CENTRAL POLLUTION CONTROL BOARD
"Parivesh Bhavan", East Arjun Nagar, Delhi-110032

REQUEST FOR EXPRESSIONS OF INTEREST

COUNTRY **: India**

NAME OF PROJECT **: National Ganga River Basin Project**

Loan No. /Credit No. /Grant No.: Ln. 8065-IN/Cr. 4955-IN

Assignment Title **: Real Time Data Qualification Services Contractor (Consultant) for CPCB, Delhi**

Reference No. (As per Procurement Plan): **NGRBA/PP 14-15/CPCB/C/05**

1.0 Background

The Government of India, Ministry of Water Resources, River Development & Ganga Rejuvenation, has received financing from the World Bank toward the cost of the National Ganga River Basin Project (NGRB), and intends to apply part of the proceeds for consulting services.

1.1 The NGRB project includes a sub-component "**Upgradation of Water Quality Monitoring System for River Ganga (WQM)"**, and under one of the packages under this program, 36 Real Time Water Quality Monitoring Stations have been operationalized in the Ganga states in first phase and more number of real time (online) water quality monitoring stations will be installed in the second phase (38 Nos.) with varying water quality parameters on R. Ganga or its major tributaries.

1.2 The network is developed on data purchase concept where monitoring system have been installed, commissioned and operated by vendor (Data Service Provider - DSP) and Central Pollution Control Board (CPCB) is purchasing the generated water quality monitoring data on real time basis after due validation process. The data so generated would help to identify the trends of a wide array of water quality indicators and sources of the pollution and their impact on the river water quality though an online system.

1.3 The validated real time data would be eligible for payment by CPCB. A Data Qualification Services Consultant (DQSC) is proposed to be appointed for the period of the contract between CPCB and DSP, to assure and ensure that Water Quality Monitoring data (WQMD) provided by DSP are representative,

derived from calibrated instruments and properly validated at site without compromising the integrity and artifacts of the data. The data so received by CPCB through online system shall be scrutinized and rationalized for their acceptance and payments as per the provision of the Contract between CPCB and DSP. DQSC will ensure that the calibration of the instruments are undertaken as per the Standard Operating Practices (SOP) and instruments are maintained as per Standard Maintenance Practices (SMP), by field/site visits at frequency pre-defined by CPCB.

2.0 Scope of Work

2.1 The scope of work DQ AC will involve:

2.1.1 Phase I

(a) Visit to 36 RTWQMS (locations, Type of station and number of monitored water quality parameters given in **Appendix A & B**) spread across the 4 Ganga States (Uttarakhand, Uttar Pradesh, Bihar and West Bengal) to witness the calibration carried out by DSP, validation of the data generated, ensure artifacts of the data are consistent, rationalization and storage of data.

(b) Development of Data Qualification software based on pre-defined criteria and facilitate qualified data to CPCB for payment purposes.

(c) Rationalized and analyze the acceptable data, trends and impact analysis of wide array of water quality indicators, to provide information for decision making and dissemination of water quality data through dashboard, internet and other means as required

2.1.2 Phase – II

The scope of work shall remain same as above in Phase I, except additional as following:

(a) The increased geographical locations of the additional number of RTWQMS (38 Nos.), to be installed, which is spread across the Ganga Basin in the state of Delhi, Haryana, Madhya Pradesh, Uttarakhand, Uttar Pradesh, Bihar, West Bengal. Tentative locations of these probable sites are provided as **Appendix D**.

(b) The technology of online water quality monitoring system may differ from the existing systems as installed in Phase – I, and accordingly impact on work load due to associated work as defined in Phase – I.

(c) The number of water quality parameter may vary for each individual location. Location wise tentative parameters for each proposed RTWQMS is provided at **Appendix C.**

2.2 The Services of "Real Time Data Quality Assurance Services Contractor (DQSC)"will include responsibility for checking water quality data provided by the Data Service Provider (DSP) and qualifying the data based on a pre-defined set of qualification rules set by CPCB. The scope of service shall also include regular visit to each monitoring station with the Data Purchase Contractor.

2.3 The DQSC shall be responsible for designing & building a computer software program that will analyze the data stream provided by the DSP and publish the results of the data qualification process on a website. The Consultant will be responsible for designing and establishing the website as per NIC guidelines.

2.4 The assignment would be for a period ending 18th June, 2020 for Phase – I & II. The period of engagement may be extended on depending on the then prevailing situation on project. However, the tenancy of engagement of DQSC will be based on satisfactorily performance, achievement on work output vis-a-vis defined mile stone during the course of mutual agreement.

3.0 The Central Pollution Control Board now invites eligible consulting firms ("DQSC") to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience in real time/online water quality monitoring, and requisite experience in developing computer program(s) to help automate processes, such as data qualification as is required in this consultancy contract. Expertise in measurement of water quality in river (Calibration of online/real time monitoring instruments, Validation of data pertaining to water quality parameters and adjusting according to calibration, data collection, data transmission and scrutinizing real-time /online data stream for missing data). Further details including the required number of Professionals and their experience may be seen in the ToR. The interested firms must provide the information in the attached format (**Annexure-I**) indicating their past experience and financial position in Real Time / Online Water Quality Monitoring Project.

3.1 The integrity pact in accordance to Central Vigilance Commission Guidelines is to be submitted by the bidder failing which the bids will be rejected.

4.0 The firms should specifically provide information showing their experience in real time / online water quality measurements with experience in quality assurance and quality control program in rivers. Consultants may associate with other firms in the form of a joint venture to enhance their qualifications.

5.0 The attention of interested Consultants is drawn to paragraph 1.9 of the World Bank's Guidelines: Selection and Employment of Consultants [under IBRD Loans and IDA Credits & Grants] by World Bank Borrowers, January 2011, Revised 2014 ("Consultant Guidelines"), setting forth the World Bank's policy on conflict of interest. The Document is available at www. http://siteresources.worldbank.org/INTPROCUREMENT/Resources/Consultant_GLs_English_Final_Jan2011_Revised_July1_2014.pdf.org

6.0 A Consultant will be selected in accordance with the Quality and Cost Based Selection (QCBS) method set out in the Consultant Guidelines.

7.0 Further details & ToR may be obtained at www.cpcb.nic.in and also at the address below during office hours--12-00 to16-00 hours (IST).

8.0 Expression of interest must be delivered on portal not later than **16th April, 2018 by 12:00 noon.**

Central Pollution Control Board
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Sd/-

Member Secretary

Central Pollution Control Board

Annexure -I

REOI- Format for information submission

1. Name and address of the Firm :
2. Contact details (Phone number and Email id):
3. Name of the Director/ CEO/GM :
4. Registration Number:
5. Whether applying in solo or with Joint Venture :
6. In case of joint venture, name & address of the other firm with contact details:

7. Details of experiences and financial position:

S.No.	Items	
Details of experiences of the Firm		
1	3 years of experience in Water Quality Monitoring and associated data analysis	
2	Real Time Water Quality Monitoring experience along with data validation	
3	Main Sector(s) in which firm is in business	
4	Total number of the projects undertaken since inception	
5	Number of years of experience in Real Time Water Quality Monitoring Project I. Executed II. Under execution. (Software & Consultancy Firms having experience of 5 years or more in software development and /or Data Management, preference will be given to firms with exposure / have worked on real time /online river water quality monitoring systems, may extend their participation individually or in JV)	
6	Number of successfully completed assignments of Real Time / Online River Water Quality Monitoring Project (Letter of Award from employer/ Project completion certificate should be submitted).	
Details of financial strength of the firm		
7	Indicate Average Annual Financial turnover during the last 3 years, ending 31st March of the previous financial year (Rs 1 Crore or more)	
8	Turnover figure of the last three years: (Positive net profit is not mandatory) I. Financial Year 2014-15 II. Financial Year 2015-16 III. Financial Year 2016-17* (Financial strength of Joint Venture will be considered)	
9	Value of contracts in the area of expertise of real time /online water quality monitoring (Total cumulative of preceding 3 years years)	

* In case of absence of audited balance sheet for Financial Year 2016-17, interested entities may submit provisional balance sheet along with an undertaking that the entity is solely responsible for any discrepancies / variations in the qualification status of bidder as per final audited accounts. The entity, if shortlisted, shall submit audited balance sheet at the time of submission of RFP.

Terms of Reference (ToR)

1. Introduction and Background

Ganga, rising in the northern most part of Uttarakhand (Gomukh), flows through Uttar Pradesh, Bihar, Jharkhand and West Bengal and finally meets the Bay of Bengal (at Sagardweep). After traversing a length of 1450 km in Uttarakhand and Uttar Pradesh and 110 km in the boundary between U.P. and Bihar the river then enters Bihar and flows 445 km more or less through the middle of the State. The length of the river measured along the Bhagirathi and the Hugli during its course in West Bengal is about 520 km. The total length of Ganga is approximately 2525 km.

Figure 1-1 The Ganges Basin

The Ganga Basin has an area of approx. 8,61,404 km^2. Ganga has a large number of tributaries. The important tributaries within India are the Kali-east, the Ramganga, the Yamuna, the Gomti, the Ghaghara, the Gandak and the Kosi. The Yamuna, a major tributary of the Ganga has its own tributaries like the Chambal, the Sind, the Betwa and

the Ken. The main plateau tributaries of the Ganga are the Tons, the Son, the Damodar and the Kasai-Haldi.

This Project will focus on the water quality of the Ganga main stem, its major tributaries and prominent drains of interest that are flowing into these surface bodies.

1.1 Project Description

The project envisages collection, analysis and dissemination of real-time/online water quality monitoring data involving two major components. The first component is a Data Purchase Contract, and the other is the Data Purchase Audit Contract, also known as Data Quality Assurance Contract.

The Data Purchase Contract involves collection of data from 36 operational RTWQMS, and up to 17 parameters per station in the Ganga Basin in the first phase. Operationalization of 38 additional number of real time / online water quality monitoring stations is proposed in second phase.

The CPCB is the executing agency and will not be responsible for installation of equipment, nor the operation, maintenance and security of this equipment. The CPCB purchase qualified data from the Data Service Provider (DSP).

In order for the CPCB (Client) to make payment for data provided by DSP, the data is required to go through a set of pre-defined data qualification process, which is the subject of the activity described in this document. The qualification and other associated process will be managed by the Data Qualification Services Contractor (DQSC) for which the Terms of Reference are provided in following sections of this document.

2. Goal and Objectives of Data Qualification Contractor

The goal of the Data Qualification Contract is to qualify real-time/online water quality measurements as provided by the Data Service Provider (DSP). The process of data qualification is specified later in this document. Data that is qualified for payment will be processed through a data purchase computation by the Consultant (DQSC) and then provided to the Client (CPCB) for payment.

The Consultant will be engaged in several objectives to accomplish the goal and the service. These objectives include, but are not limited to the following:

- Verify that Instruments and/or equipment are operational to support/produce reliable monitoring data on consistency basis.

- Witness the calibration of Instruments/equipment traceable up to NIST for respective parameters within stipulated time frame and provide their observations to the client.
- Verify that instruments were adjusted according to the calibration SOP.
- Verify that the Instruments / equipment are maintained as per SMP.
- Verify Timeliness for data collection (logging), Transmission including artifacts
- Verify Measurement Representativeness.
- Examine real-time data stream for missing data and/or artifacts.
- Prepare supportive documents and submit their observations to the client in order to meet the objective of the assignments.
- Develop a data management software, derive trend analysis on array of water quality indicators/parameters, dashboard and dissemination of information, as required by client for decision making and public awareness.

These objectives are further defined in the Description and Service Requirement to follow.

3. Scope of Services, Tasks (Components) and Expected Deliverables

The Client has developed a requirement for the measurement, collection, and delivery of real-time/online water quality conditions from numerous critical points along the River Ganga. Measurement points include select tributaries and nalla's that impact the River Ganga water quality. The measurements in Phase I, will occur in the States of Uttarakhand, Uttar Pradesh, Bihar, and West Bengal. In Phase II, the geographical location may expand to other states as well like Delhi, Haryana, Madhya Pradesh and Jharkhand.

This contract is being devised as a "data qualification service" contract whereby the Consultant will review data provided by Data Purchase Contractor (DSP). The Consultant will be responsible for checking water quality data provided by the DSP and qualifying the data based on a pre-defined set of qualification rules set forth and agreed between CPCB and DSP. This service will require the DQSC to regularly visit each monitoring station along with the DSP. The Consultant will collect information that will be used in qualifying the data collected by RTWQMS. DQSC will supply qualified technicians for the field visits along with all provisions required to support this activity, including, but not limited to, transportation, communication (i.e. mobile phones), computer equipment and supplies required to properly document the calibration and maintenance that will be performed by the DSP. DQSC will also be involved in confirming the calibration records from the DSP on the instruments/equipment that they use to calibrate/validate the sensors. DQSC will not be required to make measurements, and will only serve as an observer for the purpose of recording the results of the field

visits and using the results in qualifying data as it is provided by the DSP. CPCB and National Mission for Clean Ganga (NMCG) officers may join the field visit at their discretion.

DQSC will be required to maintain extensive documentation which will be managed by the DQSC's personnel and stored on a computer system that will be provided by the Client (CPCB). This computer system will also receive data sent by the DSP in real-time, so that the information can be processed, flagged, and qualified for payment. It is desirable that the DQSC can make the process of data qualification as automated as possible.

3.1 Task 1: Q/A, Q/C, and Compensation Model Development

DQSC will devise a computer program that will employ the following criteria under 3.1 as listed below. This program will be written in an open architecture and shall belong to the Client (CPCB) once it is satisfactorily completed and tested by both the DQSC and CPCB. The program will become the "intellectual property" of CPCB as a standalone program without restriction of use within CPCB.

3.1.1 Data Qualification Process and Methodology

As mentioned earlier, the data qualification process will incorporate in-situ validation/calibration of instruments/equipment for all associated water quality parameters for that particular RTWQMS site, as well as data reception from the field into the offices of the Client by a prescribed time after measurement. DQSC will be required to design, build, test, implement, and operate computer software program that will analyze the data stream provided by the DSP. The computer software program will evaluate all data received and qualify the data based on the following subsections of this section. This computer software program will reside on a computer that will be provided by the Client (CPCB) at Delhi.

DQSC will be receiving text files, one file for each transmission. It will be up to the DQSC to write a loader that will read these text files and put them into the CPCB database. The Consultant will need to track the time that the data was received, as this is one of the qualifiers of data purchase. DQSC will be required to have the Consultant's information system enabled to receive data 24 hours a day, 7 days a week through the entire length of the contract. If any of the files are not received within the predefined timeline defined by the client such data should be flagged and logged for reference. It should be possible for the client to pull such logged information as and when required.

3.1.2 Location of Equipment and Specifications

The tables indicating the location of the existing RTWQMS (36 Numbers) operational in Phase – I, and parameters associated with respective stations are provided in **Appendix A & B** respectively. The tentative details of the additional number of RTWQMS proposed along with their tentative location and water quality parameter to be monitored are provided in **Appendix C & D**.

All of these water quality parameters will require an audit by the DQSC to qualify for payment.

3.1.3 The Data Qualification Process

The data qualification process will consider several factors in order to be qualified for payment. Most of these factors will be confirmed during the 14-day self-validation check performed by the DSP. Other factors, such as timeliness, artifacts, changes in trends which draws question to the data, will be used to qualify or dis-qualify the data. If any one of the qualification criteria fails to meet, then the data point(s) will not be credited for payment.

The data qualification process shall include data checks as provided in the following subsections.

3.1.4 Data Completeness

a. For any given hour, at least 90% of the total possible qualified measurements must be available for purchase. If less than 90% of the qualified measurements are available for purchase, then the DQSC shall disqualify all data for the entire network for that hour.

b. For any given hour, a minimum of 90% of the total possible number of stations must be either completely or partially reporting qualified data. If less than 90% of the stations are either completely or partially reporting qualified data, then the DQSC shall disqualify all data for the entire network for that hour.

c. For the purpose of the completeness requirement, a single daily 4 hours cross-section measurement will count towards 24 hours of data for purchase.

d. If the client is sending more data than what is defined then the DQSC's software should be capable of picking data with higher confidence level (> 90 % of definition period) for all evaluation purposes.

e. If there is no water in the river or the depth of water available across the river bed is less than 0.5 m, and technically the station could not be shifted, but data

supply is technically feasible and consequently, the station is kept on halt conditions, payment to DSP will be made for each hour of such situation. However, the condition has to be verified by the DQSC after getting intimation from the DSP at the earliest.

f. In case of force majeure clauses such as flood events, when stations can or cannot be deployed and/or kept safely under halt conditions, service provider will be paid but will not be immune from 90% operational clause barring such station which is not functional due to Force majeure. Force majeure and pre-intimation will be provided by DSP and shall be verified by appropriate authority. Such information should be logged in the DQSC software for evaluations and calculations of valid and qualifying data as well as record purposes.

g. In case of total failure of transmission signals or major transmission grid failure the data must be paid even with delayed transmission to server, Data verification in such cases may be checked from the datalogger at stations.

h. Any delayed data during validation/calibration visits shall be considered and paid.

i. In case of downtime at Client's server, the data will be eligible for payment under appropriate deviation conditions. Such condition may be due to Force Majeure as specified in earlier para in this clause (3.1.4).

j. Hours of re-location of station (s) in case of flooding or river course change in required attribute or on direction by the client, should not be considered under earlier para of this cause (3.1.4), payment will be made by the client in such case to the DSP.

3.1.5 Data Collection Timeliness

Data shall be measured and logged within a prescribed period of time in order to qualify for payment. DQAC shall use Data Collection Timeliness as specified below as a means of qualifying each and every data point for payment.

3.1.5.1 Fixed Stations

Fixed station measurements will be made within the hour. The measurements will be made ± 5 minutes of the hour in order to qualify for payment. DQSC will use the logged data time stamp to make this determination. DQSC will also be responsible for checking the in-situ data collection equipment for assigning the proper time stamp as part of the field checks for measurement accuracy.

3.1.5.2 Cross-Section Stations

Cross-section stations will be received at the data center within 60 minutes of the completion of the cross-section measurement. The cross-section will be made between the hours of 10 AM and 2 PM local time. The measurement and collection of data shall be continuous throughout the measurement at a time interval not greater than every 2 seconds (time interval is time between 2 analysis). The speed of the measurement platform shall be less than or equal 5 km/hr. Data shall be received at the data center within 60 minutes of the completion of the cross-section measurement. DQSC will inspect these criteria during the performance of cross-section measurements and disqualify measurements found to not meet the above criteria.

3.1.5.3 Data Transmission Timeliness

Data must be available in real-time otherwise it is considered unavailable for purchase. Data will be routed to the DQSC's computer system immediately by the DSP. Data will be transferred by SFTP or HTTP POST, or similar technology that will allow data to flow over the network. DQSC will make provisions to receive data by either of these methods and provide the DSP the rights and information necessary to execute such transfers. The data will arrive in single or multiple files which will hold a single station measurement for one hour, or one cross-section in the case of cross-section measurements.

3.1.5.3.1 Fixed Stations

Data from Fixed Stations must be available on the computer server and transferred to CPCB Servers within 15 minutes of the hourly observation to qualify for purchase.

3.1.5.3.2 Cross-Section Stations

Data from Cross-section Stations must be available on the DQSC's computer server 60 minutes after the completion of the cross-section to qualify for purchase.

3.1.6 Measurement Representativeness

Measurement representativeness will be determined by the DQSC based on site inspections every 14th day. The site inspections will be coordinated with the DSP prior to the inspection, though the DSP is not required to join the inspections by the DQSC.

3.1.6.1 Fixed Stations

3.1.6.1.1 Flow

In order to qualify for payment, the measurement must be representative of water conditions in the main channel of the river within two meters of the surface of the water. The main channel is defined as the portion of the river where the velocity of water is at a maximum. The measurement will be deemed non-representative if the velocity at the measurement point is less than 10% of that of the main channel.

3.1.6.1.2 Depth

The continuous monitoring sensors shall perform measurements not closer than 0.5m of the surface and not closer than 0.5 m of the bottom of the channel. In the event the depth of water is less than 1.0 m, the measurement will be made in the middle of the range of depth. If the sensor is located outside of this range, the data shall not be qualified for measurement.

3.1.6.2 Cross-Section Stations

The location of the measurement will include the latitude and longitude of the measurement as well as the distance from the left bank while looking downstream. If the river is braided, measurements will be made within each braid. DQSC shall audit each and every cross-section measurements one per month. If the DQSC observes a failure in making proper cross-section measurements, the measurement will not qualify for payment.

3.1.7 Measurement Accuracy

All sensors will be subject to self-audit by the DSP. DQSC's responsibility is to witness all self-audits and document these audits as part of the data qualification process. The DSP will be performing calibrations at each and every station no longer than every 14 days at which time the Consultant is required to be in attendance. The site inspections will be coordinated with the DSP. The DQSC's technicians will be required to manage their own transport and logistics in arriving at the sites on time.

The audit will be made within the ± 5-minute time period of the measurement at the top of each hour and compared to the real-time data that will arrive on the DQSC's computer server as part of the DSP services.

3.1.8 Data Qualification Process

DQSC shall evaluate all data delivered to their computer by the DSP.

3.1.8.1 Data Qualification

DQSC will assist CPCB (the client) in terms of providing technical specifications for procurement of servers and software. This computer/server system shall store all data provided by the DSP in a non-proprietary open relational database such as MySQL or PostgreSQL. This database will include all pertinent information that will be used for data qualification. This information includes the actual date/time of the incoming data from the DSP.

The DSP will provide a continuous stream of data to the DQSC's computer system though a secure FTP process and/or an HTTP POST process. Data will be delivered in the form of files, with each file containing data from a single station for a single transmission. The format of the data will be in a non-proprietary ASCII format, such as XML or SHEF. DQSC shall be required to import these records into a selected database.

DQSC shall develop a data qualification process to be used against the incoming data that has been delivered to the DQSC by the DSP. The data qualification process shall evaluate each data point and reject data from being qualified based on evidence of the following:

- Data being an artifact or a change in the data trend that draws doubt about the data quality
- Missing data or data not arriving within the specified time window
- 14-day calibration/validation field visit missed for the station in question
- Water Quality Parameters not being adjusted during the 14-day calibration/validation field visit
- All calibration records should be available along the water quality parameter values before and after calibration and also the value measured during the calibration of instrument and results from laboratory for particular parameter.

In the event an artifact is identified, or change in trend that casts doubt about the data, the DSP can get credit for the data if the DSP can prove beyond reasonable doubt that the data is correct within three weeks from the date of generation of monthly validation report.

3.1.8.2 Qualifying Data based on Regular Field Calibration/Validation

The DSP will be performing calibrations on all stations at an interval no longer than every 14 days at which time the consultant is required to be in attendance. These calibrations, and adjustments to the parameters being calibrated, are one of several pieces of information used to qualify data for payment.

3.1.9 Calculation of Credit and Payment Due to the Data Provider

The DSP will be compensated based on each data point that is received that complies with the provision of data qualification process. The DQSC shall develop a process to use the audit results in conjunction with the data that has been delivered to the DQAC by the DSP. This process shall aggregate the qualified data so that it can be fed into the data compensation model shown in **Appendix E**. The DQSC shall demonstrate this model to the satisfaction of the Client within 30 days of the bid award.

The data qualification process shall flag the data that doesn't qualify, with the flag indicating the reason for the data was not qualified. The results of the data validation will be advised by the DQSC to the DSP within 24 hours of receipt of data at the CPCB (Employer) Data Centre except in cases where CLIENT (CPCB) wishes to examine the result before sending the communication to the DSP. Qualified data will be indicated with a qualified flag that can be readily used in aggregating the number of qualified data for payment. The DQSC shall demonstrate this software program that processes the data and use of the compensation model to the satisfaction of the Client within 30 days of the bid award.

The calculation of credit and payment due to the DSP will be performed by the DQSC on a monthly basis. By the 15th of the following month, the calculation of credit and payment due to the DSP will be delivered by the DQSC to the Client (CPCB).

3.1.9.1 Weight System for Data Credit

The calculation of credit will involve a weighting function, as some observations are of higher value to the Client than other observations. A weighting scheme has been devised which is included in the compensation model shown in **Appendix E**. There are five different weights and five observations in each of the weighting categories. The Client may reassign these weights at any time.

The observation priorities and the weights that are associated with each category are defined in the following table:

Sensor Priority	
Sensor	**Category**
Ammonia	B
BOD	A
BTX	D
Chloride	B
COD	B

Category	**Weight (Relative Importance)**
A	10
B	5
C	3
D	2

Color	C
DO	A
DOC	D
EC	A
Fluoride	C
Hydrogen Sulfide	D
Nitrate	C
Nitrites	C
pH	A
Potassium	C
Temperature	A
TOC	D
TSS	B
Turbidity	B
Water level	D

The weight of Category A being 10 means that it will be 5 times more valuable than observations in Category D, and twice as valuable than that in Category B. The DQSC shall apply different weights as directed by the Client (CPCB). The Client (CPCB) may expand or collapse categories as will, in which case the DQSC shall include these changes in the compensation model. The parameters might vary for each station. All stations may or may not have all parameters.

3.2 Task 2: Data Visualization

DQSC is required to design, develop and implement a website for data visualization. The website will be able to display data as follows:

- DQSC will be required to maintain two databases. One database will be the raw data, the other database will be the qualified data for record. Raw data will be displayed in real time on the visualization system. The qualified data will appear on the website after the qualification process which is expected to occur within 15 minutes of receiving the raw data.

- Tabular and trend (temporal and spatial) reports of water quality data for RTWQM stations and respective parameters

- Graphical presentation of water quality data by time and parameter at user selectable time intervals and parameter.

- Display of calibration records in both the Tabular and Graphical report.

- Display and dissemination of water quality data on GIS platform showing user selectable water quality parameters at each station

- User selectable statistical analysis for user selectable time periods and parameters to include the following (but not limited to):
    - Average
    - Standard Deviation
    - Maximum
    - Minimum
    - Period of exceedance of user selectable thresholds and parameters

- Reports as follows (but not limited to) :
    - Water Quality Reports by State
    - Daily reports as of a specific time (i.e. 10am)
    - Monthly reports of parameters
    - Reports that compare current water quality to historical water quality
    - Hotspot report
    - Water quality index
    - Special episode such as Kumbh Mela, Magh Mela Report
    - Sensor and Parameter error reports for any selected period
    - Report on Stations offline due to force majeure clauses for any selected period.
    - Threshold alarm reports
    - Other scenario and conditions as defined by the client.

3.3 Task 3: Carry out Activities Related to the Description under 3.1

Task 3 is the operationalization of the procedures outlined under Section 3.1 and requires all of the activities outlined there-in. This includes the preparation of reports listed under the deliverables section and regular communication between the **Client** and the **DQSC**, that will be initiated by the DQAC as required to perform the activities previously mentioned.

4. Team Composition &Qualification Requirements for the Key Experts (and any other requirements which will be used for evaluating the Key Experts under Data Sheet 21.1 of the ITC)

The DQSC is expected to have at least 5 years of working experience in real-time /online water quality management with expertise in measurement of water quality in Riverine system. The assignment is expected to be carried out by a team of experts and technical staff described below.

The staffing requirements of key personnel for this assignment will include a minimum of the following positions. The DQSC can increase the number of experts in order to adequately address the expertise that is required and to further strengthen their bid. The DQSC is encouraged to nominate experts that are multi-disciplinary and therefore cross-over the staffing requirements below to adequately meet the scope of work of the assignment.

TEAM LEADER

The Team Leader will have a broad knowledge of all components of the consultancy and will be involved in managing all activities of the contract. The Team Leader will have direct and regular communication with the Client as well as the Data Service Provider (DSP). Excellent communication skills, both written and verbal, are required. The Team Leader will be expected to be at the Clients facility on a full-time basis.

Qualifications:

1. Minimum of 15 years' experience in managing activities as described above
2. Minimum of 10 years' experience with the measurement of real-time water quality systems that have led to demonstrable knowledge of water quality in rivers and polluted surface water bodies.
3. Not less than 7 years of extensive knowledge of manual water quality measurement procedures, Quality control and Assurances methodologies, and calibration of instruments and validation of data generated thereof with exposure to internationally acceptable process/procedure like ISO/NABL
4. Minimum 5 years of extensive experience in analyzing water quality data in rivers and polluted water bodies.
5. Strong written and verbal communications skills in English.
6. Masters in Technology in Environmental Engineering or PhD in Environmental Science. Additional exposure/qualification like degree/diploma/certification

course on Instrumentation/Water Quality data management and analysis will have extra weightage.

DEPUTY TEAM LEADER

The Deputy Team Leader will serve in the absence of the Team Leader. Though the Deputy Team Leader will be junior to the Team Leader, the Deputy Team Leader is expected to have considerable experience in the field of water quality monitoring. Excellent communication skills in English and Hindi, both written and verbal, are required. The Deputy Team Leader will be expected to be at the Clients facility on a full-time basis.

Qualifications:

1. Minimum of 10 years' experience in managing activities as described above
2. Minimum of 7 years' experience with the measurement of real-time water quality systems that have led to demonstrable knowledge of water quality in rivers and polluted surface water bodies.
3. Not less than 5 years of extensive knowledge of manual water quality measurement procedures, Quality control and Assurances methodologies, and calibration of instruments and validation of data generated thereof with exposure to internationally acceptable process/procedure like ISO/NABL
4. Minimum 3 years of extensive experience in analyzing water quality data in rivers and polluted water bodies.
5. Strong written and verbal communications skills in English.
6. Masters in Technology in Environmental Engineering or PhD in Environmental Science. Additional exposure/qualification like degree/diploma/certification course on Instrumentation/Water Quality data management and analysis will have extra weightage.

WATER QUALITY TECHNICIAN (6 Persons)

The Water Quality Technicians will be performing regular field visits to the water quality stations and observing the calibration/validation process being performed by the Data Service Provider (DSP). The water quality technicians will be based and stationed full time on the project, and may be assigned to field areas to facilitate their activities. Knowledge of NABL procedures, laboratory measurement of water quality techniques, calibration of instruments and data validation process is

necessary. Knowledge of computer science and programming is desirable. It is expected that these technicians will be working full-time on the project making station visits on regular basis.

1. 3 years' experience in water sampling, transportation and quality monitoring following NABL procedures and exposure to handling and calibration of instruments.

   Exposure to functioning and maintenance of real time / online water quality monitoring instruments will be an added advantage and given additional weightage.

2. Knowledge of computer programming or water quality data handling through automated processes
3. Bachelor in Technology or equivalent in the field of Environmental Engineering / Civil / Instrumentation/ Electronic & Communication/Chemical Engineering OR Masters in Science in Environmental Science/ Instrumentation or a closely related field.

COMPUTER SYSTEMS APPLICATION PROGRAMMER(For initial 18 months)

The DQAC will be responsible for operating and modifying computer code related to the collection, storage, display and dissemination of water quality data as directed by the Client. The Computer Systems Application Programmer will be based and stationed full-time at the Delhi (Client site). The Computer Systems Programmer will be required to develop an automated process to qualify data based on a set of inputs provided through the course of work. The programmer may also be called upon by the Client to provide analysis of data, which will largely consist of statistical analysis, such as analysis of variance. The computer systems application programmer must have expertise in data base management, computer operating systems, application programming, and web development. Must demonstrate knowledge and use of database language/systems and programming languages.

Qualifications:

1. Minimum of 7 years' experience in data base management, with 5 years of experience in designing, developing, and implementation of software. Exposure to handling and analysis of water quality database will be preferred.
2. Minimum of 3 years' experience in performing statistical analysis on time series data.

3. Master's in Computer Applications or Bachelor's degree in Computer Science or Environmental Engineering with additional degree/diploma in database management and programming.

ASSISTANT COMPUTER SYSTEMS APPLICATION PROGRAMMER

The DQSC will be responsible for operating and modifying computer code related to the collection, storage, display and dissemination of water quality data as directed by the Client. The Computer Systems Application Programmer will be based and stationed full time at the CPCB project office. The Computer Systems Programmer will be required to develop an automated process to qualify data based on a set of inputs provided through the course of work. The programmer may also be called upon by the Client to provide analysis of data, which will largely consist of statistical analysis, such as analysis of variance. The computer systems application programmer must have expertise in data base management, computer operating systems, application programming, and web development. Must demonstrate knowledge and use of database language/systems and programming languages.

Qualifications:

1. Minimum of 5 years' data base management, with 3 years of experience in designing, developing, and implementation of software. Exposure to handling and analysis of water quality database will be preferred.
2. Minimum of 2 years' experience in performing statistical analysis on time series data.
3. Master's in Computer Applications or Bachelor's degree in Computer Science or Environmental Engineering with additional degree/diploma in database management and programming.

COMPUTER SYSTEMS WEB PROGRAMMER

The Consultant will develop and manage a web page to display all data received by the Consultant. The Computer Systems Web Programmer will be based and stationed full time at the CPCB project office. The web page will include time series plots, graphical tables, and tabular data. The data received is not limited to water quality parameters but also includes maintenance activities and reports developed from these activities. The WEB Programmer will provide changes to the web page as requested by the Client. The programmers should have expertise in data base management, computer operating systems, application programming, and web development.

Qualifications:

1. Minimum of 3 years' experience in designing, developing, and implementing web application
2. Exposure to water quality data will be added advantage
3. Minimum of Bachelor's degree in Computer Science, Information Technology or Masters in Computer Applications.

5. Reporting Requirements and Time Schedule for Deliverables

5.1 Data Qualification Model Development and Deployment

This deliverable is related to Task 1 as described in Section 3.

The data qualification model development, testing, and deployment will be produced over a minimum of 4 Phases. Phase 1 will be the development of a conceptual model that will include a block diagram of the logic to be used to satisfy all requirements and instances of the data qualification process. There will be a review of this phase and approval from CPCB prior to moving on to the Phase 2. This phase is to be completed within 30 days of contract signing. CPCB will provide final review within 15 days from the date of the DQSC submission of Phase 1 report. The DQSC will then make necessary changes and return as final within 7 days of CPCB's final review.

Phase 2 will be the custom computer model build based on the approved conceptual model developed under Phase 1. During this Phase, the Client can continue to request features, as the conceptual model is adjusted to meet the requirements of the consultancy. Phase 2 will be completed by the 3rd month after contract signing. CPCB will provide final review within 15 days from the date of the DQSC submission of the Phase 2 report. The DQSC will then make necessary changes and return as final within 7 days of CPCB's final review.

Phase 3 will be the testing phase during by which time DQSC shall have the Data Qualification Model developed and presented to the Client. During this Phase the Data Qualification Model will be tested to the extent possible with adjustments being made to the computational model as required by the Client. Prior to the start of Phase 3 the DQSC shall devise a simulated batch of data for 36 RTWQMS using 17 parameters in the first phase and additional number of real time water quality stations in the second phase within a period of 3 months.The qualification process will be exercised on the simulated data using different audit results. This Phase will exercise the use of the field audits, input into the system, and the resultant qualification of data. Phase 3 is expected to be completed by the 4thmonth of the Consultancy. CPCB will provide final

review within 15 days of the DQSC submission of the Phase 3 report. The DQSC will then make necessary changes and return as final within 7 days of CPCB's final review.

Phase 4 will be the final deployment, with all elements deployed by the 5th month of the Consultancy. The system will then go "online" and be undergo additional testing as the DQSC shall install the necessary equipment.

5.2 Reporting of Activities

All visits to stations will be recorded, and put into the data base for review by the Client. Results of audits will be recorded and stored in a database. The result of the audits will be made available to the Clients described below, so that the Client can notify the Data Service Provider of the data qualification results. The DQSC will also provide quarterly reports as identified below.

5.3 Reporting and Storing Field Visits and Activities

Notes will be taken for every field visit, and any activity that may impact the audit, validation and calculation of credit due to the Data Provider. The DQSC shall record all activities, including, but not limited to the following:

- Date and time arriving at the Audit site
- Time of actual Audit (i.e. observation) by element
- General observations, including:
    - Condition of station
    - Notable observations of water level, condition (this will be refined by the Client)
    - Current Weather (Cloud cover, Temperature, rain/no rain, etc.)
    - Any other notable observations or general comments
- Date and time departing the Audit site

The DQSC shall provide a monthly report of all field visits and results of calibration/validation. The report is due no later than the 15thof the month which will describe the aforementioned activities for the month prior.

This report will be known as the "Monthly Maintenance Report".

5.4 Reporting and Storing Audits Database

The DQSC shall store the results of the audits in a database that will be accessible by the Client 24 hours a day, 7 days a week. Reports will be accessible that will allow the Client to review the results of any audits performed throughout the life of the contract. The DQSC shall develop a program that can access this database that will allow the Client to perform the following (at a minimum):

- Audit report of a user defined number of parameter(s) for a user defined number of station(s) for a user defined period
- Audit report of audit failures of a user defined number of parameter(s) for a user defined number of station(s) for a user defined time period.
- DQSC shall be required to perform reports on an "as-needed" basis at the direction of the Client.

The Client will use a web based interface that will be developed by the DQSC. This interface will NOT require the Client to acquire a license or pay any other fees for the access to the interface and/or the data/reports. The DQSC shall modify/customize in the web based interface as directed by the Client.

5.5 Reporting on Data Qualification Process and Recommended Payment

The DQSC will provide a quarterly report that is due no later than the 15th of the month after the close of a particular quarter. The end of the quarter is defined to be March 31, June 30, September 30, and December 31. The data qualification report will provide a spreadsheet that will identify the following:

- Number of hours the data reporting fell below 90% for all parameters
- Number of hours the data reporting fell below 90% for all stations
- The qualified data payments due by each station for the quarter
- The qualified data payments due for all stations for the quarter
- Any other reporting the Client may request

This report will be known as the "Quarterly Data Provider Payment Report".

5.6 Reporting and Storing Communication

All communication between the DQSC and the Client as well as communication between the DQSC and any other entity which involves the Audit Contract will be stored in the same database that the actual audits are stored. This communication includes audit disputes that may be registered by the Data Service Provider and brought to the DQSC's attention by the Client.

The DQSC shall store the results of the audits in a database that will be accessible by the Client 24 hours a day, 7 days a week. Reports will be accessible that will allow the Client to review the results of any audits performed throughout the life of the contract.

The DQSC shall develop reports that the Client can access that will allow the Client to review all communication related to the DQAC's activities related to the Audit Contract. The DQAC shall add/change report format based on the input of the Client on an "as-needed" basis.

5.7 Summary of Reports Required and Deadlines for Report

The reports required by the DQAC are summarized as follows:

- Shall provide the complete specification of the server(s) and software (OS & RDBMS) within one week from the date of award of contract in consultation with IT Division, CPCB.
- Inception report providing details of the methodology and work plan be submitted within one month
- Phase 1 report due at the end 30 days.
- Phase 2 report due at the end of the 3rd month.
- Phase 3 report due at the end of the 4th month.
- Monthly Status Report based on station visited (station wise) due the 15th of the month following the month the audits took place.
- Monthly Validation Report due the 15th of the month following the month data was collected.
- Monthly Calibration Reports based on the information provided by the data service contractor. Report due the 15th of the month following the month the calibration was performed.
- Quarterly Data Provider Payment Report due the 15th of April, 15th of July, 15th of October and 15th of January, for the previous quarter.

6. Clients Input and Counterpart Personnel

The Client will provide office space for the Team Leader, Deputy Team Leader, and three IT related special lists at CPCB office building in Delhi. The equipment provided will include office space, desk, and chairs. The DQSC will be responsible for office supplies, personal computers; The DQSC will also be responsible for acquiring Internet access.

7. Termination Clause

In case of termination of data purchase contract, the data qualification consultant contract would be terminated within 30 days of data purchase contract termination.

Appendix A – Station List with Parameters to be measured

S. No	Station Code	Locations	Parameters															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			Category A					Category B					Category C				Category D		
			BOD	DO	EC	pH	Temperatu	Ammonia	Chloride	COD	TSS	Turbidity	Colour	Flouride	Nitrate	Potassium	BTX	TOC	Water level
	Uttarakhand																		
1	UK8	HaridwarNallah	√	√	√	√	√	√	√	√	√		√	√	√	√	√		√
	Uttar Pradesh																		
2	UP2	Madhya Ganga barrage	√	√	√	√	√	√		√	√	√		√	√			√	√
3	UP3	SukartalGhat	√	√	√	√	√	√		√	√				√				
4	UP8	Barrage at Narora (Ganga)	√	√	√	√	√	√		√	√				√			√	√
5	UP9	KachlaGhat Bridge Badaun	√	√	√	√	√	√		√	√	√			√		√	√	√
6	UP10	Ranganga (down-steam of Moradabad)	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√
7	UP13	Bridge on kali River at kanpur-Farrukhabad Road	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√
8	UP14	Bridge at ghatiaGhatFarukabad	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√
9	UP16	Bridge SH21 down-stream of kannauj	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√
10	UP17	Bridge SH40 down-stream of kannauj	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√
11	UP18	Bridge in Bithur	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√
12	UP19	Barrage up-stream Kanpur	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√

S. No	Station Code	Locations	Parameters															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			Category A					Category B					Category C				Category D		
			BOD	DO	EC	pH	Temperatu	Ammonia	Chloride	COD	TSS	Turbidity	Colour	Flouride	Nitrate	Potassium	BTX	TOC	Water level
13	UP26	Bridge at Kanpur 1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
14	UP29	Bridge 2 at Kanpur NH25	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√
15	UP32	Bridge near Fatepur	√	√	√	√	√	√		√	√				√				
16	UP40	Brudge DS of tributary near Sirsa	√	√	√	√	√	√	√	√	√	√		√	√	√		√	√
17	UP46	Nalla at allahabad 4	√	√	√	√	√	√	√	√	√		√	√	√	√			√
18	UP54	Varanasi at Bathing Ghat 1	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√
19	UP55	Bridge on Tributary in Varanasi	√	√	√	√	√	√		√	√				√				
20	UP56	Tributary @ Rahwari	√	√	√	√	√	√		√	√				√				
	Bihar																		
21	Bh7	Nalla in Patna 2	√	√	√	√	√	√	√	√	√		√		√	√			√
22	Bh9	RajapulNalla	√	√	√	√	√	√	√	√	√		√		√	√			√
23	Bh10	Nalla in Patna 3a	√	√	√	√	√	√	√	√	√		√		√	√			√
24	Bh11	Nalla in Patna 3b	√	√	√	√	√	√	√	√	√		√		√	√			√
	West Bengal																		
25	WB5	1 River u/s of Ganga Nallah	√	√	√	√	√	√	√	√	√		√		√	√			√
26	WB6	2 River u/s Ganga -Nallah	√	√	√	√	√	√	√	√	√		√		√	√			√
27	WB10	Ganga River d/s Murshidabad (u/s Berhampore)	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√
28	WB11	Ganga River d/s of Murshidabad (d/s berhampore)	√	√			√		√	√		√	√		√		√		

S. No	Station Code	Locations	Parameters																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			Category A					Category B					Category C				Category D		
			BOD	DO	EC	pH	Temperatu	Ammonia	Chloride	COD	TSS	Turbidity	Colour	Flouride	Nitrate	Potassium	BTX	TOC	Water level
29	WB12	4 River u/s Ganga-Nallah	√	√	√	√	√	√	√	√	√		√		√	√			√
30	WB21	Ghat d/s of srirampore	√	√	√	√	√	√		√	√				√				
31	WB23	Ganga River near Belgharia	√	√	√	√	√	√		√	√				√				
32	WB24	Nalla @ ballykhal	√	√	√	√	√	√	√	√	√		√		√	√			√
33	WB26	Nalla @Chitpur	√	√	√	√	√	√	√	√	√		√		√	√			√
34	WB27	Ganga River @ Howrah Bridge	√	√	√	√	√	√	√	√	√	√		√	√	√		√	√

List of Cross-section stations

S. No	Station Code	Locations	Parameters																
			17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
			Category A					Category B					Category C				Category D		
			BOD	DO	EC	pH	Temperatu	Ammonia	Chloride	COD	TSS	Turbidity	Colour	Flouride	Nitrate	Potassium	BTX	TOC	Water level
1	UP6	Bridge at Anupshahr	√	√		√	√	√		√		√	√						
2	UP24	U/s Bathing Ghat Kanpur	√	√		√	√	√		√		√	√						

Appendix B: Stations List with Location

S. No	Location Code	Site	Latitude	Longitude	Location
1	UK8	Hardwar Nallah	-	-	Jagjeet STP outlet drain within campus
2	UP2	Madhya Ganga barrage	29°22'26"	78°02'27"	Madhya Ganga barrage, Bijnor
3	UP3	SukartalGhat	29°29'31"	77°59'25"	Bridge on SukartalGhat at Ban Ganga after confluence (a/c) Saloni river and before confluence (b/c) to River Ganga
4	UP6 (Cross-section station)	Anupshahr main bathing Ghat	28.36452°	78.27184°	River Ganga at Anupsharat bathing Ghat
5	UP8	Barrage at Narora (Ganga)	28.190361°	78.395345°	Barrage at Narora on River Ganga
6	UP9	KachlaGhat Bridge Badaun	27.931056°	78.855289°	Road bridge on River Ganga near KachlaGhat, Badaun
7	UP10	Ramganga (d/s of Moradabad)	28.5535°	79.04748°	Bridge on Ramganga (d/s of Moradabad) at Shahbad on MDR53W
8	UP13	Bridge on Kali River at Kanpur-Farrukhabad Road	27.108614°	79.883556°	Bridge at Khudaganj, Kannauj d/s of River kali on bridge at Khudaganj, Kannauj
9	UP14	Bridge at GhatiaGhatFarrukabad	27.398842°	79.627522°	Ghatiyaghat bridge , Farrukhabad on River Ganga
10	UP16	Bridge SH21 DS of Kannauj	27°00'45.06"	79°59'19.47"	Manimau bridge (Mehendighat), Kannauj on River Ganga a/c Ram Ganga & River Garra
11	UP17	Bridge SH40 DS Kannauj	27.497972°	79.696139°	Allahganj bridge, Farrukhabad on River ramganga
12	UP18	Bridge in Bithur	26°36.010'	80°16.446'	Pariyal bridge on River Ganga b/w Laxshmanghat&Hnumanghat near DhruvTeela, Bithoor,Kanpur
13	UP19	Barrage U/s Kanpur	26°30.482'	80°18.991'	Ganga Barrage bridge, Kanpur on River Ganga
14	UP24 (Cross-section station)	U/s Bathing Ghat Kanpur	26°22.568'	80°29.549'	River Ganga d/s Kanpur; Deorighat (Maharajpur)
15	UP26	Bridge at Kanpur 1	26°27'42.01" / 26°28.339'	80°12'34.73" / 80°22.719'	Railway bridge culvert at Bhauti on river Pandu / New Road-bridge on R. Ganga b/w Shuklaganj& Kanpur
16	UP29	Bridge 2 at Kanpur NH25	26°22'14.1"	80°18'25.08"	Bridge on River Pandu (d/s of Kanpur), Bhingave (Hamirpur Road), Kanpur.

17	UP32	Bridge near Fatepur	26.05487° / 26.19909°	80.90952° / 80.53726°	Bridge on River Ganga at Ansi, Fatehpur / Bridge on river Pandu, Fatehpur
18	UP40	Bridge DS of tributary near Sirsa	25.271°	82.093°	Pontoon bridge, Sirsa (Allahbad) on River Ganga
19	UP46	Nalla at Allahabad 4	25.3899°	81.90133°	Mawaiyanala (2.5mx0.5m) at Allahabad
20	UP54	Varanasi at Bathing Ghat 1	25°20'31.5"	83°01'22.5"	Barrage on river Varuna 5-6 Km up stream/before confluence with River Ganga.
21	UP55	Bridge on Tributary in Varanasi	25°30'24.6"	83°08'27.5"	Bridge on river Gomati b/c to Ganga at Rajwari, Varanasi U/s of River Gomati b/c to River Ganga
22	UP56	Tributary @ Rajwari	25°03'21.72"	83°11'57.6"	Bridge on Devkali Pump canal (Chaudhary Charan Singh Pump Canal), Jauharganj, Saidpur, Ghazipur D/s of River Ganga a/c River Gomati
	Bihar (04)				
23	Bh7	Nalla in Patna 2	25°38'26.35"	85° 6'19.31"	KurziNalla @ MPS
24	Bh9	RajapulNalla	25°37'24.66"	85° 7'28.59"	Rajapur old pump house near pantaloon
25	Bh10	Nalla in Patna 3a	25°37'19.81"	85° 8'1.11"	MandiriNalla near pumping station
26	Bh11	Nalla in Patna 3b	25°37'19.60"	85° 9'1.59"	Anta Ghat, drainage pumping Station
	West Bengal (10)				
27	WB5	1 River u/s of Ganga-Nallah	24.505353°	88.030081°	First Influent Stream from Weast on Bridge over NH34
28	WB6	2 River u/s Ganga-Nallah	24.482371°	88.055535°	Second influence stream from West
29	WB10	Ganga River d/s Murshidabad (u/s Berhampore)	24.100378°	88.244281°	Road Bridge after Murshidabad, at Behrampore
30	WB11	Ganga River d/s of Murshidabad (d/s berhampore)	24.061719°	88.227575°	Ganga watercourse d/s of Murshidabad /Bridge if construction get completed
31	WB21	Ghat d/s of Srirampore	22.725772°	88.356118°	Ghat d/s of Srirampore
32	WB22	Nallah opposite ghat d/s Shrirampur	22.726286^0	88.364131^0	Nallah
33	WB23	Ganga River near Belgharia	22.670951°	88.359732°	Intake pumping Station of KMDA at Belgharia
34	WB24	Nalla @ Ballykhal	22.655029°	88.347635°	Bally Khal Bridge
35	WB26	Nalla @ Chitpur	22.607483°	88.369767°	Nullah (Circular canal) at Chitpur
36	WB27	Ganga R @ Howrah Bridge	22.585092°	88.346954°	Millennium Park

Appendix C: Additional 38 RTQMS with parameters to be provided by CPCB.

Appendix D: Additional 38 RTQMS with locations are as below:

.No.	State	R. Ganga/ Tributary	Location	Detail Description	Latitude	Longitude
On river Ganga						
1.	Uttarakhand	R.Ganga	Tehri Dam	D/s of Tehri Dam	30.37194722	78.47771667
2.	Uttarakhand	R.Ganga	Kedar Nath	D/s of Kedar Nath	30.73223056	79.06622778
3.	Uttarakhand	R.Ganga	Kirtinagar	D/s of Srinagar	30.21358056	78.74640556
4.	Uttarakhand	R.Ganga	Rishikesh	Distributing Canal, Left Bank	30.07245556	78.29195
5.	Uttarakhand	R.Ganga	Birla Ghat, Haridwar	Har Ki Pauri, Road Bridge	29.9580006	78.175408
6.	Uttar Pradesh	R.Ganga	Bithura, Fatehpur	Bithura, Fatehpur	26.05050833	80.90882778
7.	Uttar Pradesh	R.Ganga	Fafamau,Allahabad	Fafamau, Lord Curzon Bridge, Allahabad	25.50754	81.8658
8.	Uttar Pradesh	R.Ganga	Sirsa, Jhusi, Allahabad	Sirsa, Jhusi, Allahabad	25.26922	82.09272
9.	Uttar Pradesh	R.Ganga	Ghazipur	D/s of Ghazipur	25.58838333	83.60649167
10.	Bihar	R.Ganga	Chausa, Buxar	Bridge at Buxar (on Ganga)	25.5204	83.90016
11.	Bihar	R.Ganga	Manjhi, Madhubani	Bridge on Ghagra near Manjhi	25.82295	84.579596
12.	Bihar	R.Ganga	Buxar	D/s of Buxar	25.59180556	83.98608889
13.	Bihar	R.Ganga	Bhagalpur	D/s of Bhagalpur, Road Bridge	25.27774444	87.02798056
14.	Bihar	R.Ganga	Punpun, Patna	Road bridge at Fathua on Punpun	25.51518056	85.29925833
15.	Bihar	R.Ganga	Khurji, Patna	New Bridge, U/s of Patna city	25.6533	85.09524167
16.	West Bengal	R.Ganga	Farakka Barrage	Farakka Barrage , Road Bridge	24.80174	87.922
17.	West Bengal	R.Ganga	Nabadwip	D/s of Nabadwip, Road Bridge	23.38643333	88.36654167
18.	West Bengal	R.Ganga	Chinsura	Chinsura , Near Hooghly, Road Bridge	22.906765	80.403863
	On tributaries and sub-tributaries of river Ganga					
19.	Uttar Pradesh	Sai river	Pratapgarh	Bela Pratapgarh at Sai River	25.93571667	82.00605278
20.	Uttar Pradesh	Kali-East	Meerut	D/s of Meerut city	28.92146667	77.75614722
21.	Uttar Pradesh	Kali-East	Bulandshahar	D/S of Bulandsahar	28.39422778	77.86343056
22.	Uttar Pradesh	Yamuna	Mathura	Gokul Barrage, D/s of Mathura	27.44244722	77.71656389
23.	Uttar Pradesh	Yamuna	Barnawa	Near Galhita, Panipat, D/s of Yamuna	29.11433056	77.44059167
24.	Haryana	Yamuna	Mohana	D/s of Yamuna river	28.987033	77.201835
25.	Uttar Pradesh	Hindon	Rajnagar Extension	Road Bridge on Hindon river	28.68561389	77.392025

26.	Uttar Pradesh	Ken	Chila Ghat,Banda	Road Bridge on Confluence of Ken & Yamuna River	25.77460556	80.52383889
27.	Uttar Pradesh	Chambal	Kanjausa, Auraiya	Road Bridge on Confluence of Chambal & Yamuna River	26.437204	79.208758
28.	Uttar Pradesh	Betwa	Hamirpur	Road Bridge on Confluence of Betwa & Yamuna River	25.943398	80.154056
29.	Uttar Pradesh	Ramganga	Darhiyal	D/s of Kashipur	29.05275	79.01958
30.	Uttar Pradesh	Ramganga	Faridpur Thakuran	D/s of Bareilly	28.295264	79.370221
31.	Bihar	Burhi Gandak	Khagaria	Road bridge on Burhi gandak	25.501014	86.481191
32.	Bihar	Kosi	Kursela	Road bridge on Kosi	25.423763	87.233641
33.	Bihar	Son	Arrah	Road bridge on Son	25.567244	84.796147
34.	Bihar	Gandak	Hajipur	Road Bridge on Gandak	25.691823	85.192448
35.	Jharkhand & West Bengal	Damodar	Panchet Dam	Panchet Dam (D/s),Road Bridge	23.681318	86.747974
36.	Jharkhand	Damodar	Dhanbad, Sindri	Dhanbad, Sindri (D/s), Road Bridge	23.630686	86.462424
37.	West Bengal	Damodar	Durgapur barrage	Durgapur barrage, Road Bridge	23.477425	87.304007
38.	West Bengal	Damodar	Ramgarh	Ramgarh , Road Bridge	22.557661	88.327062

Appendix E – Payment Description and Worksheet

Sensor-hour Purchase Plan							
					Category Totals		
Sensor Category	**Sensor Weight**	Qty of Sensors	SW*QS	**Hourly Sensor Rate**	**Hourly**	**Daily**	**Yearly**
a	**10**	10	100	$ 2.85388128	$ 28.54	$684.93	$2,50,000.00
b	**5**	10	50	$ 1.42694064	$ 14.27	$342.47	$1,25,000.00
c	**3**	10	30	$ 0.85616438	$ 8.56	$205.48	$75,000.00
d	**2**	10	20	$ 0.57077626	$ 5.71	$136.99	$50,000.00
Totals	**20**	**40**	200	$ 5.70776256	$ 57.08	$ 1,369.86	$ 5,00,000.00

Bid Annual	$ 5,00,000.00
Bid Daily	$ 1,369.86
Bid Hourly	$ 57.08

Sesnor A	((B/365)/24)/(Qa*Wa+Qb*Wb+Qc*Wc+Qd*Wd)*Wa
Sensor B	((B/365)/24)/(Qa*Wa+Qb*Wb+Qc*Wc+Qd*Wd)*Wb
Sensor C	((B/365)/24)/(Qa*Wa+Qb*Wb+Qc*Wc+Qd*Wd)*Wc
Sensor D	((B/365)/24)/(Qa*Wa+Qb*Wb+Qc*Wc+Qd*Wd)*Wd

Legend
Total Budget = B
Sensor Weight= W
Sensor Quantity=Q
Category A= a
Category B=b
Category C=c
Cadegory D=d

The spreadsheet above provides a method to calculate a data purchase for four different price categories. The cells in red are to be completed by the **Client.** The uppermost part of the spreadsheet indicates the Sensor Category in column 1. The sensor category weight is indicated in column 2. The sensor category weight is a measure of the value of the category. For instance, sensor category "a" has a weight of 10. Sensor category "b" has a weight of 5. This means that the measurements (sensors) belonging to category "a" will be purchased for twice the amount of the measurements in category "b". The **Client** can change the weights of the sensors as necessary, and would likely do so if the relative value of the data to the **Client** changes over time. The Quantity of sensors is indicated in the column 3, which is the total number of sensors that belong to this category. The user of this spreadsheet would fill out all of the items in red, including the final cell in red which is the bid price on an annual basis. After these cells are completed, a price will be calculated for each sensor measurement-hour in a given category. Very simply, this hourly compensation rate

will be multiplied by the number of qualified sensor hours in the given category to arrive at the compensation for the data purchase.