	42	Dwarka CT-1 to 6	CT1-2	150	100	CI	1		1		1
55	HAIDERPUR -1 &2 WTP Command Area	42	Dwarka CT-1 to 6	CT1-4	150	100	CI	1		1		1
56	WAZIRABAD I,II &III 40 MGD W.T.P.	47	Zakhira Reservoir (IAR)	ZA1	150	100	CI	1	1	1	1	1
57	WAZIRABAD I,II &III 40 MGD W.T.P.	54	Punjabi Bagh Reservoir	PB-3	150	100	CI	1		1		1
58	BHAGIRATHI	61	Chitra Vihar	Node No. 27	150	100	CI/DI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
				to 26								
59	BHAGIRATHI	61	Chitra Vihar	Node No. 28 to 15	150	100	CI/DI	1		1		1
60	SONIA VIHAR WTP	73	Kalkajee	KAJ-5	150	100	CI	1		1		1
61	SONIA VIHAR WTP	88	Swasti Vihar	Node No. 15-16	150	100	CI	1		1		1
62	CHANDRAWAL WTP I &II	12	Idgah Reservoir	IDR-2	200	150	CI	1		1		1
63	CHANDRAWAL WTP I &II	16	Burari	B4	200	150	CI	1		1		1
64	CHANDRAWAL WTP I &II	17	Burari TPT	BTPT-2	200	150	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
65	CHANDRAWAL WTP I &II	17	Burari TPT	BTPT-3	200	150	CI	1				1
66	HAIDERPUR -1 &2 WTP Command Area	26	Rohini Sec 7	R 7-1	200	150	CI	1	1	1	1	1
67	HAIDERPUR -1 &2 WTP Command Area	27	Rohini Sector 11	R11-3	200	150	CI	1		1		1
68	HAIDERPUR -1 &2 WTP Command Area	28	Avantika UGR	AV-2	200	150	CI	1		1		1
69	HAIDERPUR -1 &2 WTP Command	29	Pitampura Reservoir	PP-1	200	150	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Area											
70	HAIDERPUR - 1 &2 WTP Command Area	31	Lawarence Road	LR-3	200	150	CI	1		1		1
71	WAZIRABAD I,II &III 40 MGD W.T.P.	43	Ramlila Ground Reservoir	Node No. 15 to 16	200	150	MS	1		1		1
72	WAZIRABAD I,II &III 40 MGD W.T.P.	48	Ramjas Reservoir	R3	200	150	CI	1		1		1
73	WAZIRABAD I,II &III 40 MGD W.T.P.	50	SGT Nagar Reservoir	SGT 1	200	150	CI	1	1	1	1	1
74	WAZIRABAD I,II &III 40 MGD W.T.P.	50	SGT Nagar Reservoir	SGT 2	200	150	CI	1		1		1

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S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
75	WAZIRABAD I,II &III 40 MGD W.T.P.	50	SGT Nagar Reservoir	SGT 4	200	150	CI	1				1
76	WAZIRABAD I,II &III 40 MGD W.T.P.	54	Punjabi Bagh Reservoir	PB1	200	150	CI	1	1	1	1	1
77	WAZIRABAD I,II &III 40 MGD W.T.P.	54	Punjabi Bagh Reservoir	PB-2	200	150	CI	1		1		1
78	BHAGIRATHI	56	Vivek Vihar	VV1	200	150	CI	1	1	1	1	1
79	BHAGIRATHI	62	Mandavali Fazalpur	25 TO 28	200	150	CI	1		1		1
80	BHAGIRATHI	67	Hindu Rao Reservoir	HR-4	200	150	CI	1		1		1
81	SONIA VIHAR WTP	71	Malvia Nagar	MN-3	200	150	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
82	SONIA VIHAR WTP	71	Malvia Nagar	MN-4	200	150	CI	1		1		1
83	SONIA VIHAR WTP	75	Jal Vihar	Node No. 147 to 50	200	150	CI/DI	1		1		1
84	SONIA VIHAR WTP	79	Shahadra	Node No. 41&54	200	150	CI/DI	1		1		1
85	SONIA VIHAR WTP	80	Tahirpur	Node No. 213 To 214	200	150	CI/DI	1		1		1
86	SONIA VIHAR WTP	81	Sangam Vihar	Node no. 9 To 10	200	150	DI	1		1		1
87	SONIA VIHAR WTP	89	Jhamarpur	Node No. 12-13	200	150	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
88	SONIA VIHAR WTP	93	Vinod Nagar	Node No. 26 to 30	200	150	CI	1		1		1
89	CHANDRAWAL WTP I &II	4	Naraina Reservoir	NA-1	250	175	CI	1	1	1	1	1
90	CHANDRAWAL WTP I &II	8	MM Reservoir	MM-1	250	175	CI	1	1	1	1	1
91	OKHLA	18	Kalakaji	KAJ2	250	175	CI	1		1		1
92	OKHLA	18	Kalakaji	KAJ4	250	175	CI	1		1		
93	NANGLOI	23	Najafgarh (New 1 MG Reservoir At Mohan Garden)	NG1	250	175	AC	1	1	1	1	1
94	HAIDERPUR - 1 &2 WTP Command Area	24	Rohini Sector 19	R19-1	250	175	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
95	HAIDERPUR -1 &2 WTP Command Area	28	Avantika UGR	AV-4	250	175	CI	1		1	1	1
96	HAIDERPUR -1 &2 WTP Command Area	29	Pitampura Reservoir	PP-2	250	175	CI	1		1		1
97	HAIDERPUR -1 &2 WTP Command Area	29	Pitampura Reservoir	SB-3	250	175	CI	1		1		1
98	HAIDERPUR -1 &2 WTP Command Area	31	Lawarence Road	LR-2	250	175	CI	1		1		1
99	HAIDERPUR -1 &2 WTP	32	Naraina Reservoir	NA-1	250	175	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Command Area											
100	HAIDERPUR -1 &2 WTP Command Area	32	Naraina Reservoir	NA-2	250	175	CI	1		1		1
101	HAIDERPUR -1 &2 WTP Command Area	35	JanakPuri New	JPN-2	250	175	CI	1		1		1
102	HAIDERPUR -1 &2 WTP Command Area	36	Mayapuri Reservoir	MY4	250	175	CI	1		1		1
103	WAZIRABAD I,II &III 40 MGD W.T.P.	44	Subhash Park	SP1	250	175	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
104	WAZIRABAD I,II &III 40 MGD W.T.P.	45	Model Town Reservoir	M2	250	175	CI	1		1		1
105	WAZIRABAD I,II &III 40 MGD W.T.P.	55	Siraspur	SI-3	250	175	CI	1		1		1
106	BHAGIRATHI	57	Jagatpuri	GP4	250	175	CI	1		1		1
107	BHAGIRATHI	58	Geeta Colony	GC-5	250	175	CI	1		1		
108	BHAGIRATHI	60	Kanti Nagar	Node No. 1 to 2	250	175	CI	1	1	1	1	1
109	BHAGIRATHI	60	Kanti Nagar	Node No. 10 to 11	250	175	CI	1		1		1
110	BHAGIRATHI	61	Chitra Vihar	Node No. 25	250	175	CI/DI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
				to 26								
111	BHAGIRATHI	62	Mandavali Fazalpur	18 T O 19	250	175	CI	1		1		1
112	BHAGIRATHI	63	Gazipur	Node No. 6 to 7	250	175		1		1		1
113	BHAGIRATHI	68	M M Reservoir	MM-1	250	175	CI	1	1	1	1	1
114	BHAGIRATHI	68	M M Reservoir	MM-5	250	175	CI	1		1		1
115	SONIA VIHAR WTP	72	Okhla	OKH-4	250	175	CI	1		1		1
116	SONIA VIHAR WTP	73	Kalkajee	KAJ-2	250	175	CI	1		1		1
117	SONIA VIHAR WTP	74	Sarita Vihar	SV-3	250	175	CI	1		1		1
118	SONIA VIHAR	76	Apollo UGR	Node	250	175	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	WTP			No. 2 to 4								
119	SONIA VIHAR WTP	82	Yamuna Vihar UGR	Node no.130-131	250	175	CI	1		1		1
120	SONIA VIHAR WTP	82	Yamuna Vihar UGR	Node no. 110-113	250	175	CI	1		1		1
121	SONIA VIHAR WTP	87	Karawala Nagar UGR	Node No. 103 to104	250	175	CI	1		1		1
122	CHANDRAWAL WTP I &II	6	Hindu Rao Reservoir	HR-3	300	200	CI	1		1		1
123	OKHLA	18	Kalakaji	KAJ1	300	200	CI	1	1	1	1	1
124	HAIDERPUR -1 &2 WTP Command	26	Rohini Sec 7	R 7-2	300	200	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Area											
125	HAIDERPUR -1 &2 WTP Command Area	28	Avantika UGR	AV-1	300	200	CI	1	1	1	1	1
126	HAIDERPUR -1 &2 WTP Command Area	31	Lawarence Road	LR-4	300	200	CI	1		1		1
127	HAIDERPUR -1 &2 WTP Command Area	36	Mayapuri Reservoir	MY3	300	200	CI	1		1		1
128	WAZIRABAD I,II &III 40 MGD W.T.P.	43	Ramlila Ground Reservoir	Node No. 5 to 6	300	200	MS	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
129	WAZIRABAD I,II &III 40 MGD W.T.P.	45	Model Town Reservoir	M1	300	200	MS	1	1	1	1	1
130	WAZIRABAD I,II &III 40 MGD W.T.P.	46	Jahangirpuri Reservoir	Node No. 114 to 115	300	200	CI	1		1		1
131	WAZIRABAD I,II &III 40 MGD W.T.P.	48	Ramjas Reservoir	R1	300	200	CI	1	1	1	1	1
132	WAZIRABAD I,II &III 40 MGD W.T.P.	49	Shastri Nagar Reservoir & BPS	SN2	300	200	CI	1		1		1
133	WAZIRABAD I,II &III 40 MGD W.T.P.	50	SGT Nagar Reservoir	SGT 3	300	200	CI	1		1		1
134	WAZIRABAD I,II &III 40	55	Siraspur	SI-1	300	200	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	MGD W.T.P.											
135	BHAGIRATHI	58	Geeta Colony	GC-6	300	200	CI	1		1		1
136	BHAGIRATHI	59	Surajmal Vihar	SV1	300	200	CI	1	1	1	1	1
137	BHAGIRATHI	59	Surajmal Vihar	SV2	300	200	CI	1		1		1
138	BHAGIRATHI	61	Chitra Vihar	Node No. 5 to 6	300	200	CI/DI	1		1		1
139	BHAGIRATHI	63	Gazipur	Node No. 102 to 2	300	200	CI/DI	1	1	1	1	1
140	BHAGIRATHI	64	Kondli Gharoli	KG3	300	200	CI	1		1		1
141	BHAGIRATHI	66	Dallupura	Node No. 25 to 13	300	200	CI	1		1		1
142	BHAGIRATHI	66	Dallupura	Node	300	200	CI	1		1		1

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S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
				No. 7 to 6								
143	BHAGIRATHI	67	Hindu Rao Reservoir	HR-3	300	200	CI	1		1		1
144	SONIA VIHAR WTP	69	Sonia Vihar	Node No. 24&25	300	200	CI	1		1		1
145	SONIA VIHAR WTP	70	Kailash	KA-2	300	200	CI	1		1		1
146	SONIA VIHAR WTP	71	Malvia Nagar	MN-2	300	200	CI	1		1		1
147	SONIA VIHAR WTP	72	Okhla	OKH-3	300	200	CI	1		1		1
148	SONIA VIHAR WTP	73	Kalkajee	KAJ-1	300	200	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
149	SONIA VIHAR WTP	74	Sarita Vihar	SV-4	300	200	CI	1		1		1
150	SONIA VIHAR WTP	74	Sarita Vihar	SV-5	300	200	CI	1		1		1
151	SONIA VIHAR WTP	76	Apollo UGR	Node No. 23 to 5	300	200	CI	1		1		1
152	SONIA VIHAR WTP	77	Sarai Kale Khan	Node No. 25 TO 22	300	200	CI/DI	1		1		1
153	SONIA VIHAR WTP	80	Tahirpur	Node No. 113 To 112	300	200	CI	1		1		1
154	SONIA VIHAR WTP	81	Sangam Vihar	Node No.17-18	300	200	DI	1		1		1
155	SONIA VIHAR	81	Sangam Vihar	Node No. 33-	300	200	DI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	WTP			34								
156	SONIA VIHAR WTP	85	Nangloi UGR	Node No. 11 to 12	300	200	CI	1		1		1
157	SONIA VIHAR WTP	86	Karala UGR	Node No. 11 to 12	300	200	CI	1		1		1
158	SONIA VIHAR WTP	88	Swasti Vihar	Node No. 24 - 27	300	200	CI	1	1	1	1	1
159	SONIA VIHAR WTP	91	Jhanjeer Puri UGR	Node No. 114	300	200	CI	1		1		1
160	SONIA VIHAR WTP	94	Sultanpuri Dabas	Node 1	300	200	CI	1	1	1	1	1
161	HAIDERPUR - 1 &2 WTP Command	30	Shakur Basti	SB-1	350	250	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Area											
162	HAIDERPUR -1 &2 WTP Command Area	33	Piragarhi Reservoir	PG-1	350	250	CI	1	1	1	1	1
163	HAIDERPUR -1 &2 WTP Command Area	40	Rohini Sec 23	RS23-3	350	250	CI	1		1		1
164	WAZIRABADI,II &III 40 MGD W.T.P.	49	Shastri Nagar Reservoir & BPS	SN1	350	250	CI	1	1	1	1	1
165	BHAGIRATHI	57	Jagatpuri	GP2	350	250	CI	1		1		1
166	BHAGIRATHI	57	Jagatpuri	GP3	350	250	CI	1		1		1
167	BHAGIRATHI	58	Geeta Colony	GC-2	350	250	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
168	BHAGIRATHI	58	Geeta Colony	GC-4	350	250	CI	1		1		1
169	BHAGIRATHI	64	Kondli Gharoli	KG2	350	250	CI	1		1		1
170	BHAGIRATHI	65	Trilokpuri	TP-4	350	250	MS	1		1		1
171	BHAGIRATHI	66	Dallupura	Node No. 29 to 30	350	250	CI	1		1		1
172	SONIA VIHAR WTP	70	Kailash	KA-3	350	250	CI	1		1		1
173	SONIA VIHAR WTP	70	Kailash	KA-4	350	250	CI	1		1		1
174	SONIA VIHAR WTP	77	Sarai Kale Khan	Node No. 4 TO 10	350	250	CI/DI	1		1		1
175	SONIA VIHAR WTP	77	Sarai Kale Khan	Node No. 15	350	250	CI/DI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
				TO 16								
176	SONIA VIHAR WTP	78	Shastri Park Bramhapuri	Node No. 14 to 9	350	250	CI	1		1		1
177	SONIA VIHAR WTP	80	Tahirpur	Node No. 218 To 254	350	250	CI/DI	1		1		1
178	SONIA VIHAR WTP	83	Narela UGR	Node No. 6	350	250	CI	1		1		1
179	SONIA VIHAR WTP	83	Narela UGR	Node No. 9 to 10	350	250	CI	1		1		1
180	SONIA VIHAR WTP	86	Karala UGR	Node No. 9 to 15	350	250	CI	1	1	1	1	1
181	SONIA VIHAR	87	Karawala Nagar	Node No. 4 to	350	250	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	WTP		UGR	6								
182	SONIA VIHAR WTP	93	Vinod Nagar	Node No. 10 to 18	350	250	CI	1		1		1
183	SONIA VIHAR WTP	95	Kirari UGR	Node No. 7	350	250	CI	1	1	1	1	1
184	CHANDRAWAL WTP I &II	16	Burari	B1	400	300	CI	1	1	1	1	1
185	HAIDERPUR -1 &2 WTP Command Area	29	Pitampura Reservoir	SB-2	400	300	CI	1		1		1
186	HAIDERPUR -1 &2 WTP Command Area	37	Khyala Reservoir Ph-II	KH,II-2	400	300	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
187	WAZIRABAD I,II &III 40 MGD W.T.P.	49	Shastri Nagar Reservoir & BPS	SN3	400	300	CI	1		1		1
188	BHAGIRATHI	59	Surajmal Vihar	SV3	400	300	CI	1		1		1
189	BHAGIRATHI	68	M M Reservoir	MM-3	400	300	CI	1		1		1
190	SONIA VIHAR WTP	69	Sonia Vihar	Node No. 5&6	400	300	CI/DI	1		1		1
191	SONIA VIHAR WTP	75	Jal Vihar	Node No. 80 to 81	400	300	CI/DI	1		1		1
192	SONIA VIHAR WTP	85	Nangloi UGR	Node No. 23 to 24	400	300	CI	1	1	1	1	1
193	SONIA VIHAR WTP	97	Vasant Kunj	Node No. 18 to 30	400	300	CI	1	1	1	1	1

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S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
194	CHANDRAWAL WTP I &II	4	Naraina Reservoir	NA-3	450	300	CI	1		1		1
195	CHANDRAWAL WTP I &II	6	Hindu Rao Reservoir	HR-1	450	300	CI	1	1	1	1	1
196	NANGLOI	23	Najafgarh (New 1 MG Reservoir At Mohan Garden)	NG2	450	300	AC	1		1		1
197	HAIDERPUR -1 &2 WTP Command Area	25	Rohini Sec 15,16,17,	R-15,16,17,-1	450	300	CI	1	1	1	1	1
198	HAIDERPUR -1 &2 WTP Command Area	27	Rohini Sector 11	R11-2	450	300	CI	1		1		1
199	HAIDERPUR -1 &2 WTP	31	Lawarence Road	LR-1	450	300	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Command Area											
200	HAIDERPUR -1 &2 WTP Command Area	32	Naraina Reservoir	NA-3	450	300	CI	1		1		1
201	HAIDERPUR -1 &2 WTP Command Area	35	JanakPuri New	JPN-1	450	300	CI	1	1	1	1	1
202	BHAGIRATHI	58	Geeta Colony	GC-3	450	300	CI	1		1		1
203	BHAGIRATHI	60	Kanti Nagar	Node No. 6 to 18	450	300	CI	1		1		1
204	BHAGIRATHI	65	Trilokpuri	TP-2	450	300	MS/CI	1		1		1
205	BHAGIRATHI	65	Trilokpuri	TP-5	450	300	MS	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
206	BHAGIRATHI	67	Hindu Rao Reservoir	HR-1	450	300	CI	1	1	1	1	1
207	SONIA VIHAR WTP	74	Sarita Vihar	SV-2	450	300	CI	1		1		1
208	SONIA VIHAR WTP	77	Sarai Kale Khan	Node No. 6 TO 7	450	300	CI/DI	1		1		1
209	SONIA VIHAR WTP	77	Sarai Kale Khan	Node No. 8 TO 9	450	300	CI/DI	1		1		1
210	SONIA VIHAR WTP	78	Shastri Park Bramhapuri	Node No. 7 to 8	450	300	CI/DI	1		1		1
211	SONIA VIHAR WTP	79	Shahadra	Node No. 56 & 29	450	300	CI/DI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
212	SONIA VIHAR WTP	82	Yamuna Vihar UGR	Node No. 104&132	450	300	CI	1				1
213	SONIA VIHAR WTP	92	Vasant Kunj	Node No. 4 to 7	450	300	CI	1		1		1
214	SONIA VIHAR WTP	94	Sultanpuri Dabas	Node 2	450	300	CI	1		1		1
215	CHANDRAWAL WTP I &II	6	Hindu Rao Reservoir	HR-2	500	300	CI	1		1		1
216	WAZIRABAD I,II &III 40 MGD W.T.P.	43	Ramlila Ground Reservoir	Node No .3 to 14	500	300	MS	1		1		1
217	WAZIRABAD I,II &III 40 MGD W.T.P.	46	Jahangirpuri Reservoir	Node No. 106 to 107	500	300	MS	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
218	WAZIRABAD I,II &III 40 MGD W.T.P.	48	Ramjas Reservoir	R2	500	300	CI	1		1		1
219	BHAGIRATHI	67	Hindu Rao Reservoir	HR-2	500	300	CI	1		1		1
220	SONIA VIHAR WTP	74	Sarita Vihar	SV-1	500	300	MS	1	1	1	1	1
221	SONIA VIHAR WTP	79	Shahadra	Node No. 6 &9	500	300	CI/DI	1		1		1
222	SONIA VIHAR WTP	81	Sangam Vihar	Node No. 45&46	500	300	DI	1		1		1
223	SONIA VIHAR WTP	96	Qutub Garh	Node No. 15 to 16	500	300	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
224	SONIA VIHAR WTP	95	Kirari UGR	Node No. 4	550	300	CI	1		1		1
225	CHANDRAWAL WTP I &II	4	Naraina Reservoir	NA-2	600	400	CI	1		1		1
226	CHANDRAWAL WTP I &II	13	Kirti Nagar Reservoir	KN-1	600	400	CI	1	1	1	1	1
227	CHANDRAWAL WTP I &II	16	Burari	B2	600	400	PSC	1		1		1
228	NANGLOI	21	Ujwah	U1	600	400	MS	1	1	1	1	1
229	NANGLOI	22	Daulatpur	DU1	600	400	CI	1	1	1	1	1
230	HAIDERPUR -1 &2 WTP Command Area	25	Rohini Sec 15,16,17,	R-15,16,17,-2	600	400	PSC	1		1		1
231	HAIDERPUR -1 &2 WTP	36	Mayapuri	MY1	600	400	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Command Area		Reservoir									
232	HAIDERPUR -1 &2 WTP Command Area	36	Mayapuri Reservoir	MY2	600	400	CI	1		1		1
233	WAZIRABAD I,II &III 40 MGD W.T.P.	46	Jahangirpuri Reservoir	Node No. 105 to 116	600	400	MS	1		1		1
234	WAZIRABAD I,II &III 40 MGD W.T.P.	52	Bangali Market	BG1	600	400	PCS	1	1		1	1
235	BHAGIRATHI	62	Mandavali Fazalpur	82 To 82	600	400	CI	1		1		1
236	BHAGIRATHI	64	Kondli Gharoli	KG1	600	400	M/S LINE	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
237	BHAGIRATHI	65	Trilokpuri	TP-1	600	400	MS	1	1	1	1	1
238	BHAGIRATHI	66	Dallupura	Node No.1 to 2	600	400	CI	1	1	1	1	1
239	BHAGIRATHI	68	M M Reservoir	MM-4	600	400	MS	1		1		1
240	BHAGIRATHI	68	M M Reservoir	MM-6	600	400	CI	1		1		1
241	SONIA VIHAR WTP	70	Kailash	KA-1	600	400	CI	1	1	1	1	1
242	SONIA VIHAR WTP	71	Malvia Nagar	MN-1	600	400	PSC	1	1	1	1	1
243	SONIA VIHAR WTP	73	Kalkajee	KAJ-3	600	400	CI	1		1		1
244	SONIA VIHAR WTP	73	Kalkajee	KAJ-4	600	400	CI	1		1		1
245	SONIA VIHAR	75	Jal Vihar	Node	600	400	DI/MS	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	WTP			No. 6 to 21			linned					
246	SONIA VIHAR WTP	75	Jal Vihar	Node No. 100 to 99	600	400	CI/DI	1		1		1
247	SONIA VIHAR WTP	80	Tahirpur	NodeNo. 101 To 122	600	400	CI	1	1	1	1	1
248	SONIA VIHAR WTP	80	Tahirpur	Node No. 201 To 242	600	400	CI/DI	1		1		1
249	SONIA VIHAR WTP	81	Sangam Vihar	Node No. 39-40	600	400	DI	1		1		1
250	SONIA VIHAR WTP	82	Yamuna Vihar UGR	Node no. 200-100	600	400	CI	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
251	SONIA VIHAR WTP	83	Narela UGR	Node No. 1 to 2	600	400	DI	1	1	1	1	1
252	SONIA VIHAR WTP	91	Jhanjeer Puri UGR	Node No. 128	600	400	CI	1		1		1
253	SONIA VIHAR WTP	92	Vasant Kunj	Node No. 15 to 14	600	400	CI	1	1	1	1	1
254	SONIA VIHAR WTP	93	Vinod Nagar	Node No. 42 to 41	600	400	CI	1	1	1	1	1
255	SONIA VIHAR WTP	97	Vasant Kunj	Node No. 2& 3	600	400	CI	1		1		1
256	CHANDRAWAL WTP I &II	8	MM Reservoir	MM-2	650	400	CI	1		1		1
257	CHANDRAW	8	MM Reservoir	MM-3	650	400	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	AL WTP I &II											
258	OKHLA	18	Kalakaji	KAJ3	650	400	CI	1		1		1
259	BHAGIRATHI	68	M M Reservoir	MM-2	650	400	CI	1		1		1
260	HAIDERPUR -1 &2 WTP Command Area	25	Rohini Sec 15,16,17,	R-15,16,17,-3	700	450	PSC	1		1		1
261	HAIDERPUR -1 &2 WTP Command Area	34	Janak Puri	JP-1	700	450	PSC	1	1	1	1	1
262	WAZIRABAD I,II &III 40 MGD W.T.P.	46	Jahangirpuri Reservoir	Node No 100 to 137	700	450	MS	1	1	1	1	1
263	WAZIRABAD I,II &III 40	55	Siraspur	SI-2	700	450	PAC	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	MGD W.T.P.											
264	BHAGIRATHI	62	Mandavali Fazalpur	100 To 1	700	450	M/S LINE	1	1	1	1	1
265	SONIA VIHAR WTP	69	Sonia Vihar	Node No. 2 &3	700	450	DI	1		1		1
266	SONIA VIHAR WTP	79	Shahadra	Node no. 4&22	700	450	DI/MS LINNED	1		1		1
267	SONIA VIHAR WTP	81	Sangam Vihar	Node No. 101 &102	700	450	DI	1	1	1	1	1
268	SONIA VIHAR WTP	91	Jhanjeer Puri UGR	Node No.106	700	450	CI	1	1	1	1	1
269	SONIA VIHAR WTP	91	Jhanjeer Puri UGR	Node No. 100	700	450	CI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
270	SONIA VIHAR WTP	96	Qutub Garh	Node No. 18 to 13	700	450	PSC	1		1		1
271	BHAGIRATHI	68	M M Reservoir	MM-7	750	450	CI	1				1
272	SONIA VIHAR WTP	72	Okhla	OKH-1	750	450	CI	1	1	1	1	1
273	SONIA VIHAR WTP	72	Okhla	OKH-2	750	450	CI	1		1		1
274	SONIA VIHAR WTP	78	Shastri Park Bramhapuri	Node No. 13 to 12	750	450	CI/DI	1		1		1
275	HAIDERPUR -1 &2 WTP Command Area	25	Rohini Sec 15,16,17,	R-15,16,17,-4	800	500	PSC	1		1		1
276	BHAGIRATHI	58	Geeta Colony	GC-1	800	500	PAC	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
277	BHAGIRATHI	61	Chitra Vihar	Node No. 1 to 2	800	500	MS Linned	1	1	1	1	1
278	BHAGIRATHI	65	Trilokpuri	TP-3	800	500	MS	1		1		1
279	SONIA VIHAR WTP	76	Apollo UGR	Node No. 1 to 2	800	500	CI	1	1	1	1	1
280	SONIA VIHAR WTP	76	Apollo UGR	Node No. 2 to 8	800	500	CI	1		1		1
281	SONIA VIHAR WTP	85	Nangloi UGR	Node No. 3 to 4	800	500	MS	1		1		1
282	SONIA VIHAR WTP	86	Karala UGR	Node No. 4 to 5	800	500	DI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
283	BHAGIRATHI	57	Jagatpuri	GP1	900	500	M/S LINE	1	1	1	1	1
284	SONIA VIHAR WTP	75	Jal Vihar	Node No. 1 to 2	900	500	MS Linned	1	1	1	1	1
285	SONIA VIHAR WTP	78	Shastri Park Bramhapuri	Node No. 100 to101	900	500	CI/DI	1	1	1	1	1
286	SONIA VIHAR WTP	79	Shahadra	Node No. 3& 34	900	500	DI/MS LINNED	1		1		1
287	SONIA VIHAR WTP	96	Qutub Garh	Node No. 3 to 4	900	500	MS	1	1	1	1	1
288	CHANDRAWAL WTP I &II	15	Cantonment BPS	C1	1000	750	PSC	1	1	1	1	1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
289	SONIA VIHAR WTP	69	Sonia Vihar	Node No. 1&2	1000	750	DI/MS	1	1	1	1	1
290	SONIA VIHAR WTP	77	Sarai Kale Khan	Node No. 100 TO 1	1000	750	MS LINNED	1	1	1	1	1
291	SONIA VIHAR WTP	86	Karala UGR	Node No. 18 to 19	1000	750	MS	1		1		1
292	SONIA VIHAR WTP	90	Dheerpur UGR	Node No.1	1100	750	MS	1	1	1	1	1
293	OKHLA	19	Sangam Vihar UGR	SV1	1200	750		1	1	1	1	1
294	WAZIRABAD I,II &III 40 MGD W.T.P.	43	Ramlila Ground Reservoir	Node No. 1 to 2	1200	750	MS	1	1	1	1	1
295	SONIA VIHAR WTP	81	Sangam Vihar	Node no 31-51	1200	750	DI	1		1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
296	SONIA VIHAR WTP	79	Shahadra	Node No. 1&2	1300	750	MS LINNED	1	1	1	1	1
297	CHANDRAWAL WTP I &II	1	Shadipur Reservoir						1	1	1	1
298	CHANDRAWAL WTP I &II	9	Tal katora Reservoir						1		1	1
299	CHANDRAWAL WTP I &II	10	Hassanpur Reservoir						1	1	1	1
300	CHANDRAWAL WTP I &II	14	Palam Reservoir						1	1	1	1
301	CHANDRAWAL WTP I &II	17	Burari TPT							1		1
302	OKHLA	20	South of J Zone							1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
303	NANGLOI	23	Najafgarh (New 1 MG Reservoir At Mohan Garden)							1		1
304	HAIDERPUR - 1 &2 WTP Command Area	42	Dwarka CT-1 to 6							1		1
305	WAZIRABAD I,II &III 40 MGD W.T.P.	51	Jorbagh Reservoir						1	1	1	1
306	WAZIRABAD I,II &III 40 MGD W.T.P.	53	Lodhi Road						1	1	1	1
307	BHAGIRATHI	55	Siraspur							1		1
308	SONIA VIHAR WTP	68	M M Reservoir							1		1

S No	WTP Name	UGRs No	UGR Name	Proposed locations of field Instruments	LINE SIZE (mm)	Meter Line Size (mm)	MOC of Line	Flow Meters	Level Transmitter	Pressure Transmitter	Turbidity Analyser (TA)	Residual Chlorine Analyser (RCA)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
309	SONIA VIHAR WTP	84	Jagjeevan Nagar						1	1	1	1
	Total							296	97	297		308

Annexure – III Summary of Field Instrument Requirement

Sl No	Name	Qty Required(New)	Existing qty to be integrated
1	Flow meters	296	319+86
2	Level Transmitter	131	
3	Pressure Transmitter	701	
4	Turbidity Analyser	199	
5	Chlorine meter	308	
6	Energy Meter	109	
7	Ph analyzer	01	
8	Ammonia analyzer	01	
Instruments at STPs			
1	Flow Meters	30	
2	BOD Meter	30	
3	SS Meter	30	

Annexure-IV Test Procedure for Instruments post manufacturing. Installation and Commissioning

18.1 INSPECTION AT MANUFACTURERS PREMISES

The inspection of all equipment / system require to be supplied to complete the works shall be done as detailed in this specification. Only defect free and sound material meeting the technical requirement of this specification and in accordance with a standard of engineering would be acceptable to the department.

For meeting this requirement of inspection, testing shall be carried out by the Agency and certificates submitted to DJB who will have the right to witness or inspect the above mentioned testing / inspection at any stage desired. Valid calibration certificates for test instrument shall be produced, consent in advance of testing and if necessary/ instruments shall be recalibrated or substitute before the commencement of the test. Items of equipment / system not covered by standard shall be tested in accordance with the details and programme agreed between DJB and IA.

No equipment/ system is to be delivered to site without the above described inspections having been carried out or officially waived in writing by the department.

18.2 TEST REQUIREMENTS

To ensure that a well engineered and specification compliant system is delivered by IA, the following tests shall be performed.

a) Factory Acceptance Test **(FAT)**
b) Site Acceptance Test **(SAT)**

Factory Acceptance Test

A Factory Acceptance Test, which is witnessed by Department's Official, is required for the system. No equipment shall be shipped without written confirmation by DJB that the system has successfully passed its factory acceptance test.

The purpose of the FAT is to qualify the system as meeting all contractual requirements. The test shall verify the performance and functional integrity of the individual subsystems, including active interfaces between subsystems and shall demonstrate the proper operation of equipments / systems.

Factory Acceptance Tests shall be conducted according to test plan with detailed test procedures. The test plan and procedures shall be subject to prior approval.

The IA shall notify the department at least (15) days prior to that scheduled starting date of FAT if the FAT is conducted in India.

A complete set of system documentation, including design and maintenance documents, user manuals and the test plan and procedures shall be available during the FAT.

Site Acceptance Testing (SAT)

Site acceptance Testing activities shall include

- System startup
- Site performance testing
- System Availability testing

System startup

The IA shall inspect every site in which system/equipment was installed to verify correct installation. The system shall then be started and brought into operation by IA and inform the DJB's representative/s.

Site Performance Testing

After the system becomes fully operational, the IA shall perform a site performance test to demonstrate that the system meets the performance requirements stated. These tests shall be performed according to a test plan with detailed procedures. The plan and procedures shall be subject to approval by DJB.

System Availability Test

Before final acceptance by DJB the equipment/ complete system shall successfully complete an availability test. The IA shall submit for review and approval a document with procedures, instructions and forms necessary for conducting the availability test.

18.3 TEST ON INSTRUMENTATION SYSTEM

Calibration of the instruments

All the instruments shall be calibrated as per applicable standards / manufacturers' practise as may be the case. The instrument will be acceptable if the accuracy and repeatability are better than those specified..

Dimensional check

The dimensions of all the instruments shall be checked thoroughly and shall be tabulated in a proper format.

1. Wherever applicable, following dimensions shall be checked /noted for flow, pressure, level, pH, residual chlorine and turbidity sensors.
- Total length

- Insertion length
- Diameter
- Mounting head
- Process connection size etc.

2. For panel mounted instruments, transmitters following dimensions shall be checked
- Width
- Height
- Depth
- Bezel dimensions and cut-out dimensions for panel mounted instruments etc.

3. Instrument Control Panel shall be subjected for the following dimensional checks
- Width, Height, Depth
- Cut-out dimensions for each panel mounted instrument
- Spacing between the panel mounted instruments

a) **High voltage test for ICP:** The H. V. test of 1 kV AC for one minute duration will be implemented between the ICP and the individual power supply feeder which shall be isolated from the respective power supply. Any reduction in voltage level or duration is not acceptable.
b) **Insulation test for ICP:** Insulation test will be carried out using a 500 V megger as specified below (all instruments will be disconnected from wiring)
- Between individual terminal of terminal block and ground
- Between individual wire and ground
- Between adjacent terminals of terminal blocks.

c) **Power supply variation test:** All the instruments shall work satisfactorily for the +10% variations in the supply voltage and +5% variations in frequency simultaneously. Accuracy and linearity shall not change.
d) **Hydrostatic test:** All flow sensors and pressure sensors shall be tested to withstand 150% of the rated pressure. The sensitivity, accuracy and calibration of the sensors shall be deteriorated at this over range. There shall not be physical damage.
e) **Repeatability test:** All instruments shall be subjected to repeatability test over the full range for three points. Three readings for each measurement mentioned above shall be taken for calculating and establishing the repeatability.

18.4 INSTALLATION OF INSTRUMENTS

Installation Inspection

After erection when IA is satisfied that all equipment/ system is as per specific requirement.

Installation Inspection of Instruments

All instruments shall be checked at site for damage during transportation. Contractor shall submit list of such items to Engineers Representatives and shall arrange for new items.

Wherever necessary, instruments mounted on pre-assembled equipment shall be calibrated in the field. Any instrument requiring changed calibration after initial calibration shall be recalibrated to DJB satisfaction Instruments shall be calibrated strictly according to manufacturer's instruction.

Complete calibration of flow meter at site is not technically feasible and hence site calibration of flow meters shall be limited to calibration of electronics by simulation of flow signals.

18.5 COMMISSIONING OF INSTRUMENTS:

Commissioning requirements

During commissioning IA shall supply all labour to supervise, operate, keep in operation, adjust, test, service, repair, and do all things necessary to keep the equipments / systems running. This shall include for the provision of such labour / staff on a 24-hours-a-day basis during the testing period and for such other period of continuous operation as the Engineer's Representative may consider necessary to establish the efficient operation of the equipment system.

Manual Commissioning Tests

These shall be such preliminary trials, tests and re-tests on individual items of equipments / systems or complete system as required by the DJB.

Acceptance Testing & Certification

The IA shall design the Testing strategy including traceability matrix, Test Cases and conduct testing of various components of the software developed. The system will have to undergo a comprehensive testing that shall include Unit Testing, System Testing, Integration Testing, Performance Testing, Load and Stress testing.

The IA shall obtain the sign-off from the Department on testing approach and test plan.

The IA shall perform the testing of the solution based on the approved test plan, document the results and shall fix the bugs found during the testing. Though the Department is required to provide formal approval for the test plan, it is the ultimate responsibility of IA to ensure that the end product delivered by the IA meets all the requirements specified in this RFP.

The basic responsibility of testing the system lies with the IA. The acceptance testing by a 3rd Party agency appointed by the Department as envisaged in this RFP is for the purpose of certification. IA shall provide all the necessary support to the agency in conducting the Acceptance Testing services. 3rd party testing should also include Functional Requirements Review, Infrastructure Compliance Review, Security Review, Performance, Availability, Manageability Review, SLA Reporting System, Project Documentation, Data Quality and Key Performance Indicators for CMS Project and IT Infrastructure proposed for CMS Project.

Reference Standards

Unless otherwise specified or approved, the radio telemetry system and SCADA system shall comply with the current version of the relevant Reference Standards including those listed in Section 3 and below:

1EC 60381-1:1982	Analogue signals for process control systems. Specification for direct current signals.
1EC 60381-2:1978	Analogue signals for process control systems. Specification for direct voltage signals
BS EN 60529:1992	Specification for degrees of protection provided byenclosures (IP code).
BS EN 60546-1:1993	Controllers with analogue signals for use in industrial process control systems. Controllers with analogue signals for use in industrial-process control systems. Methods forevaluating performance.
BS 1646-1:1979	Symbolic representation for process measurement control functions and instrumentation. Basic requirements.
BS 1646-2:1983	Symbolic representation for process measurement controlfunctions and instrumentation. Specification for additional basic requirements.
BS 1646-3:1984	Symbolic representation for process measurement control functions and instrumentation. Specification for detailed symbols for instrument interconnection diagrams.
BS 1646-4:1984	Symbolic representation for process measurement controlfunctions and instrumentation. Specification for basic symbols for process computer, interface and shared display/control functions.
BS 6739:1986	Code of practice for instrumentation in process control systems: installation design and practice.

Instrument Society of America Standards and Recommended Practices:

S 5.1	Instrumentation symbols and identification
S 5.4	Instrument loop diagrams

S 26 Dynamic response testing of process control instrumentation

S 51.1 Process instrumentation terminology

RP 69.08 Electrical guide for Control Centres

IEE Guidelines for the documentation of computer software for real-time and interactive systems.
International and local guidelines for programmable electronic systems in safety-related applications.

19. SPECIFICATIONS FOR OPERATION AND MAINTENANCE OF PROPOSED MONITORING SYSTEM

1. General

This section applies to the specifications for operation and maintenance of Central Monitoring System

2. Specifications

The specification of materials used for repairs shall be the same as have been used in the original work. Specifications for any materials which were not used during construction shall be approved by DJB engineer prior to commencement of the operation and maintenance period and must be incorporated in the O&M manual. Without being limited by this clause, during O&M period the Contractor shall use appropriate material for repairs even if material required for such repairs has not been approved earlier, and no delay in making such repairs shall be subjected to such limitation. However, subsequent to use of such material the Contractor shall submit proposals for the approval of specifications of such material. The approved material will subsequently form a part of the O&M manual

3. Activities during O & M Period General

During the O & M Period the Contractor shall carry out the following activities. However, these shall not limit the requirement for other activities which otherwise are required as per term and conditions of Contract or to fulfill the Contractor's responsibilities or are essential as per good industrial practices. The Contractor shall be responsible for, but not limited to, the following:

a) Providing the required staff, but not less then the minimum as specified by contractor, during operation and maintenance period

b) Providing all required consumables required for functioning of the CMS.

c) Maintenance of instrumentation (all field instruments), softwares, PCs, UPS etc. and all other works constructed in this Contract.

d) Entering into AMC (Annual Maintenance Contract) contracts with system / equipment suppliers, as may be necessary.

e) Periodic calibration check of all supplied instrumentation and controls as may be specified by manufacturers of the same from reputed agencies and submitting the same document to DJB engineers during the period of operation and maintenance.

f) Reporting;

- Repair history of all mechanical, electrical and instrumentation equipment;
- Daily log of operations of all the important instrumentation & equipment
- Hourly readings of pressure, flow rate and integrated quantity of water;

- Daily list of alarms with time tag;
- Logbook format and the data to be included in the logbook shall be decided during commissioning in consultation with department;
- Last periodic maintenance done for all equipment/buildings of the system;

h) Providing required spares and maintaining adequate inventory of required accessories or equipment itself for repair of system so that the all instrumentation, software and communication system can work efficiently for the proper functioning of Central Monitoring System as per the guarantees given or minimum required efficiencies asked for in the Contract, without any additional costs to department.

Prior approval to the changes required to be carried out during O&M shall be obtained by the contractor from the DJB engineer. The required changes shall be reported to DJB well in time with necessary drawing and literature for any changes shall be submitted to the DJB representative.

j) Periodic routine maintenance of structures / chambers carried out in this contract at WTPs, pumping station. Such maintenance must ensure adequate cleanliness, illumination and structural safety.

k) **Insurance:** The Contractor shall insure'

I. The work together with material and plant for in DJB therein, to the full replacement cost (term "cost" in this context shall include profit).
II. The Contractor's equipment and other things brought onto site by the Contractor, for a sum sufficient to provide for their replacement at the site.
III. The insurance shall be in the joint names of the Contractor and the DJB at the Contractor's cost and shall cover the DJB and the Contractor against all losses or damages from whatsoever cause arising from the start of the O&M until the date of completion of O&M in respect of the facility or any section or part thereof as the case may be.
IV. Any amount not insured or not recovered from the insurer shall be borne by the Contractor

4. WTPs, UGRs

(i) Operation Central Monitoring System as required, including provision of required manpower and services for proper operation and monitoring of remote locations.
(ii) **Periodic site calibration of all measuring/metering equipment and instrumentation at every 6 months minimum or as recommended by the manufacturer.**
(iii) Repair or replacement, as required, of damaged instrumentation and controls for proper functioning of system.
(iv) Maintenance of the Central Monitoring System including central server, softwares, PCs, UPS etc.
(v) Routine maintenance of the field instruments as per recommendation of the manufacturer.
(vi) Routine monitoring of each remote location for damage / repair of any equipment / parts and taking preventive measures as required
(vii) Providing safety accessories such as gloves, shoes, first aid box etc.
(viii) Ensuring safety of plant and equipment.

(ix) Furnishing required information to DJB as and when required.

5 Spare parts & stores

All spare parts used for the equipment in the maintenance of the system must be from the manufacturer of the equipment or, if the equipment itself has been made with parts from other manufacturers, the parts must be of the same make as used in the equipment supplied and installed.

All spare parts shall be packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be labeled on the outside of its packing with its description, number and purpose and, if more than one spare is packed in a single case, a general description of the case contents shall be shown on the outside and a packing list enclosed. The cost of O & M shall inclusive of spare parts during O & M contract period.

The stores inventory, the issuing and recording of spare parts will be the responsibility of the Contractor.

The Contractor is also be responsible for providing spare parts and instrumentation required for the Operation and Maintenance during the operation period, and shall bear the cost of the same, including the cost of storing and safeguarding.

The Contractor will make all necessary arrangements to ensure the continuous supply of spare parts and instrumentation for the works, and the rate of supply of these materials shall be in such quantities and amount as would ensure uninterrupted operations.

6. COMPLETION OF THE CONTRACT

On the date of Contract Completion or if the Contract is terminated, all the installations, works and equipment's placed under the Contractor's responsibility shall be handed over to the Employer, at no cost, in good working order, barring normal wear and tear.

At the end of O&M period, the Contractor shall be entitled to receive an Operation & Maintenance Completion Certificate within One Month of the Completion of the Contract.

The delivery of such Completion Certificate will relieve the Contractor from his responsibility as regard to the Operation and Maintenance and confirm that the Contractor has fulfilled all of his obligations under the Contract.

7. Operation and Maintenance Manual

The comprehensive manual shall be submitted before the operation and maintenance period, as specified. It shall be periodically updated to incorporate the "best practices" experience gained while carrying out the O&M activities, broadly on the principals listed below:

i. Up-dating any changes in the procedures set out in the O&M manual, as deemed necessary based on any limitations observed during the maintenance period, including incorporating additional procedures for maintenance of other repairs/break downs not incorporated in the maintenance manual but faced during O&M period.

ii. Procedures for repair of must be provided, with supporting drawings. The O&M manual must be updated if any differences are observed during O&M period.

iii. Records of Inventory used must be maintained and the relevant portion of O&M manual must be updated to list out the inventory requirements for maintaining the system.

iv. The provisions in the manual must incorporate every aspect of good industrial practices even if not elaborated here or in other parts of the bid document. The provisions in the approved operation and maintenance document shall be valid and binding for both the parties during operation and maintenance along with the additions and deletions made.

v. The manual so prepared must be updated after the end of every year of operation and maintenance, giving effect to the experience gained and the observations made by the Department during the maintenance period.

8. Penalties for Failure to Achieve the Functional Guarantees

In case of failure to generate the desired report, liquidated damages shall be imposed for such failure to meet the performance criteria or satisfactory service.. The Employer will be entitled to recover any such damages from the monthly progress payments to be made to the Contractor in the month in which the failure occurred, or at any time thereafter from the subsequent monthly progress payments. ***The penalty charges will be applicable as Rs. 500 per location per day.***