ECOLOGICAL
SERVICES PVT. LTD

BOD
COD
°C
Cl
Depth
pH
NO3-N
TOC
Solar Illuminance
NH4-N
Chlorophyll A
Blue Green Algae
DO
CDOM FDOM
DOC
Flow Velocity
Color
NO2-N
SAC254

FOREMS

FLOATING ONLINE RIVER EFFLUENT MONITORING SYSTEM

CONTENTS

- SENSORS MODULE
- POWER MODULE
- DATA COMMUNICATION MODULE
- SAMPLING METHOD
- CLEANING MODULE
- MOUNTING METHOD
- DATA COMMUNICATION AND SOFTWARE DASHBOARD
- FEATURES
- DIRECT DATA TRANSFER PROTOCOL
- TWO WAY COMMUNICATION
- ANALYTICAL REPORTS
- ADVANCED REMOTE DIAGNOSTICS AND CALIBRATION
- DIAGNOSIS OF DATA
- ANNEXURE A
- ANNEXURE B
- DISCLAIMER

INTRODUCTION

There has been an evolution in the measurement principle and analysis of water quality when considered site or realtime monitoring scenarios. However the method of sampling, automatic cleaning of sensors, mounting and sheltering of existing system still have drawbacks to overcome.

Basic requirement of a continuous surface water monitoring station as per EPA 817- B-16-03 Sept 2016

- Provide information to facilitate protection of the public water supply for all intended uses
- Observe long-term trends in source water quality to prepare for future challenges or regulations
- Detect and respond to contamination incidents
- Optimise treatment processes to improve finished water quality and reduce costs
- Develop information that supports regulatory compliance
- Investigate and identify pollution sources and potentially responsible parties
- Detecting possible sources of contaminants and predicting future possibilities which may be avoided

Accordingly there is a need to develop a system that complies these points as well overcomes the drawbacks of current system.

ABOUT SYSTEM

The PTESPL FOREMS is a platform specifically developed for pollution measurement in open water bodies. The floating platform is designed with lower centre of gravity making it more stable is various scenarios. The design aim was to make it suitable for on-line water quality monitoring of all Surface water bodies.

FOREMS can be defined as all inclusive uniquely stable design, self powered by off grid solar system equipped with precise and high quality precise measuring sensors along with built in cleaning system and the ability to sample without any external requirement. The equipment has ability to communicate realtime at frequency in milliseconds and transfer data directly to end server without intermediate logic acquiring the Direct Data Transfer. Also the two way communication feature of ECOLYSER gives a leading edge for the matter of remote diagnostics and data validation.

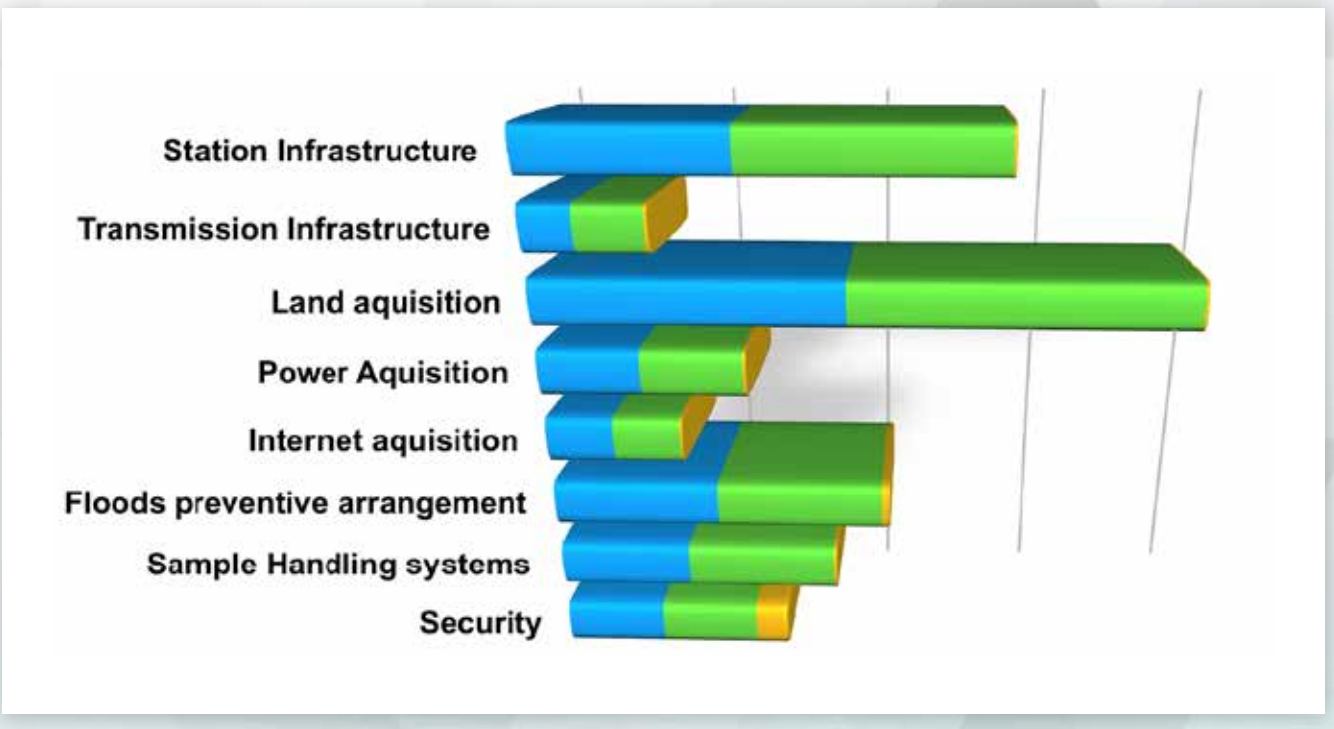
EPA overview on ideal Station Structure ● = Positive ◒ = Neutral ○ Negative

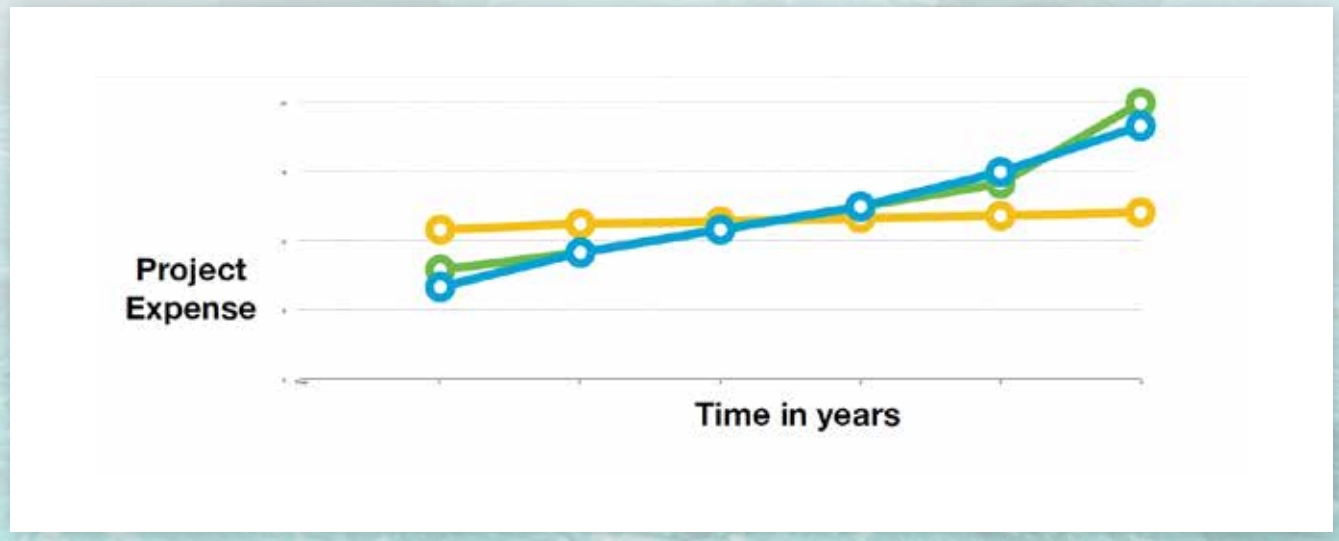
ATTRIBUTES	FREE-STANDING RACKS	FREE-STANDING RACKS	FREE-STANDING RACKS
COST	◒	◒	◒
Fabrication	◒	◒	●
Flexibility	◒	◒	●
Foolprint	○	○	●
Installation	◒	○	◒
Protection	○	●	●
Security	○	●	●

Source: Guidance for Building Online Water Quality Monitoring Stations United States Environmental Protection Agency EPA 817-B-18-002 May 2018

Infrastructural Needs	○	○	●
Valid Sample Sourcing	◒	◒	●
Effect of Floods	◒	◒	●
Secondary pollution	●	●	●

● OPEN RACK TYPE STATION ● ENCLOSED STATION ● FOREMS FLOATING STATION





DESIGN

The floating platform uses a specially designed aerodynamic body to perform against all or multi-axial directional flow making it easy to install in all types of currents.

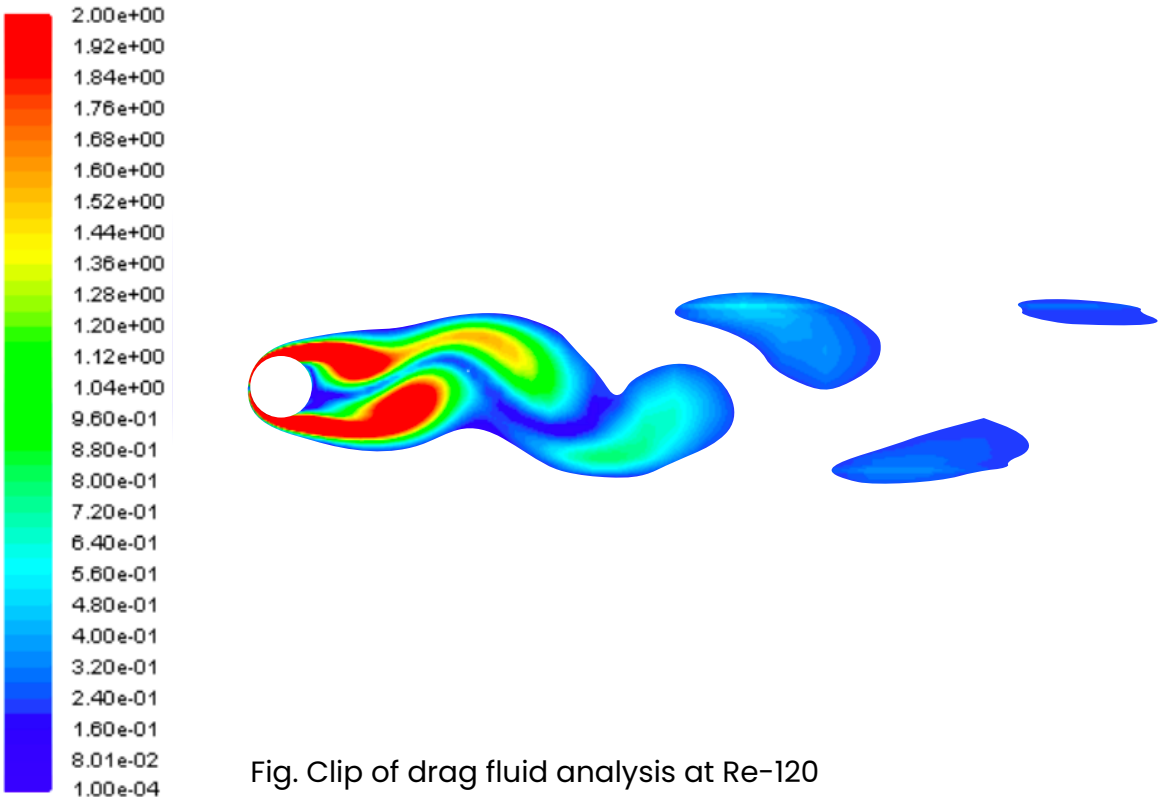


Fig. Clip of drag fluid analysis at Re-120

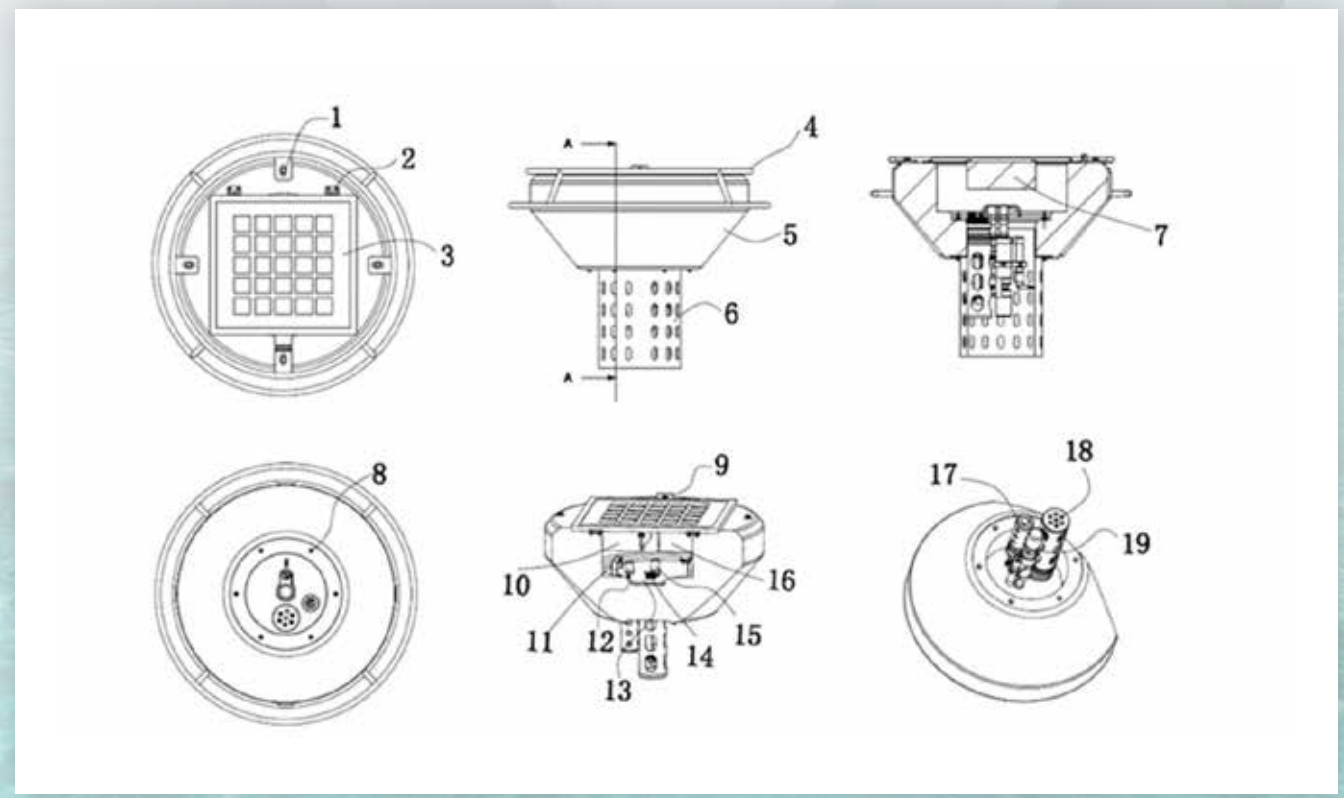
FOREMS body is designed optimising lower Centre of gravity in order to avoid non-stable operating conditions. Weighing just over 40kg, FOREMS is an ideal product for changing the positions easily, transporting, extracting without need of a crane or lifting utilities. Design Material of platform consist PE Shell, SS316L Guard rail and flow diffusing mesh cover.

FLOOD TOLERANT DESIGN

DIMENSIONS OF PLATFORM

PLATFORM COMPONENTS & TECHNICAL SPECIFICATIONS

1	Top Screw	11	Stainless steel Handle
2	Hinge	12	RS485 signal module for analyser
3	Solar Panel	13	Sensor mounting platform
4	316L Guard Ring	14	RS485 signal module for analyser
5	Hull	15	RS485 signal module for analyser
6	316L Mesh Cover	16	Battery waterproof compartment
7	Battery waterproof water proof casing	17	Analysers and sensors
8	Mesh cover mounting fasteners	18	Analysers and sensors
9	Lock catch	19	ISE sensors
10	DDT Data logger water proof casing		



SENSORS MODULE

The selective on board analyser library made by pristine manufacturers like OPRUSS AUTOMATICA, HORIBA, IN-SITU vary on basis of application, accuracy preferred by end user, technology aspects etc. However whether Optical or Ion selective Electrodes, they can be easily mounted and integrated with FOREMS platform.

POWER MODULE

Equipped with a solar photovoltaic panel, FOREMS generates its own clean energy. This energy is made capacitive by a maintenance free Li-ion batteries designed to run the system for 3-5 days (on the basis considering number of sensors on board) as a Design Autonomy.

DATA COMMUNICATION MODULE

The ultra light and swift responsive DDT data logger takes in a maximum 10 parameters per device which can be RS485 looped together. The smart DDT unit comprises of features mentioned as follows.

SAMPLING METHOD

The pollution quality at the coast and the centre of a flowing channel sometimes vary upto 30%. The optimum sampling position is the centre where the effluent is well mixed. As the system installation is in-situ, there is no requirement of externally pumping utilities, all needed is anchoring the system as the centre of flowing cross section. This makes it possible for FOREMS to measure the sample at the centre of flowing channel for the most precise output.

CLEANING MODULE

FOREMS platform uses self cleaning sensors/analyser usually the ones that possess conductive friction wiper cleaning. Conductive wiper cleaning is most reliable and cost effective than other cleaning mechanisms. The cleaning system also feedbacks when triggered externally and records minor drift before and after cleaning internally. This drift when minimises the predefined threshold indicates the change of wiper component.

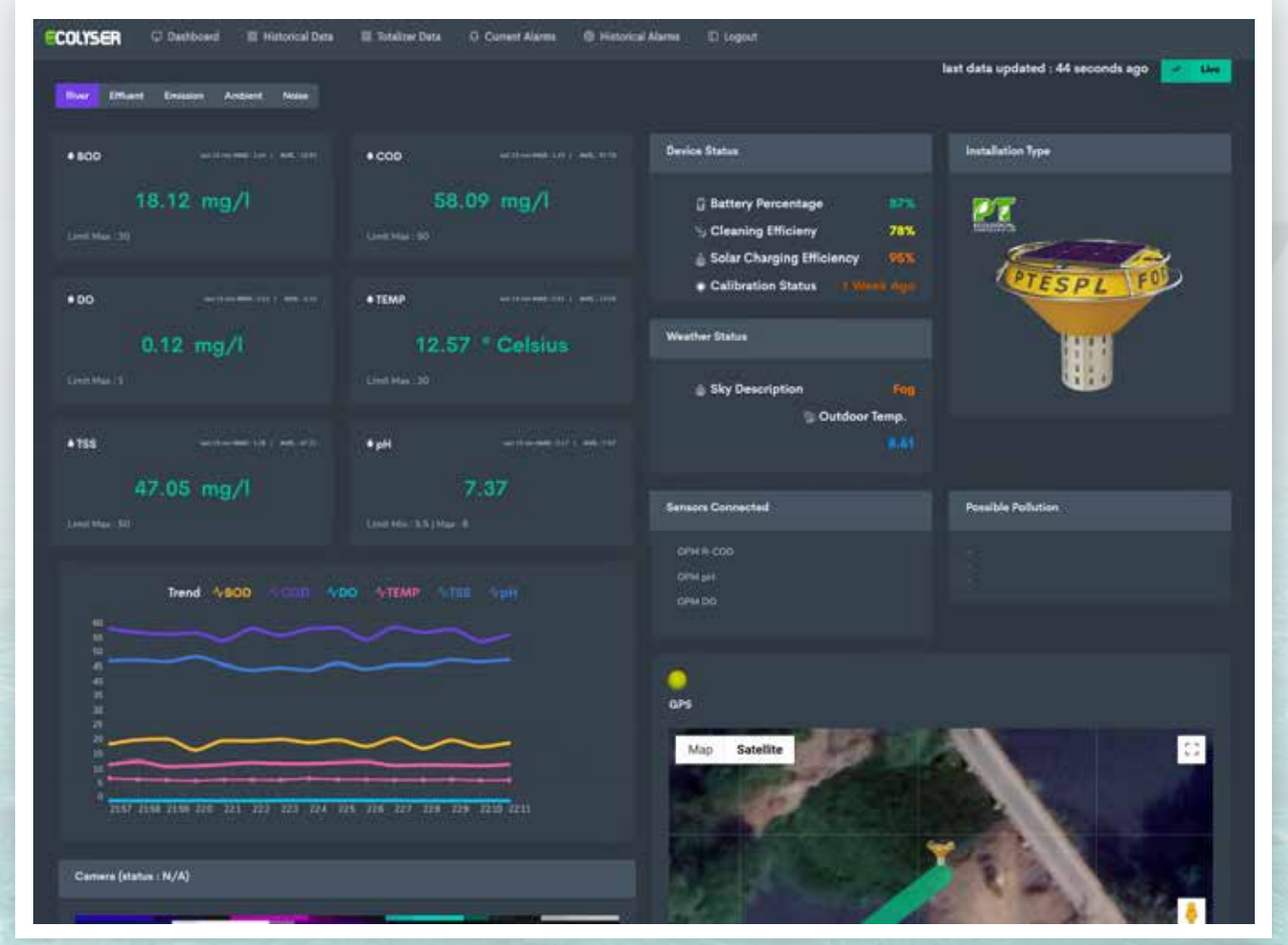
MOUNTING METHOD

The platform being light weight can be easily thrown in water along with anchor or can be tied at one or both ends at a coast. The most pro-active part being there are no external dependencies, power or internet strings attach which limit the liability of supplier.

DATA COMMUNICATION AND SOFTWARE DASHBOARD

Analytical valuation of data is an important factor when multiple stations cumulate to perform an overall output. When monitoring of surface water bodies is the aim it is necessary to categorise few important aspects like mapping, bifurcate the invalid, identify the ones that require service attention, validate and study trend, outputting system working status, analyse power module details etc.

The Dashboard of FOREMS is another leading edge that offers a lot more to analyse and not just realtime data viewing and flagging of exceeding threshold. Software specially developed by ECOLYSER for optimizing more than 50 featured tools and functions.



FEATURES

Real time data transfer redefined with blistering speed with frequency of refreshing as almost mili seconds of latency. The real time sensors/analysers have the ability to detect 30-40 instances every second hence corresponding raw data can be obtained at such frequency. Hence a logic to average the data for a certain time may make the realtime valid data vulnerable.

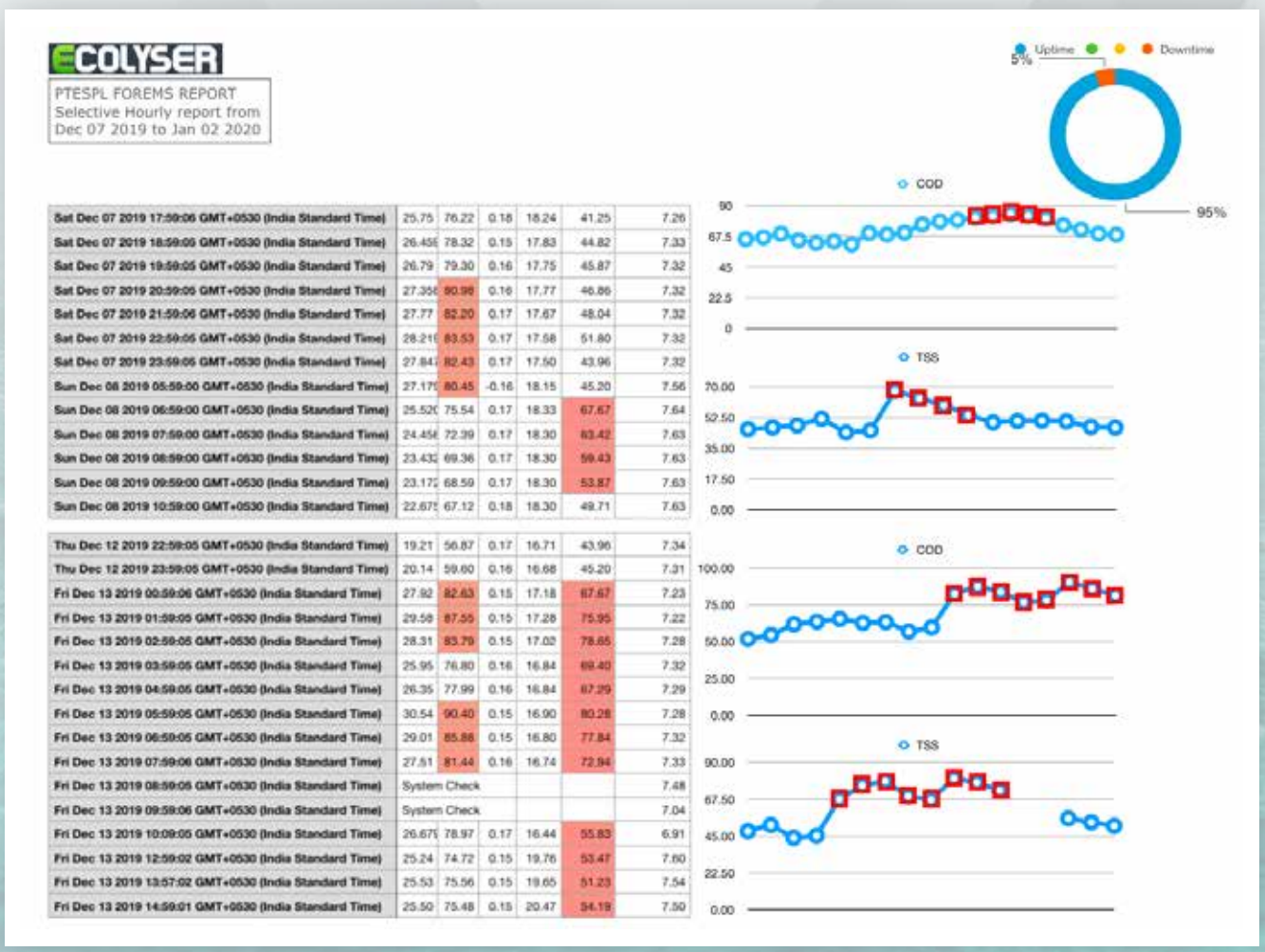
DIRECT DATA TRANSFER PROTOCOL

The ability to transfer data from sensors/analysers to final control server without any intermediate signal conditioning program/logic can be now experienced. Unleashing a new series of data validation advantages DDT is the call for new tool for Realtime Pollution Monitoring scenario.

TWO WAY COMMUNICATION

Earlier version of Realtime communication system limited its possibilities to only grab data from the transmitter to read and save, ECOLYSER enables the Server to be the controller and to command and receive the feedback from the sensors/actuators. It being an important aspect about ability of diagnostics, changing operating statistics and settings, validating and obtaining glitches in monitoring pattern remotely.

ANALYTICAL REPORTS



DIRECT DATA TRANSFER PROTOCOL

The ability of actuating process required for the instrument to meet the referencing element of medium is possible through two way communication. Using the core diagnostics of sensor for understanding the behaviour while exposure of various reference medium is an important feature to learn the life and calibration drift of measuring instruments. The enhancement of selective onboard sensor analyser library now represents the ability to command inter sensor functions like viewing or changing the existing settings, triggering cleaning, modifying correlating algorithms, analysing the raw data, accessing and modifying core settings that determine measurement quality.

DIAGNOSIS OF DATA

a. Raw data of measuring parameters to

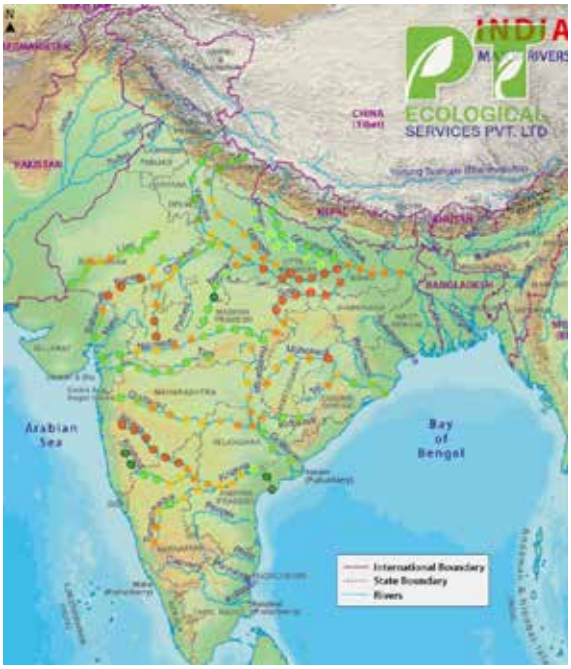
b. Primary detecting derivative data (Absorbance of detector for optical method based analysers, mV in Ion selective electrode based sensors)

c. Reading Calibration set points, drift factor for last calibration,

d. Principle component internal features Lamp illumination intensity, life curve of lamp

e. Sensor Cleaning efficiency from drift value before and after cleaning

f. Sample dilution identification from Mean Average Deviation immediate rise or drop or constant raw data.



ECOLYSER's algorithms help in pollution mapping to scale the contamination levels as desired.

The software is accessible from all Android, IOS, Windows OS based smart devices