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TECHNICAL SPECIFICATIONS AND STANDARDS

(To be uploaded in specification folder under Technical / Pre-Qual cover)

SPECIFICATIONS AND REQUIREMENTS

1. Technical specification of equipments for automation system:

A state-of-the-art ***Supervisory Control and Data Acquisition*** (SCADA) reputed brand manufactured system with all hardware and software having necessary hydraulic intelligence and other features is to be customized as per requirement of the Project by suitable discrete PID controller such as the **Programmable Logic Controller** (PLC) to monitor and control the conditions of remote equipments, while ensuring data integrity, overall system visibility and security shall be installed at the Barrage Control Room (BCR) and two other Monitoring Stations at Siliguri & Jalpaiguri by the contractor . The architecture of the SCADA system shall be designed with reputed brand manufactured products customized to make it capable of all hydraulic intelligence for monitoring and control of various devices deployed at and around Teesta Barrage. The license shall provide for unlimited points/tags and screens. All SCADA software management tools and engineering services, necessary to administer the SCADA software system shall be provided such that no additional software or IT hardware would be required to configure or run each and every feature of the SCADA system. SCADA system shall be designed to remotely control, monitor, store, display and log process and equipment operating information. The SCADA software, as finally installed after design and integration shall operate with a fully developed control screens, database and a communication network for seamless real-time of data communication. The software installed shall feature an automated backup routine to protect system from loss of data.

Computers installed at BCR shall be able to monitor and control through SCADA system, all 62 nos. retrofitted vertical MS steel fabricated electric motor operated gates through RTU, receive and process data from Water Level sensors (Local and Remote stations), Remote station RF wireless radio transmitter, GSM/GPRS messages and other devices installed on real time basis and transmit both ways through VSAT, GSM, Broad band Internet to Monitoring work stations. Other software shall be interfaced with the highly intelligent SCADA for conducting off-line as well as on-line computations for efficient functioning and operation as the case may be, and viewing computed results vis-à-vis observed real-time values. The electronic provision must be established to store observed data and communicate programmed intelligence (instructions) locally for automatic gates, Acoustic flow meter and water level sensors through field data interface devices, RTUs/PLCs. (for local intelligence supporting large number of PID loops) Entire system shall have overriding option for manual operation. The following specifications are given as minimum requirements for a complete SCADA system with necessary hydraulic intelligence to control and/or monitor remote/local sites in and around Teesta Barrage.

The successful bidder shall engineer, supply, install, integrate, test and commission a remote monitoring and control system interfacing with Supervisory Control and Data Acquisition (SCADA) system for the operation of 62 gates for Teesta Barrage, TMLC and TJMC head regulators. The control of Teesta barrage is organized through motorized vertical gates and gate opening/closure allows control of flows and barrage pond water level. SCADA shall provide an interactive HMI (Human Machine Interface), data communication for operation of 62 gates, current and historian status of selected parameters, hydraulic or otherwise of all operational details of Teesta Barrage in graphical and tabular forms. All data observed/recorded/computed shall be part of the structured relational database, which may support the operator, if required in making decisions for operation of gates. SCADA output details needs to be designed considering various hydraulic and physical features of all 62 gates and in consultation with the Authority. The PLCs (Programmable Logic Controllers) will control the regulating gates, collect and transmit sensor data to Barrage Control Room (BCR) and perform remote monitoring and automatic gate control functions.

The SCADA system shall be a complete package. No additional software shall be required to configure or run all the features of the SCADA system requiring entire hydraulic intelligence.

1.1 Objectives of the SCADA System

(i) Provide a graphical overview of the operational status of the entire Teesta Barrage Automation system its remote control mechanism and establish real time communication with remote locations and with historical perspective.

(ii) Real time Control and operation of all Gates for achieving desired operation output (release of canal water, passage of flood discharge down the barrage, river training works, pounding of water, silt flushing, emergent operations) all from the Master Controller Work Station (BCR). Real time data display from all 62 gate positions - Gate positions of 45 no. Teesta barrage gates, 17 head regulator gates of off-taking canal, TMLC and TJMC

(iii) Obtain on real time accurate upstream barrage pond level, downstream levels of Teesta, water levels downstream of head regulators of TMLC and TJMC and water levels for inflow forecasting and Flood warning communications to BCR from additional remote locations on river Teesta and its tributaries i.e Gheesh & Leesh etc (Six stations nearby Barrage and Nine in the river Teesta, Leesh & Gheesh by GSM/GPRS, thus totaling 15 nos.).

(iv) Additional Water level and discharge data at confluence of two tributaries joining the river Teesta approximately 2.00 km upstream of Teesta barrage integrated with the SCADA server by RF**.**

(v) A provision shall be made to establish a stage discharge curve for assessing inflow of Teesta River on the basis of Authority's requirements.

(vi) Inflow forecasting by inserting suitable programmable inputs in SCADA to collect and display on monitor at BCR the inflow /outflow discharge data of River Teesta which is to be received by GSM/GPRS through Text/voice messages from Teesta Low Dam Project No. IV of NHPC located on the upper reaches of Teesta at about 40 km from Barrage. Teesta Barrage Project Authority shall ensure availability of sms/text or voice data on real time basis through GSM/GPRS which is to be displayed on monitors' integrated at all three Work Station monitors for Flood Forecasting Warning Alarm and Inflow Assessment Purposes and no separate telemetry in Remote station.

(vii) Generate discharge values of river at the barrage weir and both end off-take canal head regulators every 15 minutes.

(viii) Alarm generation (blinking & buzzer types) at the BCR and at two Monitoring Stations based on river inflow data and also actual discharge passing down barrage for lower reaches.

(ix) Automatic fault/non-compliance to set Benchmark reporting for the entire Teesta Barrage system displayed in monitors at BCR and two other Monitoring Stations.

(x) Design and deliver an automated monitoring mechanism in SCADA system to eliminate unplanned and unauthorized Gate Operations to curtail human errors and identify the malfunctioning sensors by burglar alarm, camera feed and other equipments on the video wall 24X7.

(xi) Database archive for retrieval and analysis of historical and/or current data for entire operational activities of Teesta Barrage system.

(A) Database:

Completely developed Operational Database Management System (ODMS)/ Operational Historian shall be provided for the Teesta Barrage Project, which shall be interfaced with state-of-the-art ***Supervisory Control and Data Acquisition*** (SCADA) system having all necessary features and programmed hydraulic intelligence by suitable discrete PID controllers such as the **Programmable Logic Controller** (PLC) for complete information management of Teesta Barrage & both off-take canal head regulator operations. The SCADA software database shall be of true relational database/historian designed and optimized for real-time SCADA operation. The database/historian builder and editor (DBE) shall be an integral part of the SCADA package. The DBE shall allow the user to examine the contents of an existing database, monitor the running database, edit an existing database or create a new database, add, delete or change an existing tag's name, data type, I/O address, source ID, I/O interface or any other tag attribute or characteristic in the database. All changes made to the system should be promptly reflected by revising the documentation and the database and distributing copies of the revised documentation and updated database to the field.

General features and database/historian functions:

a. The databases shall include the all measured and operational data fully synchronized time stamping system.
b. This database should have administrator window like user interface that permits to monitor, supervise, archive, retrieve and control data gathering functions from the SCADA system.
c. It should have facility to exchange information from various sources like SCADA software, CSS outputs, relational database servers, MS Excel files, CSV files, XML files etc.
d. The SCADA software shall be configurable as a single global database regardless of the number of nodes or points in the system.
e. The SCADA software shall provide the capability to make configuration changes to the global process database from the SCADA software manager's station at the MCC. This function will be protected by password.
f. Historical process Graphics Display; Real-time screen updates
g. Report generation using SQL type queries to the archive.
h. Database shall be logging and archiving of observed data into a structured database, displaying them in user friendly formats, editing, running operation and for exchanging data with CSS.
i. Repetitive tasks are to be automated through macros with point-and-click options. Database shall be capable for being placed on a network and have multiple users sharing and updating data without overwriting each other's work. Data is to be locked at the level recorded.

The SCADA software shall contain project specific requirement databases in a form necessary for editing, running in operation and for exporting to other applications.

(B) Processing in database

a. The SCADA system shall be able to manage the amount of variables requested by the number of sites of the project.
b. The SCADA software shall have a single global database. The physical implementation of the database can rely on several files, but does not depend on the number of nodes or points in the system.
c. Administration of the database shall be performed through dedicated windows and menus allowing listing, adding, deleting or modifying the definition of process variables.
e. Changes to the global process database shall be made from Master Controller Workstation at BCR. This function shall be protected by password.
f. The process database shall have facility of remote administration.
g. The database shall have facility to retrieve past archives for the process variables.
h. The same database shall integrate both process data and alarm/events data.

(C) Database Builder and Editor (DBE)

The Database Builder and Editor shall be delivered as part of the SCADA software customized package. It will be used to: (a) create a new database (b) edit an existing database: i.e. add new variable definitions, remove existing variable definitions, edit existing variable definitions or browse an existing database. With the DBE, it shall be possible to import/export an existing database via an ASCII readable file in CSV format. Changes in the SCADA database are automatically communicated to the other SCADA servers, as decided by customization.

(D) General features of historical data management

The SCADA software shall include features for the management of historical data collections.

a. The SCADA software shall record historical values of analog variables on a periodic basis and values of digital variables on an event basis (change of state).
b. There shall be no limit by the SCADA software for the number of data values recorded in a historical collection.
c. The SCADA software shall support recording of historical data on one or more files, defined by the user.
d. The database files holding the historical values shall be automatically sent towards a distant secured rented server on a periodical basis. Periodicity shall be a customizable value initially set to 1 week. This function shall be available in the broadband internet available at BCR.

(E) HMI for curves management

The HMI shall provide the capability for display/plotting of real-time and historical data as curves.

a. The plot function shall provide pre-scaled display of selected process variables (pre-defined scales on type curves).
b. The operator shall select subsets of the displayed data. The plot function shall automatically scale the requested data to fit the time frame requested by the operator. The plot function shall display these data as a multiline chart with each variable easily determined by color.
c. The SCADA HMI software shall support curve display with the following features:

· Line graphs with time on a linear, continuous horizontal axis and the trended variable on the vertical axis.
· Simultaneous display of up to six plots, reporting up to 10,000 points within a user specified time range.
· Capability to pan backward and forward within a selected time range to read the exact value of any displayed variable, by selecting a point on the graph or chart.
· Display of historical information as far back in time as desired, as is available in the history log.
· "Zoom" and "Pan "facilities for both the trended variable range and the time axis range. The software shall allow a user to define the zoom area by dragging a mouse across the trend.
· Export of trending data from the historical database to disk files: it shall be possible to define the section of the trend to be exported by clicking and dragging the mouse across the trend. Data shall be exported to CSV or TXT formatted files.
· Export of any portion of the historical trend database CSV or TXT formats.
· Printing of the trends or plots generated above to a designated printer.

(F) Alarm Management

General features of alarm management

a. The SCADA software shall support alarm and event logging, including description text and time stamp.
b. The alarms shall be logged to the SCADA database without any limit on the number of alarm occurrences.
c. In order to logically divide process into smaller units, it shall be possible to define alarm groups.
d. The SCADA software shall allow viewing of alarms without disrupting data collection or alarm processing.
e. Alarm data shall be stored on the shared disk unit to allow uninterrupted logging.

Principles for 'Alarm' generation

Alarms shall be either generated by the PLCs/RTUs or by the SCADA software.
The SCADA software shall allow input of events by the operator. The logged information shall include: username, action, date & time, value, and free-format comment.

a. To enable alarm generation at structure level, the thresholds on analog variables (e.g. high level, low level) shall be sent by the SCADA software to the PLCs/RTUs.
b. The SCADA software shall monitor analog and digital variables and calculate conditions, to determine if a variable is in an alarm condition.
c. For each analog variable, the SCADA software shall trigger an alarm for each of the following conditions: variable LOW-LOW, variable LOW, variable HI, variable HI-HI, rate of change, bad sensor input. Adjustable dead bands shall be managed. It shall also be possible to disable alarm generation for a variable. All analog alarm properties shall be modified without restarting the SCADA software. Changes shall be automatically saved to the database so that if the system is restarted, the alarm settings shall be as last adjusted.
d. For each digital variable, the SCADA software shall trigger an alarm for each of the following conditions: variable ON, variable OFF.

HMI for alarm management

The SCADA HMI shall include features for alarms display and processing, including operator acknowledgement.

a. The HMI shall notify the operator with graphical screen indication of the presence of an unacknowledged or new alarm. These indications shall be organized in an alarm window that shall be made always visible, if customized so. This window shall allow easy identification of a new alarm, an unacknowledged alarm and acknowledged alarms, and shall allow review of all alarms.

b. Alarms acknowledged from Master Controller workstation shall automatically appear as acknowledged on the other two Monitoring Workstations. To avoid confusion, it is recommended to have alarms on one geographical area acknowledged from the Monitoring Workstation responsible for that area or from operators at the BCR.

c. The SCADA HMI software shall provide alarms viewing and processing with the following features:

· Display as a list in a standard alarm window, with the facility for scrolling up and down the list.

- Possibility of acknowledgment of individual alarms.
- Possibility to disable alarms on an individual basis, by page or by alarm category or all alarms.
- Possibility to attach operator comments to any alarm at any time.
- Management of multiple levels of alarm priority or category with capability to display each category/priority in a different color (including flashing colors) depending on the alarm status.
- Capability to automatically display one graphic display when an alarm occurs or to dynamically change the appearance (color, shape, blinking) of a graphical object based on alarm status.
- Capability of for providing audible alarm notification configurable for each alarm by category.
- Display of information of each alarm includes: alarm tag name, alarm description, value of the variable, trip point (threshold), alarm status (disabled, acknowledged, unacknowledged), alarm category, alarm priority, time & date, operator comments, computed information.

(G) SMS messaging software

The SCADA software shall be able to send SMS using dedicated gateway including a SIM card. The features are as follows:

a. SMS shall be sent to specified list of mobile phone numbers or a list,
b. The lists of phone numbers for customization can be imported from a text file. Duplicate entries shall be detected.
c. In case of a list of phone numbers, delay between messages shall be customized to minimize load of SMS
d. Sent messages shall recorded, documented and stored in computer servers for future reference (storage to archive file)

(H) Web Server

a. Web servers should be added to the control and monitoring system to allow data display within in the frame work of the project and to restrict this website on local IP fully encrypted and protected so that it is not available without specific authorization to outside world.
b. This server allows the viewing of real-time and historical data from multiple locations managed by the SCADA software (mimics, curves).
c. Information displayed in the web server window can be personalized using access configuration.

(I) Human Machine Interface (HMI)

The SCADA HMI applications shall present the operators with control screens that provide for all the control interaction to operate the gate structures. The HMI shall present an overview and detailed state of the operational conditions of the canals based on customized views of the project area ("mimics"). It shall allow users to input commands to the structures and also access the historical data for reporting or trending. The mimics are created using a graphics editor. They will display key process variables as digital and graphical data. Navigation between mimics is made by selection in a menu or selection of buttons or similar graphic objects. The HMI part of SCADA software shall be based on requirements of Teesta Barrage Project and shall be duly customized as per the operational and other requirements of the Project, as explained by project officials. The SCADA screen builder and editor shall be an integral part of the SCADA package, supporting user building and editing of user friendly control screens in the project. Authority shall provide full explanation of tags and assigned registers and their associated recommended values that need to be designed and displayed in HMI. The screen builder shall allow users to edit existing screens, create new screens or save existing screens to new screen definitions. Besides others, at least following screens shall be developed:

a. Project Overview Display Screens for the whole Project at the Main Master Controller Server Station at BCR and two monitoring stations at Siliguri & Jalpaiguri Towns.
b. A graphical representation of entire Teesta Barrage Project with display of real-time data as well as all developed mimics as approved by Authority.
c. Real time control of gates for executing instructions through HMI. Cross regulator control screens (one for each regulator or explained by Authority shall provide the operator with the necessary information to monitor and control the canal control gates.
d. Automatic faulty/non-compliant/un-authorized/unplanned gate operations detection for immediate action for rectification of operation. A set of suggestive default values shall be prepared in consultation with officials for various scenarios that shall be applied in absence of ready instructions.
e. The SCADA HMI shall provide for operator input of alphanumeric data, checking numeric entered data for valid range and reject out-of-range information entered.
f. The SCADA HMI software must support real-time and historical trend graphic displays with up to eight variables trends per graph. The plot function shall automatically scale the requested data to fit the time frame requested by the operator and display as a multiline chart with each variable easily determined by colour, pattern or combination.
g. Automatic Controls-The software shall allow users to create scheduled controls and automatic controls in response to date, time, value, or event.

(J) General features of HMI for Teesta Barrage Project

a) The SCADA HMI shall not limit the number of possible mimics. It does not limit either the number of opened windows at any time
b) The SCADA HMI software shall includes support for real-time and historical trend graphic displays.
c) Popup windows shall be used by the SCADA HMI software to display, for instance, device control information and trend curves.
d) Graphical objects shall be associated with any variable in the system. The SCADA HMI software shall display or represent the value of the variable associated with graphical objects as could be read from the database source field at all times.

e) Runtime graphics in the mimics shall include: freehand lines, lines, poly lines, rectangles, ellipses, pie slices, text, 3D style objects, and bitmaps.
f) Objects' support, when relevant, singly or concurrently, the following dynamic properties that shall modify the attributes of the object according to the value of the variable attached to the object:
   - movement (horizontal, vertical and rotational),
   - filling (fill level, fill foreground, fill background),
   - color change for foreground or background (on/off, multi-state, integer, threshold),
   - scale.
g) This shall be applied to single objects or grouped objects.
h) The appearance of objects shall also depend on the status of the variable. If communications to a particular sensor has failed for any reason, then the HMI software shall posts a visual indication that the point is not valid.
i) The SCADA HMI shall be capable of refreshing and display mimics with a minimum of 50 analog variables in less than one second (Local Display on the Master Controller Server Workstation' Lap Top Computer and 110 inch Display Screen/ video wall) at BCR.
j) The SCADA HMI shall allow operator input of alphanumeric data including range check.
k) The SCADA HMI software shall support keyboard entry that allows adjustment of the variable associated with the selected object. Operator entered values are not displayed until read back from the SCADA database.

(K) Graphics editor

The graphics editor shall be delivered as part of the SCADA package. It shall allow creation and update of mimics by positioning graphical objects, associating variables of the SCADA database with them, and defining their behavior. Graphical objects shall be managed individually or as groups.
With the drawing tools, it shall be possible to draw circles, ovals, arcs, lines, connected lines, open polygons, closed polygons, boxes or squares. Line style and width shall be customized. The editor shall be used to change the appearance of objects: position, aspect ratio, scale, rotation.
The graphics editor shall also support the standard HMI objects, including buttons, pull down menus, dialog boxes, sliders, icons and images.

(L) Monitoring workstations

A SCADA Software shall also be installed at two locations on dedicated industrial grade PCs/workstations named "Monitoring stations" which shall be at Siliguri, office of Chief Engineer, Teesta Barrage Project; and at Jalpaiguri Town, North Bengal Flood Control Room at Club Road; as identified by the Engineer-in-Charge. The Civil renovation work of all work stations (Master Controller & Monitoring) has been included in the scope of works contract. The Main Master Controller Server with 110 "LED Video wall would be at the BCR. These Monitoring stations with 110 inch video walls with computer CPU sever shall be connected to the SCADA Server using VSAT satellite network and GSM/GPRS redundancy communication telemetry.
The Monitoring workstations shall have the display of data available from SCADA system. From this HMI, the users shall monitor the structures under their management. The data acquisition shall be performed in a centralized manner at the BCR, where VSAT ground station satellite equipment is available, and then dispatched for display to the Monitoring Work stations.
The SCADA HMI will be protected by access control (login) by Bio Metric lock system.

(M) System security

Security of software is vital to the operation of the Remote Monitoring and Control System, ensuring that the facilities meet the Authority's security requirements (data security, database security and system security) as of utmost importance. The contractor shall map the Remote Monitoring and Control Systems risk profile to an appropriate security policy. The contractor shall design the system security policy including the network security giving due consideration to the application services hosted, the level of security that these demand and the services/protocols the system needs to support.
Safety of operation – (a) The contractor shall provide security of software storage in encrypted database and secured licensed Firewall protected network from all viruses and malwares. (b) Redundancy – provide software running on a pair of identical servers. The two servers are installed and the SCADA software will run on one server (active server) while the other shall be backup WARM redundancy. (c) The SCADA database shall be updated by the active server. Database integrity is ensured by redundant disk architecture (RAID disk unit in each server) and by redundant computers (real-time update of the databases on both servers). (d) In case of failure of the application on the active server, the application is automatically started on the other server (operation of each server is observed by the second one).
The contractor shall submit the system security plan as a part of the SCADA system design document for Engineer-in-charge's approval.

a. The SCADA system shall provide for security to allow access to any individual part of the system only to users with appropriate security levels. The security levels shall be defined for each user or group of users in the system.
b. The SCADA system software shall provide the capability to define the following privilege levels: operator, skilled operator and system administrator.
c. The actions by the user are checked by the SCADA software and an error message shall be displayed in case of insufficient privilege.
d. The restriction of access to specific areas of the project shall be performed by customization of the Client SCADA software installed at each Monitoring Workstation.

To control operator access to unauthorized software or to the operating system, access to Windows "hot" keys such as Ctrl Esc, Ctrl Alt Del etc. will be limited by specific customization of users by the windows system administrator only.

(N) Report management

The SCADA software shall perform all report generation, report scheduling and management using its built-in capabilities. Reports shall be defined based on historical data.

a. Reports shall be generated into files under CSV or TXT format, and can be displayed on the users' screens.
b. The contents of the reports shall be defined from the Engineering Workstation.
c. The reports shall be either "single-point-in-time" (online and historical) or "time-range", with no software limit on the number of points in one report.
d. Reports shall be scheduled for a specific time of day, on a periodic basis, upon operator request, or event initiated (e.g. alarm condition).
e. The reports shall be automatically sent to a designated printer when generated.

The contents of the reports shall be defined together with the 'Authority'.

(O) SPECIFICATION FOR CABLING AND CONNECTING

i. The term cable shall always include necessary type of connectors at both the ends for connecting between two equipments. The connectors shall be properly anchored with protective sheathing of the cable in such a way that the loads due to pulling and twisting shall be borne by the protective sheathing and the conductors shall not be subjected to any stress.
ii. The connectors shall be so fixed on the individual components of the system that the metal/ plastic connector shall always transfer the loads due to pulling and twisting directly to the protective body of the component and the internal interface cards / connections shall not be subjected to any load.
iii. Laying of necessary data and power supply cables connecting various components and embedding them or protecting them with necessary conduits.
iv. Wherever the cables are to be laid indoors and the length of the individual cable run exceeds 1 meter, the cable shall be housed in a protective conduit made of electrical supply grade conduit of appropriate diameter and the conduit shall be fixed with the wall at a height not less than 1 meter above the floor surface. Whenever the indoor cable is required to cross the floor, it shall be housed in a Galvanized Iron pipe of 12.5 mm internal diameter and the pipe shall be fixed to the floor with suitable protective covering to avoid tripping of personnel using the area or disturbance to the pipe due to such movement.

v. Wherever cables are to run through open ground including the public road and pathways, the cable shall be armored and shall be water ingress proof up to static water pressure of 5 kg/cm2. All joints made in cable shall also meet the water proofing criteria. In addition, the cable shall be protected by housing the same in 12.5 mm Galvanized Iron pipe embedded at a depth of not less than 0.3 meter below the ground surface with a warning brick on the same. A sketch of the cable layout with respect to the identifiable marks of the area shall be prepared and handed over to the Authority for each such cable run on completion of the work of cable laying operation.

vi. The joints in the cable connecting between the sensor and data collection unit shall be avoided by measuring the appropriate length of the cable required and attaching the same in one piece. If the cable joints become necessary, prior permission of the Authority shall be obtained before executing the same. The joint fabricated through a splicing and jointing kit shall be stronger than the parent cable.

vii. The cable carrying data and electrical power shall be housed separately in different conduits separated by adequate distance to prevent leakage currents. The data cables shall also be laid out in such a way that the data integrity is not compromised due to mutual interference.

TECHNICAL SPECIFICATIONS OF EQUIPMENTS

General: All sensors and equipments to be used should be best suited to deal with high silt content and turbid river flow condition and provide precise and accurate reliable data in extreme weather. Like submergence due to Floods/ other conditions, and as such IP 67 international protection marking standards is required..

1. WATER LEVEL MEASURING SENSOR – NON-CONTACT RADAR TYPE

The Contractor shall design, supply and install preferably non contact radar type water level sensors totalling to 15 (Fifteen) different points and locations with complete telemetry data loggers and power backups. Bubbler type water level sensor may be considered for river gauging etc., where there is no bridge across the river or other equipment mounting solution is available.

Up to six points near barrage comprising upstream barrage pond water levels, downstream levels of Teesta Barrage, downstream of head regulator gates of TJMC and TMLC for pond level/water level/ hydro-dynamic flow pattern measurement purposes and calibration etc and up to 9 (Nine) other remote location stations on river Teesta, Leesh and Gheesh which are tributaries of Teesta as desired by the Authority for inflow assessment purposes in uncontrolled upstream catchment. These points shall be selected in consultation with Engineer-in-charge, so that most accurate measurement of water level is recorded. The preferred telemetry for water level non contact type Rader type sensors on River Leesh, Gheesh and Teesta upstream of Barrage would be through GSM/GPRS or through wireless RF-Radio Sensor Slaves to VSAT to link with Master Controller server.

All accessories along-with cage to avoid theft and animal menace and also proper mounting of these instruments will be supplied by the contractor. All necessary instruments, interconnecting wiring, HDPE/GI pipe work, housing, cabling, panel, etc., shall be provided according to the type of equipment proposed to be supplied/ accepted in the Contract. Adequate safety measures shall be included in the design of these sensors to negate the effects of disturbances due to turbulence of water levels, strong air currents & electromagnetic waves etc.

Technical Details:

S. no.	Components and its specifications	Requirement as per RFP	Specifications offered by bidder during bid submission
1	Type	Microwave non contact type RADAR	
2	Manufacturer	Endress + Hauser / Siemens / P+F	
3	Range	0.0 m to 30.00 m	
4	Accuracy	0.02% FSO	
5	Resolution	3 mm or less	
6	Type of Mounting	MS Steel/High Density Plastic	
7	Temperature operation range	0°C to +60°C	
8	Type of wiring	CAT6/Any Other	
9	Casing of wiring	HDPE/GI	
10	Humidity operation range	0 to 98%, non-condensing	
11	Battery	9 to 15 Vdc with internal rechargeable battery pack with service life exceeding 12 months.	
12	Protection	Minimum IP65 enclosure or higher	
13	Interfaces	SDI-12 or approved equal serial digital interface (RS 232, RS 485 or RS 422) output signal	
14	Power	10-15 VDC	
15	Display read out	4-20 mA.	
16	Method of Communication	Cabling(Ethernet/OFC) ,GSM, Wireless RF	
17	Common Protocol	Compatible with SCADA	

The telemetry for various sensors adjoining BCR/barrage shall be through copper wiring/OFC with GSM/GPRS redundancy. However remote locations shall communicate with BCR through GSM/GPRS or through wireless RF-Radio Sensor Slaves to VSAT to link with Master Controller server.

2- DATA LOGGER SPECIFICATIONS

Data Logger specification (for remote water level sensors) will need to be adjusted based on the telemetry that is being specified. It is recommended that the data logger be able to communicate simultaneously with at least two different data communication devices. The Data Collection Platform shall be a well proven and widely used model, produced by a primary brand name and tested in a large number of installations. A manufacturer's certificate shall be provided that the model proposed has been in production at least 2 years by reputed manufacturer as per German DIN/American Standards. The data logger should work as SLAVE with RTU-BUS combination protocol with SLAVE ID Specialties. It should have the RS 485 port to support communication modules like Cables, Wireless Radio, GSM/GPRS and VSAT links with inbuilt robust software. It should have the sensor type defining and calibration specialties through USB port and RTU MODBUS through master controller. The data logger should pole (periodically as programmed) the signals from the sensor (in 4 to 20mAmp) and convert into FLOT (SCADA data format). Each sensor should have defined ID. On enquiry from the master controller for data on defined ID it should transmit the data in RTU MODBUS-PROFIBUS format.

Data Logger Specifications

Features	Specifications	Specifications offered by the bidder **during bid submission**
Analog inputs	8 and above	
Analog input range Analog input range	0.0 to 5.0 V	
Analog input accuracy	±0.02% of full scale	
Digital inputs/outputs	4 bidirectional	
Digital input range Digital input range	0.0 to 5.0 V	
Digital output range	0.4 V to 3.5 V (at maximum 5 mA current)	
Switched voltages	1, 12 V	
Telemetry options	GSM/GPRS,Wireless-Radio-slaves, compatible with external VSAT Modem	
Communication interfaces	USB1 , RS-485	
SDI-12 Support	Version 1.3 compliant	

Power consumption	Without internal modem: Typically 3.5 mA standby, 50 mA active With internal modem: Typically 4.5 mA standby, 100 mA active	
Common Protocol	SCADA Compatible	

Other features:

1. Multi-tasking operating system capable of simultaneous data collection and data transmission
2. The Data Collection Platforms shall be capable of unattended operation for up to one year. The continuous power is not available for most of the network, so the power will need to be supplied on-site with the use of solar panels with inbuilt battery backups.
3. Unlimited licenses for the software used for data communication
4. Memory for data storage shall be non-volatile. Data stored will not be lost in the event of power interruption or system reset.
5. If Data Collection Platform power is interrupted the platform will have the option to restart data collection and transmissions automatically, and without technician intervention.
6. 1 input/output interface for the programming of the data collection platform. This must be in addition to the two input/output interfaces used for data communication. Cables for programming shall be included with each data logger.
7. Software compatible with Windows 10 and higher OS compatible

3- DIGITAL AUTOMATIC RAIN GAUGE

One digital rain gauge connected with server to measure exact amount of rainfall shall be mounted on BCR so that it gives accurate measurement of rains.

Technical Details

S. no.	Components and its specifications	Requirement as per RFP	Specifications offered by bidder during bid submission
1	Type	Tipping Bucket Reed Switch	
2	Manufacturer	MECHATRONICS / ZENO/SUTRON/ Hydrological services/OTT or other highly reputed manufacturers	
3	Range	0-250 mm/hr	
4	Humidity	5-100%	
5	Accuracy	2% or better	
6	Resolution	0.5mm	
7	Protection for sensor electronics	IP65	
8	Materials	Corrosion resistant – Stainless Steel	
9	Output interference	SDI 12/ RS 485 with MODBUS / PROFIBUS compatible to PLC/RTU	
10	Type of Mounting	MS structure/ high density Plastic	
11	Type of Wiring	CAT6 or any other	
12	Casing of wiring HDPE/GI	HDPE/GI	
13	Communication mode	Cabling	
14	Enclosure	Ability to service tipping buckets without involving the relabeling of the gauge.	
15	Tools	Complete tool kit for operation and routine maintenance	
16	Protection for data logger / electronics	NEMA4 or IP65	
17	Manuals	Documentation & maintenance manual in English	
18	Accessories'	Sensor Mounting support duly HDPE/GI Pipe conduit, cables and other accessories as required	
	Special features		
19	Collecting Funnel	Diameter 200 mm or equivalent	
20	Calibration	Manufacturer calibration certificate is must, and a certificate from IMD for rain gauge testing is must.	
21	Insects cover provided	Insect cover on all openings to be provided	
22	Accessories	Rain Gauge Calibrator & Mounting	

4 GATE POSITION MEASURING SENSORS

Gate position sensors will be provided for accurate measurement & indication of position of all 62 Gates of Barrage (45 gates), TMLC (13 gates) and TJMC (4 gates), including gear boxes, flexible shaft couplings, reducers, fittings, connections, supports, wiring, lightning protection, flexible and rigid conduit, testing, and all required accessories. These sensors will be equipped with suitable shaft couplings and electronic circuits to transmit the signals to the SCADA System for indication in BCR & for further processing. All sensors are to be mounted at the outdoor locations, therefore, suitable protection class of the enclosures shall be ensured. Minimum IP65 protection class shall be provided. Suitable safe & reliable arrangements of coupling with the lifting motors of gates shall be provided. **It shall be ensured that there is no slippage between the motor shaft & the transducers**.

Contractor shall provide manufacturers data including model numbers, installation instructions, spare parts list, maintenance requirements, testing methods, repair instructions, and related information for the gate position sensor and appurtenances.

Technical Details

S. no.	Components and its specifications	Requirement as per RFP	Specifications offered by bidder during bid submission
	Gate Position Measuring Sensor:		
1	Type	Shaft Encoder based rotary position sensor with digital display	
2	Manufacturer	Certified by CE/UL - Reputed Manufacturer	
3	Range	0-5 m	
4	Resolution	5.00 mm or less for gate position	
5	Type of Mounting	MS Steel./High Density Plastic	
6	Type of wiring	CAT6/Any Other	
7	Casing of wiring HDPE/GI	HDPE/GI	
8	Sensor shaft coupling play	Zero	
9	Working temperature range	0 to 60 Degree Centigrade	
10	Enclosure protection class	IP6X	
11	Output Interface	SDI-12 v1.3 serial digital interface (RS 232,RS485,RS422) compatible to PLC Ethernet	
12	Humidity operation	0-98%, non-condensing	
13	Operating power	Compatible with RTU as it would be powered from RTU.	
14	Enclosure	IP65 or better corrosion resistant	
15	Common Protocol	SCADA Compatible	

INSTALLATION

1. All gate position sensors shall be installed on gate hoists at the required regulator sites. The sensor shall be installed on the pinion shaft of the gate hoist. The sensor drive shaft shall be connected to the shaft using a zero backlash flexible coupling. The Contractor shall adapt the mounting of the sensors to the existing installations. A suitable mounting plate and shaft adapter plate shall be furnished and installed for each required regulating gate hoist.
2. The bidder shall furnish and install a 2-pair instrumentation cable in accordance with - Conductors and Cables for wiring the sensor data output to the BCR.
3. The instrumentation cable shall be routed to the control building using the existing cable trench system. The Contractor will create any missing cable trench. The gate position sensor shall be furnished complete with mating connector.
4. Mounting of the sensors shall not disturb previous performance of the structures.

TESTING AND CALIBRATION

The communication between gate position sensors and PLC equipment will be tested to ensure that data acquisition is correctly made by the PLC. The gate position sensors shall be calibrated to indicate the gate position in meters.

5 SILT LEVEL TRANSDUCERS

Sl. no.	Components and its specifications	Requirement as per RFP	Specifications offered by bidder during bid submission
	SILT LEVEL TRANSDUCERS		
	Type(Source)	Laser/Light Emitting Diode	
	Manufacturer	Endress + Hauser/Siemens or equivalent	
	Measurement Range	0-100000PPM	
	Selectable Unit	FTU, NTU, g/l, EBC, PPM	
	Accuracy	0.02% FSO	

	Resolution	100 PPM	
	Type of Mounting	MS Structure/High Density Plastic	
	Type of wiring	CAT6/Any Other	
	Casing of wiring HDPE/GI	HDPE/GI	
	Protection	IP65	
	Display	Yes/No	
	Accessories offered:	Floating platform	

6 – ACOUSTIC DOPPLER CURRENT PROFILER (ADCP)

The discharge past the canal gates at head of main canal or at cross regulator or at head of regulatory can be measured by providing gate position measuring sensors and water level sensors at upstream and downstream of gates or the contractor may/shall propose measurement options for gauging such flows as an alternative to monitoring gate sensors (e.q. providing side looking ADCP) or combination of level sensor and movable ADCP). Acoustic Doppler Open Channel Online Flow Monitoring System is to be used for monitoring open channel or river discharge in real-time and output Q, V, and H (discharge, mean velocity, and water level) data directly to a data logger or telemetry system. The data logger or telemetry system is not part of this specification. The Acoustic Doppler Open Channel Online Flow Monitoring System must consist of (a) A horizontal acoustic Doppler current profiler (b) Software for system set-up, data acquisition and play back. The horizontally mounted ADCP shall be installed on a sloped bank of a channel and shall be kept in the water during normal operation. There shall be no on-site display or interface module except that as part of the data logger or telemetry system. Mounting frame or structure for the horizontally mounted ADCP shall be designed and constructed for each specific site according to site conditions and therefore is not part of this specification.

SL. no.	Components and its specifications	Requirement as per RFP	Specifications offered by bidder during bid submission
	SIDE LOOKING ACOUSTIC DOPPLER CURRENT PROFILER (ADCP)		
	Type	Side looking ADCP	
	Manufacturer	Teledyne RDI/SonTeK / or equivalent	
	Acoustic frequency	600 kHz	
	Maximum profiling range	90 m or more	
	Cell profiling	Upto 128 cells	
	Velocity range	±5 m/s (default) max ± 20 m/s	
	Water level range	0.1 to 10.00 m	
	Communications	RS-232 with SDI-12, or RS-422, RS-485 with MODBUS	
	Temperature range	-4 to 45º C	
	Discharge computation	Index velocity rating	
	Accuracy: Velocity and water level	±0.5% and ±0.25% of measured values	
	Resolution	1 mm/s	
	Power: External DC input Consumption	10-18 V DC less than 0.15W	
	Cable length	~ 25 m standard, extended length should be made available	

ADCP (**Acoustic Doppler Current Profiler) for River Profile/Discharge Measurement**

The Project Authority requires ADCPs (Acoustic Doppler Current Profiler). These ADCPs will be down-looking system that shall be used for manual stream gauge measurement. The specifications of ADCP are provided below. The ADCPs will be provided with all accessories to make measurements from a bridge, boat, tag line and from a cableway. This includes a floating platform. This equipment will be used by the Supplier and serviced by the contractor for repair due to malfunction or other equipment breakdown. This equipment will be used by the Project Authority during the maintenance transition period and stay in the possession of Project Authority at the end of the operation and maintenance contract.

- ADCP Type : Down-looking ADCP for manual measurement of discharge
- Profiling Velocity : +/-10m/s
- Velocity Accuracy : 0.25% of measured velocity
- Velocity Resolution : 0.001m/s
- Depth Range : 0.3–30 m of water column
- Depth Accuracy : 1%
- Depth Resolution : 0.001m
- Accessories : Floating platform for the ADCP
- DGPS for bottom tracking in moving bed situations
- All necessary tethers and taglines
- Real time display for instantaneous readings

7- **Solar Power with inverter and Battery**

i. All equipments and control panels **at the Master Controller** server at BCR will rely firstly on solar power charging system and battery backup except for extended operation during periods of extreme cloudiness or loss of charging system. The solar panel and battery system shall satisfy the following specifications:
Solar Power arrangement at BCR is to be installed of 10 KVA of minimum 72 hrs backup without sunshine to run all the panels and provide lighting arrangement at the BCR. The Solar Panels shall be provided in anodized aluminum frame with tubular batteries, preferably Power Solar Panel of TATA or equivalent make and Batteries of EXIDE or equivalent make as approved by Engineer In- charge after due consideration of performance of equipment. Solar panel should conform to IEC- 61730, 61215 and 61701 with inverter facility for AC/DC main power supply charging facility.
ii. Additional power backups for remote locations on the upstream of Teesta having 280 Watt Solar Power Panels (TATA or equivalent make) for Flood Warning System Remote Stations power supply located on intermediate Hub/huts with fencing and enclosure in IP 67 boxes to transmit data from remote stations. Solar regulators will also be supplied at these remote stations to regulate power and maintain optimum battery and data collection platform operation with 280 Watt Solar Panel with EXIDE or equivalent (Battery 12V solar photo voltaic system) with the capacity to provide power to all equipments associated with this hub/station. The solar panel system shall be capable of full charging the 12V battery system that has gone 20 days without charge with 2 days in full sunlight.

iii. Both the solar panels at BCR and Remote Hut/Hubs shall be capable of not only powering the equipments, but charging the batteries(Solar power with inverter charging through AC/DC for BCR and only solar power charging for Remote Hub) to provide continuous operation.

8-RF Transmitter-Tower:

One suitable RF Transmission tower with transmitter Receiver and Amplifier as needed installed at about 2.00 km upstream of Teesta Barrage in IP 67 enclosure to protect against vagaries of nature and vandalism for water level data communication with the Master controller, and provide telemetry for Flood warning System data from Remote locations in addition to GSM/GPRS.

9-Sensor: All the sensors should work with 12 Volt DC power and give 4- 20mAmp output.

10 - Specifications for Supervisory Control Equipment:

(i) Remote Terminal Unit (RTU)

RTU(Remote Terminal Unit) shall confirm following or better specifications Display	Graphic Display for viewing latest data as well as resetting stage level with Burglar Alarm Warning System
Manufacturer	Siemens/ABB/Schneider/Allen-Bradley/Mitsubishi/GE
Keypad	Either touch screen or membrane keys
Processor	32 bit desirable
Sensor Input	4 Analog Input and 8 Digital Input Input to detect battery storage (amps), solar panel charge amps Devices to detect gate opening from gate position sensors of all gates SDI-12 input, allowing connection to 10 SDI-12 devices with 5 parameters each A/D resolution of 24 bits or higher
Sensor I/O Expansion	RTU should have control Function. This includes: Control individual gate at a single station by operating relay systems in the motor control panel. Operate the alarm signals and flash lights. Output of alarm signals or limit triggers Further expansion as needed
I/O Interface	2-RS232, 1- RS485, 1 SDI12, USB Host, Ethernet Port, USB Programming port 1 input/output interface for the programming of the data collection system. Cables for programming must be included with each RTU Other I/O as needed by Computer
Time Synchronization	In Built GPS or attachment for external GPS for time synchronization
Measurement	Capability to program sensor measurement time for each sensor at different intervals as often as 1 per second up to once per 6 hours Capability to store data for each sensor at different intervals as often as 1 per 15 minutes up to once per day

Telecommunications Support	Telecommunication strategy will include both self-reporting as well as reporting as requested by Interrogation/Automation/Control software as supplied by the contractor.
Software	Unlimited licenses for programming RTU All software in English Language
Voltage	Operation 11-19 VDC RTU will survive reverse polarity connections without need for maintenance or replacement of unit If RTU power is interrupted, the platform will restart data collection automatically, and without technician intervention

11 - Gate Control Console (GCC):

The equipment is the control console fabricated in sheet metal and duly powder coated in approved shade with required switching device like contactor, ON/OFF switches, Push-buttons, Auto/Manual switch, indicating lamps, safety fuses etc. One compartment is utilized for each motor and the proper termination is done with cable entry at the bottom. Voltmeter, ammeters shall be provided for monitoring purposes. Proper ferruling should be done for easy maintenance.

Each Gate can be switched ON/OFF individually. In MANUAL mode, each gate can be opened / closed with the help of pushbuttons provided on the front panel. The proper indicating lamps should also be provided.
In AUTO mode the local operation is disabled and it will take the instructions from the Industrial Grade PC through the RTU. Proper interacting logic is provided. Gate control console will be installed for every motor at the motor end.

The Gate Control Console should be constructed in the enclosure fabricated from the CRCA sheet and treated and powder coated / painted for the outdoor use directly exposed to rain and sunlight.
The switchgears used in the console should be of suitable rating for the operation of hoist motor. The protections for the motor like over-load relay, safety fuses of required ratings should be used in the construction. The GCC should have forward, reverse and stop switches for the operation of the gate with the emergency stop switch. The GCC should have LED cluster indicator lamps for forward, reverse, overload.

Operation	Local/Remote
Data Interface	RS 485/SDI 12/compatible to RTU / SCADA
Enclosure	IP 65
Switches	Up, Down, Stop, Local/Remote
Indicator	Indicator lamps for gate operation, open /close, motor failure, gate operation limits, overload, voltmeter, ammeter
Switchgears	MCCBs, Contactors, Switchgears, Overload Protection, fuses, MCBs pushbuttons suitable for motor operation
Cables & wirings	Wiring for compatibility with RTU, Power supply/ cable glands for entry at bottom

The old existing local control panels would be repaired for redundancy. The new local control panels with VFD and RTU with gate position measuring system etc complete built into the new GCC as per specification. As the gate unit apparatus are to be connected to the BCR through wired cables, the design of cable network should involve minimum wired cable content, i.e the local control panel may club up to four gates per RTU, a group of gates for operations**.** The SCADA should be programmed to operate clubbed gates together or individually as per command.

12 - INSTRUMENT GRADE POWER AND CONTROL CABLE:

The PVC armored cables to be used on work shall be heavy duty instrument grade with copper conductor. All cable ends shall be terminated electrically by suitable lugs and provided with adequate size brass cable glands for mechanical strength.

A continuous earth wire of required size should be laid along with the cables the cost of which should not be claimed by the contractor. The cables shall be bent with radius not less 16 times dia. of the cable. The cable entering the switchgears required to have sharp bends shall be provided with connecting chambers. The cables shall be one length and no joints will be allowed. The portion of these cables to be erected on wall shall follow the following procedure. The position of cable saddles will have clearance 50 cm between the saddles.

13 - Gate Operation for Barrage:

I Automatic Mode:
The gates will be operated automatically from the commands received from BCR. The operation of gates will be strictly as per the barrage operation schedule and gate operation schedule approved by the competent authorities. While operating barrage gates, situation in the river downstream of the barrage will be taken into consideration.
In the event, when any gate causes mechanical or electrical failure, an alarm will be generated for non-functionality of the particular gate.

II Semi-Automatic Mode:
The facility to operate gates as per the current instructions from the authorities by over-riding the automatic operation is provided in the Barrage control software. This option has following various modes of operation.

III Set Level Mode:
In this mode of operation, operator can enter the particular pond water level to be maintained automatically and period for retaining the set level in the pond by releasing excess water. This operation is over-ride to the reservoir operation schedule set-out.

IV Gate openings mode:
In this mode of operation, operator can set opening for particular gate for defined time period and gate will be adjusted to the desired gate opening. After expiry of the time period, gate will be automatically set to its original position or as per the requirement of situation in automatic mode of operation.

V Discharge mode:
In this mode of operation the operator can set the discharge rate and quantum of water to be released or the discharge rate for the defined period and Barrage control software system will calculate and adjust the opening of gates to let out the desired flow. After completion of time period the system will automatically reposition the gate to its original position or as per the demands of situation in automatic mode.

VI Manual Mode:
The Barrage / Canal gates can be operated in manual mode for flood / discharge regulation. In this case, the Barrage control software will act as monitoring system and operation will be carried out by the engineer / operator at site. This facility is provided for regulation of flood/canal discharges even when the some component of the remote control system is not functioning properly.

VII Event log:
Each and every event at the Barrage site will be logged by the software system along with the password of the operator in encrypted form. The data collected from the field stations, calculated by the system will also be logged in the system along with the date and time stamp at predefined time interval. This data will be used to refine the operation and analysis.

13 – **Motor Starters: VFD**
AC motors shall be designed for Variable Frequency Drive (VFD), which shall be controlled through PLC such that the load requirement of AC electric motor is synchronized the speed of the motor.

3-phase VFD starter panel consists of SPP, MCB, OLR, Timer, Main switch of Alstom/Crompton Greaves/ Siemens/Schneider/L&T/ABB Makes including wiring and Electronic Digital Dial indicator etc.

If the contractor proposes alternative sourcing from any equally reputed manufacturers, he can propose the same with complete details, references list of successful starters supplied/installed. However approval shall be taken from Authority before placement of order with any of the manufacturer.

The Authority reserves the right to reject any or all of such proposed manufacturers, including the manufacturers named in this chapter.

14-Central Control Panel

The central controller shall be based upon modular PLC. The central controller shall be of same make as controller in RTUs. The central controller and gate RTUs/PLCs shall be able to exchange data freely and seamlessly, without requirement of any intervening hardware, apart from optical convertors. PLC shall have at least 50% extra I/Os. The RTU shall act as slave and pass-on all the I/O information directly to the central controller. The controller shall be able to communicate on open protocol such as Profinet/ MODBUS etc. with high speed. The communication should be integrated in CPU and should not require any additional cards or gateways. It should be possible to view, control and trouble shoot the PLC without requiring any software from any PC using web based protocols. Data logs should be stored inside the CPU and should be downloadable in CSV format using a web browser.

The central controller shall have non-volatile memory of at least 12MB. The central controller shall have in high immunity to electromagnetic interference according to IEC 61000-6-2 and vibrations according to EN600068-2-6.

Maximum number of gates that shall be controlled by single RTU/PLC shall be 4 or less. The RTU/PLC at gates shall be communicating to BCR through Copper Wired cables with backup redundancy in Optical Fiber Cable (OFC). It should possible to remotely program RTU/PLC from the Barrage control room.

Industrial grade optical fiber convertor shall be housed in each RTU/PLC at gates for optical communication between RTU/PLC and central controller.

15. Signal Cable Standards – Cat 5 & Cat 6

The specification for category 5 cable was defined in ANSI/TIA/EIA-568-A, with clarification in TSB-95. These documents specify performance characteristics and test requirements for frequencies up to 100 MHz Cable types, connector types and cabling topologies are defined by TIA/EIA-568-B.

Nearly always 8 point 8 connector (8P8C) modular connectors (most often RJ45 connectors) are used for connecting category 5 cable. The cable is terminated in either the T568A scheme or the T568B scheme. The two schemes work equally well and may be mixed in an installation so long as the same scheme is used on both ends of each cable.

Each of the four pairs in a cat 5 cable has differing precise number of twists per meter to minimize crosstalk between the pairs. Although cable assemblies containing 4 pairs are common, category 5 is not limited to 4 pairs. Backbone applications involve using up to 100 pairs. This use of balanced lines helps preserve a high signal-to-noise ratio despite interference from both external sources and crosstalk from other pairs.

The cable is available in both stranded and solid conductor forms. The stranded form is more flexible and withstands more bending without breaking. Permanent wiring (for example, the wiring inside the wall that connects a wall socket to a central patch panel) is solid-core, while patch cables (for example, the movable cable that plugs into the wall socket on one end and a computer on the other) are stranded.
The specific category of cable in use can be identified by the printing on the side of the cable.

i Bending radius

Most Category 5 cables can be bent at any radius exceeding approximately four times the outside diameter of the cable.

ii Maximum cable segment length

The maximum length for a cable segment is 100 m per TIA/EIA 568-5-A. If longer runs are required, the use of active hardware such as a repeater or switch is necessary. The specifications for 10BASE-T networking specify a 100-meter length between active devices. This allows for 90 meters of solid-core permanent wiring, two connectors and two stranded patch cables of 5 meters, one at each end.

iii Category 5e

The category 5e specifications improve upon the category 5 specification by tightening some crosstalk specifications and introducing new crosstalk specifications that were not present in the original category 5 specifications. The bandwidth of category 5 and 5e is the same (100 MHz) and the physical cable construction is the same, and the reality is that most Cat 5 cables meet Cat 5e specifications, though it is not tested or certified as such.

iv Category 6
The category 6 specifications improve upon the category 5e specification by improving frequency response, tightening crosstalk specifications, and introducing more comprehensive crosstalk specifications. The improved performance of Cat 6 is 250 MHz and supports 10GBASE-T (10-Gigabit Ethernet).

a. Applications

This type of cable is used in structured cabling for computer networks such as Ethernet over twisted pair. The cable standard provides performance of up to 100 MHz and is suitable for 10BASE-T, 100BASE-TX (Fast Ethernet), and 1000BASE-T (Gigabit Ethernet).
10BASE-T and 100BASE-TX Ethernet connections require two wire pairs. 1000BASE-T Ethernet connections require four wire pairs.
Through the use of power over Ethernet (PoE), up to 25 watts of power can be carried over the cable in addition to Ethernet data.
Cat 5 is also used to carry other signals such as telephony and video.
All the necessary transducers and instrumentation, terminals, contacts, cabling etc. for the above at various locations shall be provided and incorporated in the control system.
Operator stations shall include Operator's console consisting of PC of latest configuration and latest popular operating system preferably windows, with hard disk &DVD writer and colour LED (110'')/Video wall screen with push buttons for operation and video screen which indicate the gate movement. The operator shall be able to view the gate positions or any gate status with the help of graphic display in the screen.
The Operator station shall have two controllers each backing up the other so that the failure of one of the controller shall not cause any discontinuity in the control system and shall ensure that no loss of data takes place during change over. The system shall also have a printer (minimum capacity 300cps) for printing various logs, instructions and reports. Interlocking shall be provided between Operator's station and local control panels located near the individual gates.
At any time individual gates shall be allowed to be switched over from the automatic mode to local mode of operation, and vice versa, however the operation from the local panel cannot be overruled by the remote/automatic operation stage once the selector switch is set on the local position. Manually adjusted gates shall, when returned to automatic mode of operation, be adapted to their normal functioning in the automatic mode. The automatic system shall work independent of the number of available gates with the same characteristic. If all gates have been changed over to MANUAL, the master controller shall be reset so as to permit a smooth switching-over to AUTO operation.
All the input display from field including water level of pond shall be displayed at the Screen. The system shall continuously monitor the pond level and depending upon this level it shall be able to calculate the input and output discharge in to the ponding area depending upon the ponding area profile made available by the user (OPTIONAL FACILITY). In addition to this the gate opening of under sluice & spillway vertical gates should be displayed in the form of graphic display. The system shall be able to display the output discharge through under sluice & spillway gates so that operation of under sluice & spillway gates can be carried out in auto mode. This will be achieved using the standard software like FLOWCAL or other equivalents. Necessary inputs for using FLOWCAL or equivalent to calculate the

discharge through the under sluice & spillway gates will be provided by the Authority'. Formats for various reports & screen displays will be finalized during the engineering stages. The software used by the bidder should allow modifications at site without involvement of any other special software.
One uninterruptible power supply to provide continuous automatic back up to the system in case of failure of main AC power supply to BCR & all equipment shall also be provided. Solar power back up for BCR, control panel, computer, monitor and all other installations for charging of batteries in case of non availability of main AC or DC power will be provided.

(A) Automation System

CE/UL approved manufacturer's Remote Terminal Unit, RTU/PLC in IP65 enclosure having modular PLC (Plug and play type) for control & monitoring with Modular Controller and should have modular communication. The PLC should be able to communicate to the master controller on an open protocol such as PROFIBUS and MODBUS for III party etc. with high speed desired. The communication should be integrated in the CPU and should not require any additional cards or gateways. It should be possible to view, control & troubleshoot the PLC without requiring any software, from any PC, using web based protocols. Data logs should be stored inside the CPU and should be downloadable in CSV format using a web browser. It should be possible to increase the I/O handling capacity of the PLC, without changing the CPU. Maximum number of gates that shall be controlled by a single RTU shall be 4 or less. The RTU shall communicate to the central monitoring station on Optical Fibre Cable. It should be possible to remotely program the RTU from the control room. Each CPU shall be capable of interfacing with 4 no. two phase incremental encoders. CPU shall be tested to work in a temperature range of 0 degree to +60 degree Celsius. The CPU shall have integrated non-volatile memory capacity greater than 4 GB. All must be complied with IEC-611131-03 and IEC 61158(4-20Amp).

Suitable industrial grade AC to DC Power Supplies shall be mounted inside each RTU. Each RTU shall have separate power supplies for electronics and field. Both the power supplies shall be redundant.

Surge Protection Device shall be provided inside each RTU shall as per the following, to safeguard against transient & lightening surges. -Class B + C on mains input - Class D, for 24 V DC Supply.
Industrial grade Fiber Optic convertor shall be housed in each RTU for optical communication between RTU & central controller.

Each RTU shall house up to 4 no. digital drive starters rated for at least one higher sized motor and capable of operation at up to 60 degrees Celsius.
The RTU equipment shall be housed in a properly sized, weather-proof panel; Housing of RTUs' in protection standards like IP65 box etc.

(B) Tele-metering and Supervisory Control

The Contractor shall provide the digital transmitters and indications, and terminal strips via the bus system. The Real Time Data Acquisition System software should have the facility to track the non-functional sensors on daily basis and display on the web. Contractor shall provide VSAT for necessary communications of data transmission from Barrage Control Room (BCR) to remote monitoring work stations.

VSAT satellite data radio communication equipment shall meet the requirements of the regulating agencies of India. The bidder will make all arrangements for acquisition of VSAT radio frequencies (C or extended C band frequency allocation) for BCR and all Monitoring control rooms.

The GSM/GPRS data radio communications equipment shall meet the requirements of regulating agencies in India. Evidence of meeting these requirements of certification will be required as part of the bid. The GSM/GPRS technology will allow for on-demand data collection and reprogramming of the data collection platform. This functionality may be requested to be demonstrated as part of the bid acceptance process at the request of the Authority. The GSM/GPRS antenna shall also meet the requirements of the GSM/GPRS provider and regulatory agencies of India. The bidder will make all arrangements for GSM/GPRS access ground stations/modem and will include the usage fees in the operation and maintenance contract.

The bidder shall be responsible for all civil works related to the installation of the sensor/ satellite communication, VSAT, mounts, base, frames & fittings, though plan for civil work must be approved by the E,I,C prior to the acquisition, installation and commissioning of the sensor. Regardless of the sensor solution, the flows past the gates must be accurate to within 5% of the actual flow. Examples of similar installations by the bidder must be produced in the bid document with comparisons between actual and calculated discharge for the given sensor solution.

(i) Tele-metering Items

- Digital type gate position indications.
- Digital type water level indication.
- Digital type discharge indication of spillway.

(ii) Supervisory Items

Dry contacts shall be provided for signal transmission to the BCR for all alarms and indications of gate mentioned above. These shall include, but not limited to, the following:

- A.C. fault
- Common Alarm
- O/L Trip
- Open
- Close
- Stop
- Remote/Local

(C) Standards

The design, manufacture and testing of all works and installations shall strictly comply IEC publications/IEEE/BIS under IP 65 or higher and standards certified by ISRO, DRDO, Bharat Electronics, Atomic Power Station automation equipments.

(D) Automatic Reservoir Monitoring and Control System or similar equivalent control system.

The ARMAC or equivalent computing and control system along-with Real Time Data Acquisition System shall be provided in the Barrage control room (BCR) along-with license software, linked through VSAT. The Data provided in master control server at BCR should be displayed in complete explicit way (Sl units) and can be extracted in different formats at remote monitoring stations i.e. Jalpaiguri Town and Siliguri.

The local control and computing system for the under sluice & spillway shall be able to calculate the actual spillway discharge depending from pond water level and gate opening. The system is to be mounted in the equipment control cabinet (ECC).

The local computing system shall be interconnected with the latest industrial grade computer with monitor of 110 inch diagonal single screen monitor size in the BCR, from which the command for the necessary discharge, the spillway shall be provided. All signals shall be sent and received to/from the BCR. Operating system shall be OS Windows 10 or OS most compatible with SCADA.
RAM & Hard Disc would be suitable for 50 years retention in secured master server with Cloud storage or equivalent storage to be hosted by the Bidder as per direction of EIC till extended Warranty Period.

A PID-master controller shall define the required total gate opening. The positioner shall compare the required value with the total actual opening found by adding up the individual opening values, if the deviation of one or more gates from the required value is large enough, an ‘Open’ or ‘Close’ instruction shall be given to the respective gate(s). However to prevent hunting of hoist the deviation should be beyond the preselected tolerance band.

In a selection circuit the ‘open’- instruction shall be transferred to that gate, which at the time of the comparison controls the smallest opening. Similarly, a ‘close’ instruction shall be given to the gate controlling the largest opening.

For the gate selection, only the gates shall be considered, of which the manual switches are in the ‘Automatic ‘position, and where no alarm signal has been received from, the ‘open’ or ‘Close’ instruction shall remain with the selected gate, unless any of the following conditions is met:

- The required and actual openings agree and the positioner cancels the instruction, or
- The gate had previously reached its limit position, or,
- The max. Permissible deviation (pre-set difference in position between controlled gate and average of all gates available) has been reached previously.
- The selected gate is not in operating condition.

In the event of major changes in required size of opening, the gates shall be moved successively one step each, i.e. after re-setting all gates again agree within the pre-set margin in size of opening. After all available gates have reached their limit positions a corresponding signal shall be given. At any time individual gates shall be allowed to be switched over from the automatic mode to manual mode of operation, and vice versa, however, the operation from the local panel cannot be overruled by the remote/automatic operation stage. Adjustments made manually are to be automatically compensated for with the other gates by the automatic control system. Manually adjusted gates shall, when returned to automatic mode of operation, be adapted to their normal functioning in the automatic mode. The automatic system shall work independent of the number of available gates with the same characteristic. If all gates have been changed over to MANUAL, the master controller shall be reset so as to permit a smooth switching-over to AUTO operation. The system is to be designed to monitor the duration of the instruction. The monitoring is to prevent, that an instruction is maintained over a period, that is longer than a pre-select e.g. in the event of a malfunction of a gate selected by the controller, if the monitoring system is actuated, the particular gate is to be cancelled from the group of gates available for selection.
Electronic attenuation is to be included to provide against unsteady level signals.

The system should be compatible with flood fore-casting system to be provided by the employer for the monsoon period.

(E) Discharge Calculation

The discharge rate per gate is to be computed by electronic means. Water level measurement and measurement of the gate position serve as input variables. The necessary discharge rating curves shall be agreed by the Authority's Representative. The discharge rates shall be added and be displayed digitally as total water discharge rate, which shall also be recorded.

(F) Flood Alarm System

A Flood Alarm System shall be provided at BCR to communicate with rivulets Leesh & Gheesh on upstream from Barrage on Teesta River or as suggested by Engineer-in-charge and also interfaced to receive message from TLBD-IV through GSM/GPRS with the complete telemetry being a combination of GSM/GPRS, RF and VSAT to integrate with the master controller at BCR and generate Flood Warning Alarm with requisite programmable logic input. The objective of providing Flood Alarm System (blinking display as well as buzzer alarm on monitors at all stations) is to know flood discharge in advance. It shall work 24x7 hrs, sending information at least every 15 minutes to the Barrage Control Room at Gazoldoba. One Flood Alarm System shall contain one 280 Watt Solar Panel with Battery, inverter facility, Complete HIS comprising nine remote stations of Radar based water level sensor with mounting arrangement, in the absence of bridge bubbler based water level sensors may be provided along-with one RF Tower at 2.00km upstream of Barrage on Teesta at confluence of Leesh & Gheesh with transmitter to receive communication integrated with SCADA sever at BCR with all WPC clearance/licenses etc of desired bandwidth / frequency and receiver with amplifier, if needed. All the above equipment shall be suitably placed in IP67 enclosure and installed in such way that it can sustain any flood sub mergence or wind pressure. The Technical Specifications of One Radar based pond level sensor and Automatic Digital Rain Gauge are mentioned hereinabove as mentioned in clause C (i) and C (ii) respectively.

(G) Control Panel Configuration

M.S / CRCA Steel fabricated L.T. switchboard suitable for indoor floor / wall mounting installation & for controlling the above generating set.

The control panel will be equipped with.

1. Voltmeter of suitable range.
2. Voltmeter selector switch.
3. Ammeter of suitable range.
4. Ammeter selector switch.
5. Main On/Off switch / MCB
6. Set of indicating lamps.
7. Set of instrument fuses.
8. Set of current transformers.
9. Frequency meter.
10. Selector switches for Remote/Local Control.

The switch board will be complete with internal wiring, front cover, rust proof, powder coated paint and arrangement for receiving incoming and outgoing cables. The control panel shall have an automatic mains failure feature for remote automatic starting from the PLC based Control panel at the Field Station. Necessary equipment like solenoid coil etc. shall be provided for the same.

(H) Barrage Control Room

The fully furnished Barrage Control Room shall consist of one AC. control room with complete view (provided with Toughen Glass to withstand adverse weather & ground situation) of Teesta Barrage (All 62 Gates), with annexed Toilet, Battery Room, and Supervisory room. And also the first floor of Control Campus one fully furnished one Bed room. The Drawing shall be submitted within one month from the issue of Letter of Acceptance of offer and same shall be approved by Engineer-in-charge (Index map of existing structure annexed with the bid document)

SCADA-PLC Room at Teesta Barrage also known as Barrage Control Room (BCR)

The bidder will be required to install all computer systems, software and ancillary devices that are supplied as part of this tender. The Authority will provide space to install equipment at offices in Central Location.

(I) Information Technology (IT) Infrastructure

Computer Servers

Master controller at the Teesta Barrage BCR

Master controller is an industrial grade PC with USB, RS232/RS485, Ethernet Ports, OS Windows 10 or higher compatible Operating System. BCR shall have **Master controller** server with at least better performance than WIN CC / higher configuration Software developed in High Level OBC (C++, Java, VB, +net etc.) as SCADA compatible software.

Master is connected to data loggers, RTU controller through RS485 or wireless means in RTU MODBUS-PROFIBUS open protocol. LED display Unit to be connected to master controller with separate USB Port. External communication modules (for Ethernet, GSM/GPRS, VSAT) connected to another USB port.

Soft ware should mandatorily provide GUIs from Main menu with:

1. Calibration and setting of Sensor
2. Programming of Data logger.
3. Real time data monitor on GUI and LED display.
4. File creation and Storage controller.
5. External Data transmission controller.
6. RTU controller under authentication.
7. Burglar and alarm warning system controller.
8. Power status monitor and logging.
9. Motor status monitor and logging.

There will be three computer servers required, with the Master Controller placed at the BCR. These Computer servers are expected to operate the DAS software as well as all software required for the project. The computer servers will be managed and operated by the Contractor and his skilled trained experienced operators/engineers till the end of extended warranty period. The specifications for the servers are given in Table below:

Data Centre Computer Server			**Specification offered by bidder** during bid submission
No.	**Item**	**Technical Specification as per RFP**	
1.	Form Factor	• Rack Mount Server or other compatible	•
2.	Processor	• Intel XEON ES-2440 or higher compatible configuration	•
3.	DIMM Memory	• Speed: 1600MT/s RDIMMS or higher compatible configuration • 8GB RDIMM, 1600MT/s, Low Volt, Dual Rank or higher compatible configuration	•
4.	Hard Drive	• RAID 5 with Hardware Controller (software based RAID controller would not be acceptable) • 5-1TB 7.2K RPM Near-Line SAS 6Gbps 2.5in Hot-plug Hard Drive or higher compatible configuration	•
5.	Network Adapter	• 2 GB or higher compatible	•
6.	Power Supply	• Dual, Hot-plug, Redundant Power Supply/Solar Power and battery backup as compatible configuration	•
7.	Electrical Supply	• 220V AC and supply from AC distribution, Solar Power, DC of DG Set	•
8.	Devices	• Soft touch Keyboard • Optical Mouse • 110” LED single screen (combination of more than one not permitted) monitors/Video Wall with minimum 1400X1050 Pixel resolution, Luminance not less than 110cd/sqm.	•
9.	Software	• SCADA compatible as per specification and OS Windows 10/ or higher compatible.	•
10.	Accessories	• Power Cord • Rack Rail with cable management system • Power Points as needed	•

Monitor Display Screen/Video Walls

Video Walls at BCR and two other stations would be installed with the Main Controller Server linked with two other computer servers by communication module. All the three Monitor should be 110 inch diagonal screen LED of reputed brands like Sony/Samsung or equivalent with minimum 1400X1050 Pixel resolution, Luminance not less than 110cd/sqm having front access for maintenance without opening the screen. The Monitor/Video Wall shall be fed by digital rear projector having rear projection and shall be connected suitably in order to display any of the control system views. The Monitor will have hot swappable redundant lamp system to provide an uninterrupted image in case of lamp failure. The lamp life shall not be less than 8000 hrs (medians). The video wall shall be provided with all fittings, wall hanging fixtures, mounting frames, connections.

All outputs in the Monitor/Video Walls at the BCR and at Monitoring Stations at Siliguri and Jalpaiguri towns shall be displayed in SI Units/Metric System of BIS.

Computer Rack and related parts

The bidder is required to procure two full height computer racks that will hold the computer servers and UPS system.

UPS

An Uninterruptable Power Supply (UPS) will be required. The UPS must be capable of operating the computer server(s) for a minimum of 60 minutes.

Ancillary Equipments

The contractor will be required to provide ancillary equipment to the two Monitoring Centers and BCR. This equipment will include:

- 3 - Full height computer racks to hold rack mount computers
- 3 - 16-port computer switches
- 3 - Rail mounting system for server
- Cables/OFC/ Ethernet and all power points as needed.

(J) Software Procurement and Development

The contractor shall be fully responsible for development design & architecture of all customized state-of-the-art ***Supervisory Control and Data Acquisition*** (SCADA) system having all necessary features and programmed hydraulic intelligence software in accordance with the Technical Specifications with required licensed version of the development and deployment tools used. While passing on the rights (license) of using any software/software tool to the Engineer-in-charge, the contractor shall ensure that such rights are inclusive of the use of that software for development in addition to deployment. The prices quoted shall be inclusive of the cost of the licensed software required for actual running of applications including all supporting software packages, tools etc. The contractor shall be responsible for necessary configuration, customization, calibration, and validation etc. of such developed software in accordance with the Technical Specifications. The contractor must deploy the software at the places specified by the Authority and ensure smooth running of the software as per requirement fully integrated with the system. The contractor shall also provide all the necessary CD, magnetic media, operating manuals etc. at every deployment site for assuring minimum down time of the system. The contractor shall upgrade with all such developed software during the extended warranty O & M period on need basis and provide the latest versions of all such software including Source Codes, while finally handing over the facilities to the Authority. All the procurements shall be invariably in the name of the Engineer-in-charge. The contractor shall maintain the audit trail of all the modifications made clearly specifying the reasons thereof.

In addition to the testing requirements mentioned here in this Technical Specification chapter, all other aspects of the procured/developed software, eg. Usability, functionality, security, quality, extensibility, modularity, efficiency, reliability, maintainability, portability etc. will be audited and tested.

The contractor shall ensure that all reasonable security measures have been incorporated in the systems and all software, upon commissioning, is free of viruses, trapdoors, and other software contaminants, contains no software enabled with “electronic self-help”, is purged of all sample scripts and sample codes, and has had all default accounts and passwords removed or disabled.

After successful completion of the System Performance and Acceptance Test (SPAT) and before commissioning of the Facilities, the contractor shall verify all the software for interfaces with Engineer-in-charge provided data sources and contractor provided data sources and systems, validation of system databases, displays, reports and outputs using field data. Such verification shall also ensure that the Facilities are protected against unauthorized access within the trusted environment of the Teesta Barrage Automation Project, or from attacks on unsecured communication lines to remote equipments.

The prices quoted for the respective software shall be inclusive of necessary data collection, compilation and entry for testing of the software.

(K) Installation of Hardware and Software and storage of data

Installation of all hardware and software items shall be strictly as per the performance/installation plan furnished by the contractor and duly approved by Engineer-in-charge in advance. Planning of the installation works shall be made by the contractor so as to ensure the usability and functionality of the installed part(s) of the facilities e.g. Installation of communication link shall be carried out from node to node only. Unless otherwise agreed by Engineer-in-charge, all the installation works shall be carried out in the presence of Engineer-in-charge’s representative. For all data Storage for at

least 50 years secured retention, local non volatile memory, web clouds, proprietary data storage agencies link google, Red Hat, etc. to be utilized with appropriate license the cost to be borne by the bidder till the Extended Warranty Contract.

Special Terms & Conditions

The following Special Conditions is the part of tender documents. Whenever there is a conflict, the provisions herein shall prevail over those in other terms and condition of Contract.

1. Definitions

(a) The Authority is the Superintending Engineer, North Bengal Mechanical & Electrical Circle, Siliguri on behalf of the Government in the Irrigation & Waterways Department.
(b) The Contractor : The bidder

2. Inspections and Tests

2.01 The Authority or its representative shall have the right to inspect and/or to test the Goods to confirm their conformity to the Contract specifications at no extra cost all of which to be borne by the Contractor/Supplier. Technical Specifications shall specify what inspections and tests the Authority requires and where they are to be conducted. The Authority shall notify the Contractor in writing in a timely manner of the identity of any representatives retained for these purposes.

2.02 The inspections and tests may be conducted on the premises of the Authority or the Project Site, at point of delivery and/or at the Goods final destination. All reasonable facilities and assistance, including access to drawings and production data shall be arranged and to be furnished to the authorized inspectors.

2.03 Should any inspected or tested Goods fail to conform to the specifications, the Authority may reject the goods and the Contractor shall either replace the rejected Goods or make alterations necessary to meet specification requirements free of cost to the Authority.

2.04 The Authority's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival at Project Site shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by the Authority or its representative prior to the Goods shipment.

2.05 Nothing of this testing in any way release the Contractor from any warranty or other obligations under this Contract.

2.06 Any or all of the following inspection procedures and tests are required by the Authority.

i) Inspection of equipments before dispatch.
ii) Inspection of equipments at site of work before installation/commissioning.
iii) Testing of equipments at site of work after installation to ensure conformity to the specification.

3. Inspection and Testing

3.01 Shop Tests

All equipment shall be checked by the Contractor in order to ascertain its correct functioning and shall be witnessed by the Authority's representative and the Engineer-in-charge.

3.02 Site Tests

Tests to be performed shall include, but not be limited to, the following:

- Checking sensitivity of transducers, water level transmitters, shaft encoders etc.
- Checking of sensitivity of all Equipment.
- Checking of correct functioning and correct calibration of all Equipment.
- Automatic operation of the gates shall be tested "dry" by simulating various reservoir elevations at the level-sensing equipment.

3.03 Local Control Systems

It shall consist of complete set of local controls for all equipment near their installation.

All electrical equipment shall be designed for use in a tropical climate. In order to avoid operational errors and accidents, the hoisting equipment of all gates shall be equipped with an electrically operated emergency stop such that all operations of the machine are stopped on pushing of an emergency stop button.

Complete wiring of the hoist/crane electrical equipment and the control device with all cables shall be included, under the scope of Contractor.

4. Packing

4.01 The Contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration

during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit.

4.02 Packing Instructions: The Contractor will be required to make separate packages for each Schedule. Each package will be marked on three sides with proper paint/indelible ink, the following:

i) Project ii) Contract No. iii) Country of Origin of Goods iv) Contractor's Name, and v) Packing list reference number.

5. Delivery and Documents

5.01. Delivery of the Goods shall be made by the Contractor in accordance with the terms specified.
Upon delivery of the Goods, the Contractor shall notify the Authority by cable/telex/fax the full details of the shipment including contract number, railway receipt number and date, description of goods, quantity, name of the consignee etc. The Contractor shall mail the following documents to the Authority:

(i) Two Copies of the Contractor invoice showing Contract number, goods' description, quantity, unit price, total amount;
(ii) Railway receipt/acknowledgment of receipt of goods from the consignee(s);
(iii) Two Copies of packing list identifying the contents of each package;
(iv) Manufacturer's warranty certificate;
(v) Inspection Certificate issued by the nominated inspection agency, and the Contractor 's factory inspection report; and
(vi) Certificate of Origin.

The above documents shall be received by the Authority before arrival of the Goods.

6. Spare Parts

All spare parts automation to be supplied shall be interchangeable with the corresponding parts of all the Works supplied under these Specifications and shall be of the same material and workmanship. They shall be replaceable without cutting or destruction of adjacent components. Before issue of the Taking-Over Certificate the spare parts shall be checked and tested at the Site by the Contractor In presence of the Engineer. Acceptance of any spare parts will not take place before the Contractor has submitted the complete final detailed list of all spare parts and tools. All spare parts, tools and materials shall be delivered in marked boxes of sufficient sturdy construction to withstand long term storage cum maintenance.
a) Mandatory Spare Parts
b) Recommended Spare Parts

Additional automation spare parts as recommended by the manufacturer for trouble free operation of equipment for 6 years shall be stated in quantity and description in the Technical Data Sheets Orders for recommended spare parts shall be optional to the Authority for a period of six years after date of commissioning of the Project.

The Contractor may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the Contractor:

a) such spare parts as the Authority may select to purchase from the Contractor , providing that this election shall not relieve the Contractor of any warranty obligations under the Contract; and

(b) In the event of termination of production of the spare parts:

i) Advance notification to the Authority of the pending termination, in sufficient time to permit the Authority to procure needed requirements; and
ii) Following such termination, furnishing at no cost to the Authority, the blueprints, drawings and specifications of the spare parts, if requested.

Contractor shall carry sufficient inventories to assure ex-stock supply of consumables and spares for the Goods during the entire Warranty and Extended Warranty Services period and components shall be supplied as promptly as possible but in any case within time schedule specified..

7. Warranty of spares

7.01 The Contractor warrants that the Goods supplied under this Contract are with Manufacturer's warranty, unused, of the most recent or current models and those incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Contractor further warrants that all Goods supplied under this Contract shall have no defect arising from design, materials or workmanship or from any act or omission of the Contractor that may develop under normal use of the supplied Goods in the conditions prevailing in the country of final destination.

7.02 The warranty shall remain valid for **6 (six) years** from the date of Acceptance of Goods or from the date of start of operation, whichever occurs later. The warranty shall comprise complete replacement guarantee of any Electro-mechanical spares, bearings, rollers, all other parts comprising mechanical, electrical and civil works, all sensors, entire telemetry(VSAT, GSM/GPRS,RF, Rader, Broadband, Internet all equipments, Computer, Video Wall, PTZ camera ,all

other installations involving, SCADA software and all hardware, Control Panels, VFD starters, ADCP, Silt Transducer, ARG, all electrical and electronic & instruments, connections equipments, OFC, Copper wires and cables, DG sets, Solar Panels due to defects, damage, misuse, pilferage, non-functioning, found unsuitable, and no repair is permissible **within first one year after commissioning**. After successful completion of 1(one) full year of operation after project commissioning, all above such machineries except electro mechanical part spares (Gates & Hoist system, gantry, monorail Stop log, Chequered plates, Painting work etc) would be covered under extended maintenance warranty contract to be restored by repair maintenance and/or replacement as required as per contract free of any additional cost. Works like installation and commissioning of all the equipment and its trial, testing as per Technical Specifications as stipulated hereinafter. The Contractor shall, in addition, comply with the performance and/or consumption guarantees specified under the Contract. If for reasons attributable to the Contractor, these guarantees are not attained in whole or in part, the Contractor shall at its discretion with consent of EIC **make** such changes, modifications, and/or additions to the Goods or any part thereof as may be necessary in order to attain the contractual guarantees specified in the Contract at its own cost and expense and to carry out further performance tests.

7.03 The Authority shall promptly notify the Contractor in writing of any objection arising under this warranty.

7.04 Upon receipt of such notice, the Contractor shall, within the period as specified and with all reasonable speed, repair or replace the defective goods or parts thereof, free of cost at the ultimate destination. The Contractor shall take over the replaced parts/goods at the time of their replacement. No claim whatsoever shall lie on the Authority for the replaced parts/goods thereafter.

In the event of any correction of defects or replacement of defective material during the warranty period, the warranty for the corrected/replaced material shall be extended to a further period of 18 months.

The period for correction of defects in the warranty and Extended Warranty Services period is *2 (Two) Working Days from the date of intimation*. If the Contractor fails to remedy the defects within 3 Working Days of notification, the Authority, at its discretion, shall deduct from security deposit at the rate of Rs.500/ Sensor/any supplied material/ day for the first 30 days and at the rate of Rs 2000/Sensor/any supplied material/Day thereafter, from the date of notification till the date of setting right the defects or replacing the good with equivalent new Goods.

The Contractor's including Manufacturers Guarantee & Extended Warranty covers the use of the Goods and Services on Teesta Barrage, at Gazoldoba, PS Mal & Rajgunj, District Jalpaiguri in West Bengal in India.

7.5 **System Performance Criteria**

In general, the response to any query from Barrage control room will be immediate and will not exceed three seconds for any response where no computation or wide area networking is involved.

The following performance parameters must be strictly maintained.

7.5.1 Average uptime – 99.5% for 24x7 operations

7.5.2 MTBF (Mean Time between Failures) for individual units - 6 months

7.5.3 MTTR (Maximum Time to Repair) when the system is down as per definition given below:

- 3(Three) hours during rainy season (June - October)
- 6 (Six) hours during the rest of the year.

Note:

Computation of Down time:

The System will be considered to be down under any of the following conditions:

A. Control for more than 2 (two) Teesta Barrage Spillway Gates are down at a time
B. Control for more than 1 (one) Canal Gate on TMLC Head Regulator are down at a time
C. Control for more than 1 (one) Canal Gate on TJMC Head Regulator are down at a time
D. Control for more than 1 (one) Canal Gate on TMLC silt ejector are down at a time
E. Control for more than 1 (one) Under sluice portion of Teesta Barrage Gate are down at a time
F. Monitoring of Water Level at Teesta river is down for more than three (3) hours
G. Monitoring of Water Level at 2 km upstream of Teesta Barrage is down for more than 8 (eight) hours.
H. Monitoring of any other parameter as defined is down for more than 24 (twenty four) hours.
I. Remote Monitoring of Barrage from Barrage Control Room at Gazoldoba or at Siliguri and Jalpaiguri are down for more than 3 (three) hours.
J. Any particular hardware or software functionality defined in technical specifications is down for more than 48 (Forty eight) hours.

Unless otherwise stated, Control/Monitoring as referred above will mean Monitoring or Control from Barrage Control Room (BCR) at Gazoldoba.

The real time Data Acquisition System Software should have the facility to track the all non-functional sensors on real time basis and display by blinking on the monitor /Video Wall at BCR. Due to non-functioning sensors beyond minimum recovery times, daily basis charges as penalties would be recovered from the contractors monthly maintenance bills during entire Defect Liability Period and Extended Warranty period @Rs 1000/ per day per sensor for first 30 days after

maximum restoration time of 48 hours and then @2000/ per sensor till it is completely replaced as per original specifications and starts functioning.

8. Performance Security

The amount of performance security of the above work is amounting to 7.5% of the contract price. At the early stage bidder will deposit 2% of estimated cost (early defined) through online system of e-procurement/e-tender (RTGS/NEFT) option. The rest of 5.5% will be borne by the bidder in the progressive bills up to the completion of work with reference to the contract price of the bid.

After successful completion of one year defect liability period security deposit will be release in such a way for which lump sum amount of Rs.50 Lakh would be retained by the Authority' for next 5 (five) years of defect liability period. Each year security release will be in pro-rata basis of 10 Lakh i.e. 10.00 Lakh per year if bidder performs satisfactorily as per existing contract rules.

Extended Warranty Maintenance

The bidder will be responsible for the free on-site maintenance (with free replacement of parts) of the entire system as defined in sections 5-10 during the warranty period.

8.1 Spares

8.1.1 Spares to be included in the Bid price and Bid evaluation

1. Critical Subsystems like Gate Position Sensing Unit, Gate Control Unit/RTU, Sensing Instruments etc. which are not for installation but for immediate replacement at subsystem level in case of failure.
2. Critical high usage components (not entire subsystems) which will be used for field level repair. This may include Gate Control Parts, Gate Position Sensors, communication components, connectors etc.

Note:

The bidder shall decide components and subsystems to be stocked as spares in the Barrage Office on the basis of MTTR (Maximum Time To Repair) figure quoted in section 4.6.3

8.1.2 Spares to be quoted but <u>not</u> to be included in the Bid price and Bid Evaluation

1. In addition, the Bidder must submit a complete list of recommended spare parts at Subsystem Level as well as Component Level, which will be <u>ordered separately as and when needed.</u>
2. Price quoted must be valid for 5 (five) years from the date of Final Acceptance of the system.

9. Training:

The designated officers, staff or operators of the Authority and his authorized Technical personnel shall be trained by the Contractor to enable them to effectively operate the total system. Suitable training handouts / manual shall be given to each of the Trainee. The training schedule shall be agreed to by both the parties during the Performance of the Contract. The details of the trainings are specified as below.

The Contractor shall impart training to 'The Departmental staff for Operation, safety, security of each of equipment stalled free of cost within the guarantee period and also in the EXTENDED FIVE YEAR WARRANTY PERIOD.

9.01 Training

9.01.1 Training Programme

The Bidder is required to provide an extensive training programme for the system. The training set forth in the following paragraphs is a minimum requirement and the bidder should propose any additional training that he considers critical for long term success of the system operations.

The Bidder is expected to provide an outline or table indicating the contents of each of the required courses. The table shall describe the specific topics to be covered for each day of the training period.

The Bidder is responsible for the salaries of the training instructors and all training materials. The costs of travel, transportation and per diem for the trainees shall be borne by the Authority.

9.01.2 Training in General Operation

Training shall be provided by the bidder in several phases. The training shall include both classroom and field trainings and will be continued during all five years. The bidder is required to have hydro-meteorological equipment specialists. The training shall include:

Table: Formal training courses

Sl. No.	Description	Numbers of Training sessions/Year	Number of Participants per Session
1	Users Training Course for senior management.	2	6
2	User Training Course for working staff.	3	10
3	Operation and Maintenance course. Course topics will include sensor calibration, data logger configuration, data downloading, data retrieval, collection, compilation, processing, maintenance requirements, and procedures for equipment configuration, installation, site testing and Commissioning.	3	10
4	Design, operation and maintenance of the database at Central Data Centre (Siliguri/Kolkata) and Teesta Barrage control room including back-up, recovery and web-services.	2	5
5	Specialized Training for Maintenance Technicians on O&M	3	10
6	Theory and practice of discharge measurements, and Development of rating curves.	2	10
	Total no. of sessions of training courses	**15**	

The training course will take place at Siliguri, Jalpaiguri and Gazoldoba at Teesta Barrage site *or as decided by the Authority*. In case of formal training, the Authority will provide classroom and other logistics. The Bidder will facilitate the professional and the training materiel. On-the-job training will be provided by the Bidder in conjunction with the installation of hydro-meteorological stations and during the course of maintenance as required.

The Bidder shall prepare a training course plan and include the same in the Bid Document. These trainings will be repeated every year during warranty and annual maintenance periods for refreshing the trained staff and training additional staff.

The classroom training, hands on experience and troubleshooting will be prepared as video for easy access and will be posted on the web. All training modules will be also provided as a media file (Windows Media Player Compatible) on a USB Drive. Five copies on five separate media shall be required

A On-Job Training

On-job training will be provided by the selected Bidder during installation of the SCADA system and Field Instruments and also during the course of maintenance and operations of the system as required.

B Training Video

The classroom training and hands-on experience of troubleshooting will be used to prepare a video and will be posted on the web for easy access. All training modules will also be provided as Windows Media Player compatible media files on a USB Drive. Three copies on three separate media shall be required.

C Location and Logistics of Training

The theoretical training will take place in Gazoldoba or Siliguri as decided by the Authority. On-job training will be at Gazoldoba, except for operation and maintenance of ADCP, which can take place at Oodlabari.

Authority will provide class room and other logistics.

9.01.3 Operation & Maintenance Manual

The Bidder will provide complete Operational & Maintenance Manual for Operating Teesta Barrage Gates through Auto Mode as well as Manual Mode in a Hard Covered Booklet Form also in Soft copy in 4 sets. Operation Manual would be framed on the basis of Departmental Guidelines for Teesta Barrage Operation, Existing Booklet of Barrage Operation and recommendations of the High Power Technical Committee on Teesta Barrage. The SCADA-PLC system software should contain provisions for future modification of systems of gate operation and up gradation.

10. Technical Documentation:

Technical Documentation involving detailed instructions for Operation and Maintenance is to be delivered with every unit of the equipment supplied. The Language of the documentation shall be in English.

11. Standards & Specifications

The Goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications, and, when no applicable standard is mentioned, to the authoritative standard appropriate to the Goods' country of origin and such standards shall be the latest issued by the concerned institution.

Materials: All materials and components supplied by the manufacturer shall conform to the requirements of the latest relevant Indian Standard. In the absence of the Indian Standard for any material other specifications, mutually agreed to between the Authority and the Contractor, may be used. For important components, manufacturer's test certificate needs to be furnished.

12. Discharge Calculations

The discharge rate per gate is to be computed by electronic means. Water level measurement and measurement of the gate position etc. serve as input variables.
The necessary discharge rating curves shall be agreed with the Authority's Representative. The discharge rates shall be added and be displayed digitally as total water discharge rate, which shall also be recorded.

13. Registration

Registration and recording of all available values shall be in the BCR (Barrage Control Room), provided by the Contractor.

14. Manufacturer

Only CE/UL certified Sensors, RTU/PLC, Sensors shall be used. The Remote Control system is to be sourced from a world-renowned designer cum manufacturer.

Following manufacturer's names are given as standards for use in this Project as pa reference:

PLC	Siemens / Advantech/ Allen Bradley / ABB / Schneider
SCADA	Siemens / Advantech/ Rockwell / Schneider
Water level Sensor	Siemens /P+F/ ABB
Isolator	Siemens /BCH/C&S/GE
Switch Disconnect or Fuse	Siemens /BCH/C&S/GE
Fuses	Siemens /GE
MCB	Merlin Gerin / Legrand / Siemens
Contactor	Telemecanique / Siemens / BCH / GE
Overload Relays	Telemecanique / Siemens / BCH / GE
Auxiliary Relays	Telemecanique / OEN / Omron
Push Button	Essen / Telemecanique / Siemens
Indicating Lamps	Essen / Telemecanique / Siemens
Selector Switches	Telemecanique / Siemens / Kaycee
Terminals	Phoenix / Connectwell/ Wago
Plug & Sockets	BCH / Legrand / Telemecanique
Indicating Instruments	AE / MECO / Selecton / Cabs Electra
Control Panels Cables	Finolex/KDK/Lapp
Armored Cables	Havells / Gloster / Polycab / KEI / Rallison
Fiber Optics Cable	Molex/ Finolex
Encoders	Wachendroff / Renishaw/ Scancon / Telemecanique /P+F
Limit Switches	Telemecanique / BCH
SMPS	Siemens / Telemecanique / Schneider / Wago / EAPL
UPS	Libert / APC
Computers	HP/ Lenovo / Dell / Acer
Printers	HP/ Epson/ Cannon
Switch Gear	Siemens / L&T

If the bidder proposes alternative sourcing from an equally reputed and expert Remote Control System manufacturer, he

can propose the same with complete details, references, lists of successful Remote Control Systems supplied/installed. However approval shall be taken from Employer before placement of order with any of the manufacturer.

The Engineer-in-charge reserves the right to reject any or all of such proposed manufacturers including manufacturers named above.

15. Site Inspection and Tests

During erection, commissioning and trial operation, the Contractor shall organize at suitable intervals all inspections and tests in the presence of the Engineer in order to prove the orderly execution of the works in accordance with the Contract. Unless otherwise specified, all costs for testing at site and of the works and charges associated with it shall be borne by the Contractor. This includes the measuring devices, properly calibrated, and any pertinent accessories which shall be made available by the Contractor for the entire duration of the tests. The Contractor shall delegate his experts to supervise the tests at site.

1. Running tests
2. Overload tests

All such tests and checks shall be performed in the presence of the Authority's Representative. If not satisfied with the performance of the tests and checks, the Authority's Representative shall have the liberty to ask for additional tests or repetition of same. The testing at site shall be complete in every respect to prove the successful performance and operation of all the works and works supplied and erected under the Contract. For the procedure of inspections and test at site, notice to the Engineer, reports, commissioning, trial runs and trial operation, and acceptance tests as per guidelines & Conditions.

16. Commissioning and Trial Run

After the Contractor has notified the Authority's Representative and received his agreement that the equipment is ready for the commissioning tests, the Contractor shall start with the tests as stipulated in the Conditions of Contracts.

The tests shall comprise of the following stages:

a) Pre-Commissioning Tests
b) Commissioning Tests
c) Trial Runs

During the trial operation period, the Contractor may request any minor adjustments which do not in any way interfere with or prevent the use of the equipment by the Authority or result in reducing the output or decreasing the efficiency. If any failure or interruption occurs in any portion of the equipment covered by the Contract due to, or arising from faulty design, materials, workmanship (but not otherwise sufficient to prevent full use of the equipment) the trial operation period is to recommence after the Contractor has remedied the cause of defect. Immediately upon termination of commissioning of a part or section of the Permanent Works which can operate as an independent unit a "Certificate of Suitability for Operation" shall be issued by the Engineer in charge.

This document shall be signed by an authorized representative of the Authority, the Engineer in charge and the Contractor.

This Certificate shall state:

- the Contractor of the Works concern
- the quantity and type of Works concerned
- the conditions of commissioning
- the names of the participants
- the date of commencement of trial run
- the list of minor defects, if any

During the trial run, the Contractor shall make familiar the Authority's personnel with the properties, the operation and maintenance of the Works and its auxiliaries to such extent that thereafter the duties can be assigned to the Authority's trained personnel.

17. Flood Alarm System

1(one) Flood Alarm System (blinking and buzzer type display on video monitor) shall be provided at BCR communicating with nine remote stations (where water level sensors are placed) upstream of Teesta Barrage and at the confluence of River Teesta with Leesh and Gheesh rivers at locations identified by the Engineer-in-charge. Upper reaches river Teesta discharge and inflow data would be provided by authorities of TLDP-IV of NHPC at about 40 km from Barrage (no separate telemetry required) through sms/text in GSM/GPRS modes which is to be integrated with the Master Controller in SCADA software by suitable programmable inputs. The objective of providing Flood Alarm System at BCR is to know flood forecast in advance. It shall work 24X7 during monsoon in particular, and shall send information every 15 minutes from TLDP-IV to Barrage Control Room and Command/ monitoring stations at Siliguri & Jalpaiguri. The

Flood Alarm System shall also contain 280 Watt Solar Panel with Battery backup, RF Transmission Tower, Transmitter and Amplifier transmitting data in dependable C or extended C band frequencies (WPC license and frequency allocation to be obtained by the Contractor) and Receiver with amplifier as needed. All the above equipment shall be suitably placed in IP 67 enclosure and installed in such way that it can sustain massive flood related inundation or submergence and wind pressure. The complete telemetry should be a combination suitably interfaced with the Master Controller server.

18. Operation & Maintenance

After commissioning, the contractor shall be responsible for operation of Teesta Barrage gates, Head Regulator gates through SCADA software from Master Controller at (BCR) I.e Barrage control room as well as local control panel round the clock for one year guarantee period and further five years extended warranty period for hazard free continuous operation. All associated costs containing all spares, fitting, wirings, connectivity shall be part of the bidding price and bidder will submit year wise cost for operation & maintenance, if necessary replacements, charges of Satellite rent, licenses, GSM/GPRS. The contractor would also guard the equipments, machineries & installation of the SCADA-PLC Automation including BCR equipments & monitors against theft, damage vandalism and pilferage.

The operation of Barrage shall have to managed in three eight hourly shifts per day, and two operators in each shift for continuous monitoring of the barrage. The operators shall have to well acquaint with automatic system, hardware, network configuration and installed software. Two person of each shift shall be responsible for operation of the barrage and they will sign daily in each shift in Registers of the Engineer in charge or his representative for daily attendance records & in case of emergency i.e. power failure, earth quake and all such Force Majeure.

The bidder shall also be responsible for maintenance of the barrage (sensors, PLCs, software, RTUs, inter phasing components, VSAT communications etc.) during guarantee period and Bidder will submit a list of spare parts and its prices which may utilize in case of damage or breakdown of parts after Guarantee period of one year. The cost of all spare will be borne by the Contractor during warranty period to be included in the bid price by the contractor. The bidder will submit duty roster chart to Engineer in charge of operators followed by attendance sheet for each shift. All cost of operational staff shall be inclusive of bid price and which shall have to be quoted each year wise in the e-bid submitted.

The Bidder will provide sufficient protection and shall be responsible for any loss or damage of PLCs, Sensors or other soft electronic parts during mechanical maintenance work or painting if carried out during first year Guarantee period or further 5 year extended warranty period.

The bidder will allow 'The Departmental staff endorsed from concerned authority for taking as on job training during barrage operation by the operational staffs engaged by the Bidder.

19. Spare Parts & Tools

All spare parts to be supplied shall be interchangeable with the corresponding parts of all the works supplied under these Specifications and shall be of the same material, quality and workmanship. They shall be replaceable without cutting or destruction of adjacent components. Before issue of the Taking-Over Certificate the spare parts shall be checked and tested at the Site by the Contractor In presence of the Engineer-in-Charge.

Acceptance of any spare parts will not take place before the Contractor has submitted the complete final detailed list of all spare parts and tools. All spare parts, tools and materials shall be delivered in marked boxes of sufficient sturdy construction to withstand long term storage cum maintenance.

a) Mandatory Spare Parts
b) Recommended Spare Parts

Additional spare parts as recommended by the manufacturer for trouble free operation of equipment for 6 years shall be stated in quantity and description in the Technical Data Sheets. Orders for recommended spare parts shall be optional to the Authority for a period of three years after date of Contract award

20. Guarantee and extended warranty

All the equipment supplied, installed and erection and automation work shall be guaranteed for full replacement for 12 months from the date of commissioning and repair, maintenance and if unavoidable replacement warranty for next 60 months. For any accidental incident or malfunctioning of components the contractor/bidder will be soul responsible in the guarantee/extended warranty period for new replacement of the spare, components, software or connecting cables etc. so as to smooth and hassle free automation operation of the barrage gates.

21. Defect liability period-extended warranty period

The Automation of Gates shall be maintained by the contractor, for the period of 5(Five) years or 60 months after first 12 months of guarantee period. During Defect Liability period of first 12 months after completion of project, the contractor shall completely replace any equipment, spares within a maximum period of 48 hours from reporting of the incident. For the extended warranty period from start of 2nd year after project completion, the contractor shall be bound to repair as per original standards quality and performance all spares, equipments, machineries of SCADA-PLA system, including control room installations, river installations, gauges, radars etc. and hence quote the cost of defect liability accordingly in the extended warranty period from, 2nd to 6th year, separately in BOQ. During extended warranty period the contractor shall ensure quality, performance and if necessary, replacement of damaged, ragged or theft equipments in connection

with the automation work as per Technical Specifications and all commitments as per the Contract. **If any replacement or maintenance is required the bidder has to done the work within 48 hours from the reporting time of the incident.**

22. Schedule of Work and Progress Reports

22.01 Schedule of Work

The time and the date of completion of work as stipulated shall be deemed to be the essence of the contract. The Contractor shall submit a detailed programme for all the activities to perform the work as per the Contract. The schedule will be in the form of a detailed CPM network consisting of adequate number of activities covering various key phases of the works such as designs and drawings, procurement, manufacturing, shop assembly and shop painting. This network shall also indicate the interface facilities to be provided by the Authority, if any, and the dates by which such facilities are needed.

The Contractor shall so organize his resources and perform his work as to complete it not later than the date agreed to by him. The time for completion of the supplies contracted for, shall be reckoned from the date of award of supplies to the Contractor.

During the performance of the contract, if in the opinion of the Engineer-in-Charge proper progress is not maintained, suitable changes shall be made in the schedule to ensure proper progress.

22.02 Progress Reports

The above CPM network shall be reviewed and periodic reports shall be submitted by the Contractor as directed by the Engineer-in-Charge before initiating the procurement/fabrication, the Contractor shall submit a detailed list of items/materials to be bought out from outside agencies/fabricated at his or any other supplies. The list should be exhaustive and should serve as a check list for reviewing the progress from time to time. It shall be obligatory on the part of the Contractor to submit a detailed monthly report by 7th of every month (for the previous month) giving the progress of the following activities:

1. Designs and Drawings of complete assembly to be submitted to the Engineer-in-charge within one month of issue of Letter of Acceptance.
2. Procurement of materials and bought out items.
3. Fabrication of various assemblies and sub-assemblies indicating detailed status of fabrication of critical items involved and expected date of completion.
   i) Stages of shop assembly.
   ii) Shop testing
   iii) Dispatch of materials.

23. Drawing Submission by bidder

The complete design along-with each components drawing and complete Architecture of SCADA, shall be submitted within 30 days from the issue of Letter of Acceptance to Engineer-in-Charge. The Contractor shall also submit the architecture of SCADA in their Bid mandatorily as Appendix-III. The whole system model should be described with schematic diagram. Communication Model should be described with schematic diagram and flow chart with interface description

24. Submission of Following Documents

Bidder shall submit details of following works on separate sheets for each of them, for evaluation of Bids along-with their offer:-

(1) Warranty Related Services
(2) Software Licenses
(3) O&M Staff details
(4) Training to the 'The Departmental Officers & staff
(5) Installation and Commissioning Services
(6) Calibration and Tool Kit
(7) Manual and Documents of all the components to-be supplied
(8) Mandatory Spare Parts
(The prices as to-be quoted in BOQ shall include all the prices of above services/Software/equipments, staff, permits and taxes).

25. OTHER PROJECT SPECIFICATION & REQUIREMENTS

All Goods materials to be incorporated in the supply be new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials unless provided otherwise in the contract.

Wherever reference is made in the Technical Specifications to specific standards and codes to be met by the goods and materials to be furnished or tested, the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are

national or relate to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be acceptable.

25.1.1 Plan and Schedule to be provided

A project execution plan in CPM network shall be provided after award of award of contract commensurate with project completion schedule, specification and sub components of project, including system design block diagrams, a list of critical engineering activities, a manufacturing and delivery schedule, the proposed training programme, as well as guidelines and standard drawings for the works.

26. General Specifications

26.1 Specifications and Models Offered

The specifications offered by the Bidder will be part of the Contract between Authority and the selected Bidder, and will be used by the inspection authority to verify compliance on delivery. All Goods supplied shall be new, unused, and of the most recent or current models, incorporating all the latest improvements in design and materials used.

26.2 Software and PTZ Night vision Camera Feed

The software to be procured at this stage includes all functionalities required for the configuration, control and operation of all network components (sensors, RTUs, PLCs telemetry system etc.). Features required at the data processing centre include real-time data decoding, processing and storing of incoming messages, database management, basic statistical, graphical and reporting capabilities as well as data conversion. An appropriate software solution will be developed and implemented. The software provided by the bidder must be open for integration with the specialized software package to be developed and the bidder must provide sufficient database documentation and user rights for this purpose.

Data Acquisition Software (DAS)

There is a requirement for two Telemetry Based BAS software package to be installed by the Bidder at Central Location. The DAS must be capable to providing the following:

- Collection of Telemetry data from the Telemetry receiver (to be supplied by the bidder as part of the bid).
- Telemetry DAS software will come free of annual licensing charges, such that it can run indefinitely without incurring further expense.
- No cost for software upgrades through the Warranty and Maintenance period.
- Ability to set alarm thresholds and issue SMS text. There must also be an ability to send email to any number of stakeholders, based on either a single condition of multiple conditions.
- Ability to automatically enter rating tables that are produced by the time series processing software.
- Ability to export the data in xls or xls format as well as in text format. The text format shall be in conformance to Agency standards. The export facility must be one that can be run automatically to feed another system (hot drive), such as the DSS or forecasting system.
- Colour map display of stations and alarm related data that is automatically updated as data is received. Colours of station data on the map will be user programmable based on the requirements of the user. A simple interface to programme the display must be available.
- Ability to move data from the Master Controller computer server at BCR to the Cloud or equivalent server.

Time Series Processing Software

Time series processing software is required to perform quality control and develop rating tables. The software is required to have the following capabilities:

- Graphical and Tabular viewing facility
- Real-time and historical trending of data
- Data exporting features
- Multiple data base feature (it is required to keep the raw data as well as the processed data, but in separate tables of the data base)
- RDBMS Microsoft SQL Server or MySQL
- Automatic and Scheduled reporting features
- Diagnostic report
- Development of rating curves
- Statiscal capabilities
- Manual data entry and input programmes
- Printing graphical and tabular data
- Data Aggregation (e.g hourly totaling by basin)

PTZ Night Vision Camera to monitor and record Teesta Barrage operation:

Installation, commissioning and tria-run of 4 no. of PTZ Night vision Cameras of Sony/Cannon brand with NVR GW

Security 16CH independent PoE 5MP NVR 4TB Network Security System with 12 HD 1920P 2.8 12mm Manual Varifocal Lens 64PCs IR LED Waterproof IP Cameras or equivalent of 50 Mega Pixels including storage of recording with 240° rotation screen resolution compatible to with stand harsh environments for 24 X 7 monitoring**.** It may be video stream pictures to all Monitoring Stations & BCR by Internet Broadband/GSM-WB SWAN. The CCTV may be viewed using VSAT links. (CCTV at Teesta Barrage Bridge and WB-SWAN at Siliguri and Jalpaiguri stations installed already existing commissioned separately by Authority)

Legal Issues and Intellectual Property Rights

All hardware and software supplied will be legal and without any dispute on intellectual property rights. The Bidder indemnifies the Authority against any legal issues that may arise out of usage of any part or the whole supplied system.

26.3 Lightning Protection at Teesta Barrage, BCR, Monitoring Stations and Remote Stations

All sensors, data loggers and other equipments shall be suitably protected as required against all interferences/damage and guarded against pilferage. Equipment for lightning protection, such as conductors and ground rods, are part of the station equipment to be supplied strictly as per highest protection standards and markings.

26.4 Accessories and Tools

All accessories, tools and fixtures required for installation and dismounting/ remounting of the equipment shall be treated as a part of the supply for each type of equipment. Devices and instruments required for sensor re-calibration shall be offered separately.

26.5 Documentation

The bidder must submit full documentation, including user's manuals and guidelines for operation and maintenance in English, for all equipment and software components supplied.

In addition a project-specific system operation manual has to be prepared, including

- Specific equipment layout;
- A procedural handbook;
- System block diagrams (logical connections);
- Wiring diagrams;
- Interface specifications, including communication protocols and configuration modes; and
- Software licenses.

The documents will also be transformed in to web-based helpline. The manual shall be provided both as hardcopy (5 copies) and on CD-ROM.

26.6 EQUIPMENT ENCLOSURES AND HOUSING OF DESIRED IP MARKINGS NOT LESS THAN IP65

INSTALLATIONS

A. The PLC/RTU and Communication System Equipment (CSE) cabinets shall be installed in the Barrage Control Room (BCR). The Remote Monitoring Unit (RMU) cabinets shall be installed in the cabins housing the RMU.
B. The CSE cabinet shall be installed in the BCR building or as as directed by the Authority.

PLC/RTU cabinet protection etc.

A. The factory fabricated cabinets shall be used for housing the PLC/RTU and other equipments, interposing relays, selector switches, terminal blocks, transient protection equipment, instrument power supplies, wiring, wiring gutters, power distribution equipment, and uninterruptible power supply (UPS) equipment as required for the complete communication system equipment design.
B. The Communication System Equipment cabinets shall be used for the communication system equipment (switches etc.), fibre optic termination equipment, if any, WAN equipment, LAN equipment, power supplies, VSAT equipment, etc. as required for the complete communication system equipment design.
C. The contractor shall supply and install Remote and Monitoring Unit (PLC/RMU), Remote Control and Monitoring Unit (RCMU) cabinets in buildings located at BCR site. The cabinets shall be furnished in accordance with these specifications and the latest applicable Indian standards, codes or specification.
D. The contractor shall also supply and install Communication System Equipment cabinets in the BCR and other two monitoring sites. The cabinets shall be furnished in accordance with these specifications and the latest applicable Indian standards, codes or specification.
E. In case, a RMU cabinet has to be installed outside of any building, it shall be rated IP65 with double door construction.

DESIGN FEATURES

A. RTU/PLC Enclosures / Housing boxes of protection protocol of IP65 and above

1. Factory fabricated to requirements, lockable doors, dead-front, self-supporting.
2. Cabinets shall consist of a rigid self-supporting structure constructed of not lighter than 2 mm thick, cold rolled, stretcher levelled sheet steel, braced rigidly where required with structural members. Panels and

doors shall be constructed of the same weight and type of material as the housing. Housings, including doors and panels, shall show no evidence of warping, weaving, or distortion upon completion of installations. Edges shall be bent to 0.5 cm radius.

3. All cable entry in to the panel shall be form bottom using cable glands of adequate size.
4. The panel shall be provided with forced fan cooling system as a standard
5. The internal panel layout must be designed considering proper approach to the PLC, instruments, relays, terminals and other accessories for maintenance
6. The Cubicles should in sheet steel construction, free floor mounting with front and back access. The doors and side covers should be of 2- mm thick sheet and all load-bearing members are 2 mm thick.
7. Arrange doors with for minimum 105 degrees open position and with stops. Construct doors so that they neither weave nor warp; provide stiffening members where necessary to ensure rigidity. At RCMU sites, Remote Control and Monitoring Unit shall be installed in the front door.
8. Provide ample duct space for adding and removing wiring from the top.
9. Dimensions - W x D : 600 x 800 (in mm)
10. Lock System: Slam lock /Screw Fixed - with common key or unique key
11. The cabin shall be provided with power distribution units with sufficient number of sockets to provide power to equipments hosted inside the cabin
12. Exterior panels shall have no drilling or welding for attaching wires or devices on interior where holes or fasteners would be visible from exterior and shall not have butt joints.
13. Provide channel base for mounting.

B**. Equipment Arrangement**:

1. Wiring ducts to provide easy access for inspection and maintenance.
2. Design and arrange ducts and terminal blocks to accommodate bottom entry to cabinet for control, alarm, status, power, and instrumentation cables, as required.

C. Ground Bus

Provide continuous copper bar ground bus, size not less than 6 mm by 25 mm along the full length at the rear of the panel.

D. Nameplates

1. Engraved 20-gage metal/baked enamel or phenol plastic, black background/white letters, drilled for screw mounting with round head screws.
2. Provide nameplates for all equipment, instruments, power supplies, relays, circuit breakers, fuses and other devices furnished and mounted in the cabinet.
3. Provide nameplates for each device on panel interior and exterior door.
4. Submit size, type, and wording for AUTHORITY's approval. All nameplates shall be in English and Bengali.

E. Terminal blocks

1. Terminal blocks for switchboard control wiring shall be DIN rail mounted screw clamp type, rated not less and 600 V.
2. Provide white or other light-colored markers to the terminal block, for terminal designations.
3. Make no more than two connections at each terminal point.
4. Confine switchboard internal wiring to one side only of the terminal block. The other side shall be reserved for incoming leads.
5. Twenty percent of terminal points in each panel section shall have no connections and shall be designated as spare terminals.
6. Form control wire bundles without sharp bends and support adequately.

INDICATING LAMPS

The indicating lamp assemblies shall be a heavy duty oil-tight transformer type with color caps. Indicating lamps shall be suitable for 240 V ac, utilizing long life incandescent type lamps.

LIGHTED PUSHBUTTONS

Each lighted pushbutton shall be mechanically interlocked, illuminated type. Lighted buttons shall be the recessed guarded type to preclude inadvertent operation. Gate control lighted pushbuttons shall be furnished with a flasher so the lamps will blink at a 1-second on and off rate when the maintained pushbutton is operated.

PUSHBUTTONS

Each unit shall be a maintained contact type. Pushbuttons shall be the recessed guarded type to preclude inadvertent operation.

CONTROL SWITCHES

A. Heavy duty cam operated type with silver-to-silver contacts. The contacts shall have positive contact opening and closing action through cam pressure at each position and shall operate with a positive wiping action. Switches shall

be provided with barriers between adjacent contacts and insulated cover to meet standard requirements for panel mounting.

RELAYS

A. Auxiliary relays: The auxiliary relays shall be in accordance with IS standards, and shall be machine tool or industrial type. The relays shall have convertible contacts and shall be self-resetting. A minimum of two spare contacts shall be furnished on each relay.

FUSEBLOCKS

Control and metering circuits requiring fuses shall have the fuse holders conveniently mounted on the inner termination section of the panel. The fuse holders shall be of latest design and of suitable rating. Each fuse holder shall be furnished with an appropriate nameplate which identifies the protected circuit.

Other arrangements and types of fuses and fuse holders may be furnished with the approval of Authority.

AERATION

Aeration will be made by the means of a vent in front door, raised top and fan.

SPECIAL TOOLS

The contractor shall furnish any special tools that may be required to allow proper connections of wiring to devices and all terminal blocks. Two sets of all such tools shall be furnished the Authority.

SURFACE FINISH

CABINET HAS TO BE NANO-CERAMIC/EPOXY POWDER QUOTED WITH RAL 7035 AFTER PROPER PRE-TREATMENT AS PER THE BEST INDUSTRY PRACTICE, WITH THICKNESS OF 80 TO 120 MICRONS.SHOP INSPECTION AND TESTING

After the cabinets are completely assembled and wired, perform the following tests and procedures.

A. Dielectric test on all circuits in accordance with standard test requirements. Instruments or other devices that cannot withstand test voltage shall be disconnected.
B. Circuit continuity test to verify connections.
C. Functional tests of all control switches and indicating lamps.
D. Verify operation of Operator Interface Unit on RCMU cabinets.
E. Temperature testing to ensure that operational temperature of all equipments are maintained.

CSE CABINETS

A. 42U Rack Specifications:

i. 42U Floor-mounted Rack 800W *800D for MCC / DOC
ii. Full Height with castors: 2090 mm
iii. Full Height without castors & without base screw: 1990 mm
iv. The rack should be with front tinted toughened glass door held with plastic latches & VHP tapes. All the doors should be lockable.
v. The side panels should be on Slam latches & should be open able with bare hands when required & should not have a screw/ bolt arrangement.
vi. Each side panel should have a minimum of 4 slam latches for easy access.
vii. The Rear MS door should be lockable.
viii. The doors, side panels, top panels are to be made from 1.2 mm thick sheets,
ix. The cable entry position should be there from the top & bottom panels covered with a Cut out cover/ plate.
x. For Proper Thermal Management each rack should be fitted with a Minimum of 4 fans on top - the fans should be of good quality and Size 120mmx120mmx38mm.
xi. Power Accessories

a) Horizontal & Vertically mountable universal sockets AC
b) Distribution Box with 5/15 amps 5 sockets, with individual on/off switches, every socket should have its indicator lamp to show if it is ON/OFF. The ACDB should be CE approved.
c) MOV protection: To minimizes the resistance of the extra Voltage in a Flick of time, thus effectively reducing the interface of noise, keeping the fine acoustic fidelity & clear pictures & prolong the life of the electrical equipment
d) Recoverable Overpower Protection: To eliminate the risk of overpower, and to recover the power source without changing the Fuse, which can be used repetitively
e) Universal Socket design: The 5 - plug - hole socket should able to receive all kinds of Plugs used in the various countries of both 5 & 15 amps.
f) High Grade Plastic shell shall have high Flame retardant & insulating property; the metal fitting pieces shall be of high quality material.
g) With in built lightning surge Protector and overload Circuit Breaker

15U Rack Specifications:

15U wall mounted rack Dimension: 800W*800D for RCMU/RMU sites.

i. The rack should be with front tinted toughened glass door held with plastic latches & VHP tapes. The door should have lock.
ii. The doors, side panels, top panels are to be made from 1.2 mm thick sheets.
iii. The cable entry position should be there from the top & bottom panels covered with a Cut out cover/ plate.
iv. Fans: For Proper Thermal Management each rack should be fitted with a Minimum of 4 fans on top - the fans should be of good quality – Size 120x120x38mm.
v. Power Accessories:
a) Horizontal & Vertically mountable universal sockets AC Distribution Box with 5/15 amps 5 sockets, with individual on/off switches, every socket should have its indicator lamp to show if it is ON/OFF. The ACDB should be CE approved.
b) MOV protection: To minimizes the resistance of the extra Voltage in a Flick of time, thus effectively reducing the interface of noise, keeping the fine acoustic fidelity & clear pictures & prolong the life of the electrical equipment
c) Recoverable Overpower Protection: To eliminate the risk of overpower, and to recover the power source without changing the Fuse, which can be used repetitively
d) Universal Socket design: The 5 - plug - hole socket should be able to receive all kinds of Plugs used in the various countries of both 5 & 15 amps.
e) High Grade Plastic shell shall have high Flame retardant & insulating property; the metal fitting pieces shall be of high quality material.
f) With in built lightning surge Protector and overload Circuit Breaker
g) The ADCB should be cascadable to at least 3 levels with link wires; the same should be connectable without opening the AC distribution box.

26.7 Wiring Devices & Wiring Housing

INSTALLATION

A. The wiring devices shall be installed in appropriate boxes. All switches, duplex outlets, power receptacle and plug shall be tested according to the Indian standard specifications.

The contactor shall furnish and install all wiring devices as required for the electrical distribution systems. Wiring devices shall include lighting switches, plug receptacles, multi-outlet assemblies and miscellaneous wiring devices including cover plates and all other materials and accessories required for the complete wiring device installations.

QUALITY ASSURANCE

A. All lighting switches and plug receptacles shall be listed by UL, and conform to applicable NEMA standards.

MATERIALS

A. Switches: Single-pole and double-pole switches shall be toggle type, rated 20 amperes, 240-volts, alternating current, side and back wired.
B. General Purpose duplex receptacles shall be the grounding type, 240-volt, alternating current, 20-amperes.
C. Convenience receptacles in outdoor or corrosive areas shall be having stainless steel or nickel-plated parts and plastic parts of Melamine.
D. Ground Fault Interrupter (GFI) Receptacles: GFI receptacles shall have the following electrical characteristics. Supply voltage, 240-volt alternating current; frequency 50 hertz; receptacle rating-15 amperes; circuit rating-20 amperes; trip level of 5 milliamp with effective protection without nuisance tripping from line transients, motor starts, etc.; interrupt dangerous fault currents within 1/30 of a second; a built-in test circuit which imposes an artificial ground-fault on the load circuit to ensure that the ground-fault protection is functioning properly; and a reset circuit. Rainproof covers with gaskets, as required, shall be of the same manufacturer as the receptacles over which they are installed.
E. Cover Plates - Outdoor: Weatherproof cover plates for switches and duplex receptacles shall be one-piece silicone rubber mat which fits under type 302 stainless steel plates.
F. Miscellaneous: Miscellaneous wiring devices and accessories not covered herein by detailed specifications shall be standard commercial grades that are satisfactory to the Engineer-in-charge.

27. Inspections and Tests

The following inspections and tests shall have to be performed by the Contractor:

27.1 System Performance and Acceptance Test (SPAT) and Trials runs

The contractor shall conduct trial runs of the entire system for a period of five working days after completion of installation and commissioning for conducting System Performance and Acceptance Tests (SPAT). Trial runs shall involve operational testing of all electro-mechanical installations, electrical and electronic equipments installed like server (hardware and software), data dissemination software, RDBMS and/or historian indicating their full implementation as specified and trouble free operation of all hardware and software, performing in total synchronization.

The SPAT shall be performed on the entire furnished and installed at Teesta Barrage project. The SPAT shall be performed to verify that the availability requirements for all SCADA system hardware and software. All other requirements (functional, performance, engineering and design) will have been checked prior to SPAT. The contractor shall provide all necessary test equipments and replacement parts during the SPAT period. The Engineer-in-Charge will instruct the Contractor to perform normal, emergency and other necessary extreme barrage operations using the installed SCADA system during the SPAT period. The minimum period for the SPAT shall be 10 working days.

In order to facilitate the acceptance of the system, the Contractor should give a list of deliverables to the Engineer-in-charge. The list shall be verified by the Engineer-in-charge and accordingly will give a verification report whether all

deliverables have been delivered properly at the site**.** For site acceptance test, the supplier should give a check list of all components and their functions. This check list shall be decided in consultation with the Engineer-in-charge. This check list shall indicate the tests to be conducted at the site and the results that are expected for each and every component that are to be installed at the site.

During the SPAT, if Engineer-in-charge, or any other consultant engaged by Engineer-in-charge, for this purpose rejects any equipment or item, the contractor shall at his cost make good for such rejections either by replacement or modification, repairs as may be necessary, to the satisfaction of Engineer-in-charge. Damages occurring to any part(s) of the Facilities during the SPAT shall also be made good by the contractor at no extra cost.

Timely completion of the SPAT shall be the responsibility of the contractor and hence he shall deploy extra resources to compensate the time lost in replacement or modification and repairs.

The system will have a comprehensive warranty of five years after the successful SPAT and the bidder will also provide warranty on all supplies and services for this period including all required spares/ replacements/ hardware and software enhancements and upgrades required to meet the described performance.

The contractor and Engineer-in-charge will mutually agree when the system is considered fully operational and when the SPAT shall begin. The SPAT shall be performed with all Teesta Barrage Automation Project equipments fully operational. Testing Coordinator designated by the contractor shall remain present during all the Design Coordination Conferences, discussions on the Testing procedures and throughout the SPAT.

The SPAT shall be conducted at site by the contractor as detailed in the Technical Specification and as per the detailed SPAT procedures submitted in advance by the contractor and approved by the Engineer-in-charge. Such tests will commence, immediately after successful completion of field operational check out specifications and objectives. Contractor shall perform all necessary tests, in consultation with Engineer-in-charge, for equipments supplied before and after the installations.

28.1.1 Redundancy

Distributed system instead of one strong Host Server is recommended for having a built-in WARM redundancy in the system. Total host functionalities should be divided in the two systems as described below.

Redundancy should be incorporated in other areas like Master Controller to Field Device communication by having additional ports in RTU and dual BUS to which each device is connected.

The idea is not to build a duplicate system but to ensure that the core system operates without any major breakdown. Bidders can incorporate their own ideas in the proposal with written approval of the Authority.

28.1.2 In general, while designing the system, the Bidder will conform to:

- Use of state of the art and reliable technology suitable for 24x7 operation.
- Modular design and ease of maintenance
- Uptime, MTBF and MTTR as defined article 4.6
- Redundancy in design
- High capacity P-series secured server with disaster management facility confirming to ISO 9001 : 2000 and ISO 27001 : 2005
- Set for Master Controller at BCR includes required sensors, data collection platform, solar power charging system (Inverter facility) & Solar power panel with battery backup, grounding and surge protection, pole/mast and sensor supports and brackets, adequate lightening protection, GSM radio and antenna or VSAT ground station, GSM/GPRS station, radio and antenna as per the requirement as specified.
- Set of SCADA includes Remote Terminal Unit and frame, Housing boxes, Gate Control Console, DG set and AMF panels, local barrage control software, control cable copper LAN wiring OFC/Ethernet, complete housing, boxes, ducts etc.
- If Technical Specifications do not cover any equipment or any other item specified in list of goods, appropriate specifications may be assumed which shall satisfy functional requirement of the equipment under consideration as per BIS, German or American Standards only.
- Each of the three stations will need civil work in the form of gauge house, chain link fencing and foundation or support for mounting equipment. Approximate size of gauge house to be constructed in brick masonry and chain link fencing area and of appropriate height. Appropriate mount or support or foundation block size for mounting equipment may be assumed by the contractor which will satisfy functional requirement of the equipment.