

REAL TIME WATER QUALITY  
MONITORING AND ALERT SYSTEMS,  
APPLICATIONS AND SUSTAINABLE  
MONITORING USING OPEX BUSINESS  
MODEL

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**Abstract**

The paper covers the following:

- o Methodology and setup in Water Quality Monitoring System, a Real Time Monitoring and Alert System (RTMAS).
- o Considerations for sustainable operation in water monitoring applications, using the OPEX (Operational Expense) Model

**System Setup and Methodology  
of  
Real Time Water Quality Monitoring**

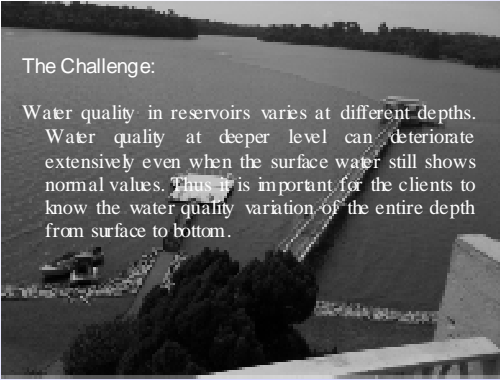
**Real Time Water Quality Monitoring and Alert System**  
*System Setup and Methods*

Illustrates the System Setup based on 2 applications we have deployed in Singapore:

- o Remote Monitoring of Reservoirs Water Quality profile.
- o Remote monitoring of Total Suspended Solid (TSS) in drainage and catchment.

### System Setup and Methods

#### *Remote Monitoring of Reservoirs Water Quality Profile*

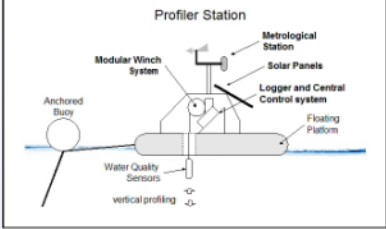


The Challenge:

Water quality in reservoirs varies at different depths. Water quality at deeper level can deteriorate extensively even when the surface water still shows normal values. Thus it is important for the clients to know the water quality variation of the entire depth from surface to bottom.


### System Setup and Methods

#### *Remote Monitoring of Reservoirs Water Quality Profile*



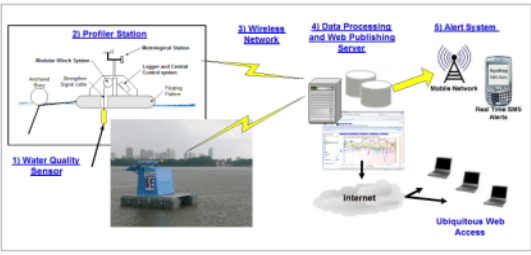
The Solution:

The Profiler Station is a fully automated system designed for measuring the entire vertical column of water qualities of the reservoir. These stations continuously winch the water quality sensors to various pre-programmed depths.



### System Setup and Methods

#### *Remote Monitoring of Reservoirs Water Quality Profile*




The 5 main components of Reservoir Profile Monitoring system

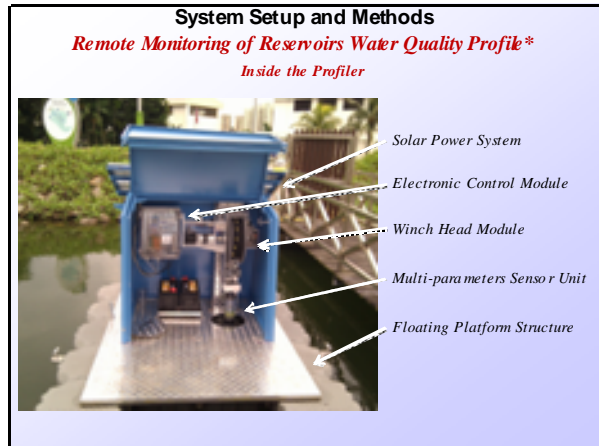
- Water Quality Sensor
- Profiler Station
- Wireless network
- Data processing and publishing server
- Alert system

### System Setup and Methods

#### *Remote Monitoring of Reservoirs Water Quality Profile*



Total: 19 Stations deployed



**System Setup and Methods**  
*Remote Monitoring of Reservoirs Water Quality Profile\**  
*Deployment - Tow and install*

**System Setup and Methods**  
*Remote Monitoring of Reservoirs Water Quality Profile*  
*Data processing & Hosting Server and Alert System*

**System Setup and Methods**  
*Remote Monitoring of Reservoirs Water Quality Profile*  
*Web-base Access*

**System Setup and Methods**  
*Remote Monitoring of Total Suspended Solid discharge*

The Challenge:

Municipal reservoirs are in higher risk of pollution as it within the vicinity of highly populated areas. One major pollution source is urban construction sites discharging silt contain water into catchment drainage network which may eventually end up in municipal reservoir(s).

### System Setup and Methods

#### Remote Monitoring of Total Suspended Solid discharge

- In Singapore, legislation requires that all construction sites to pre-treat any used water to below 50mg/l of TSS, before it is discharged into open public drain.
- Code of Practice on Surface water Drainage, Clause 6.3 (part of effective earth control measure ECM)



### System Setup and Methods

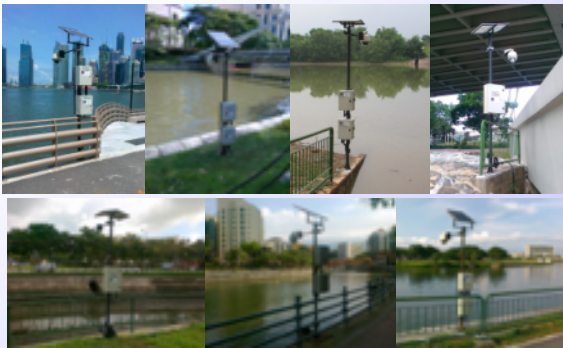
#### Remote Monitoring of Total Suspended Solid discharge

- As a preventive measurement, wireless TSS monitoring stations are setup at drainage canals near potential source of pollution discharge.
- When the TSS readings exceed their limits SMS alerts are send out to inform various stake holders for immediate attention



### System Setup and Methods

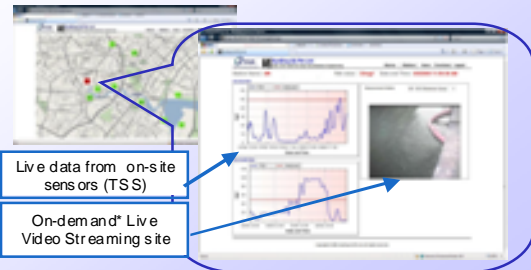
#### Remote Monitoring of Total Suspended Solid discharge



### System Setup and Methods

#### Remote Monitoring of Total Suspended Solid discharge

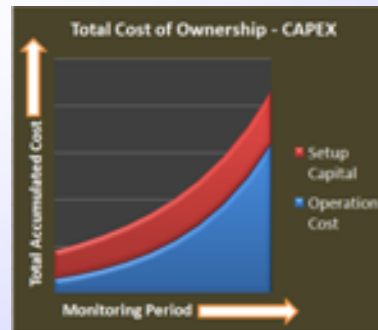
- Brings the real time TSS information from multiple remote sites to the desktop of the stake holders leveraging on smart sensor, wireless and internet technologies.
- Equipped with live video feed, leveraging on 3G network. The video are also automatically recorded on the server when TSS readings are above preset trigger level



## Consideration for a Sustainable Water Quality Monitoring Operation

### Real Time Water Quality Monitoring and Alert System *Considerations in Sustainable Water Quality Monitoring*

Total Cost of Ownership (TCO) of Water Monitoring System



### Real Time Water Quality Monitoring and Alert System *Considerations in Sustainable Water Quality Monitoring*

**Ownership Risks** - Increasing Operation Cost /Hidden Cost:

- Repair cost are not accurately forecasted (especially after warranty period)
- Increasing maintenance cost due to wear and tear, bio-fouling, weathering, etc. (dependent on skill level in maintenance)
- Equipment obsolescence
- Maintaining and training of *manpower in diversified areas of skills* required in water quality monitoring
- Others...

This Hidden Cost in **Ownership Risks** are often underestimated or left out. If it is un-planned for, the system will not be sustainable due to the increasing operation cost.

### Real Time Water Quality Monitoring and Alert System *Considerations in Sustainable Water Quality Monitoring*

CAPEX (Capital Expense)

**Stake Holder**

Water Resources and Treatment

**Water Quality Monitoring System**

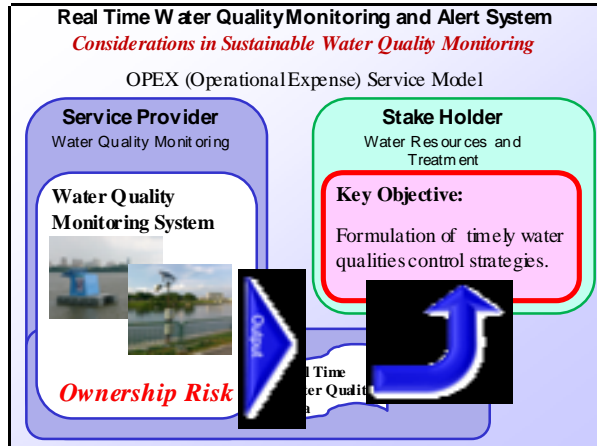


**Ownership Risk**

**Key Objective:**

Formulation of timely water quality control strategies.





**Real Time Water Quality Monitoring and Alert System**  
*Sustainable Monitoring with OPEX model*

Mitigate Ownership Risk for sustainable monitoring operation.

In OPEX model, The stake holder pays the **service provider** for monitoring services used (buying of data).

The service provider supplies a one-stop monitoring solution to its clients by :-

- Supplying and rental of the monitoring system,
- Runs the preventive maintenance
- Hosting the server system. (Data processing, Data hosting, Alert system)

**Real Time Water Quality Monitoring and Alert System**  
*Sustainable Monitoring with OPEX model*

The service provider establishment is able to handle ownership risks more effectively, due to the following:

- Having a focus business in remote monitoring solutions for multiple clientele base
- Able to amortize infrastructure and facilities cost
- Multiple concurrent projects to maintain and train cross-disciplinary engineering teams.
- Company Resources for continual upgrade of its monitoring system

**Better manage of ownership risk and increase cost-efficiency of its solutions.**

**Real Time Water Quality Monitoring and Alert System**  
*Sustainable Monitoring with OPEX model*

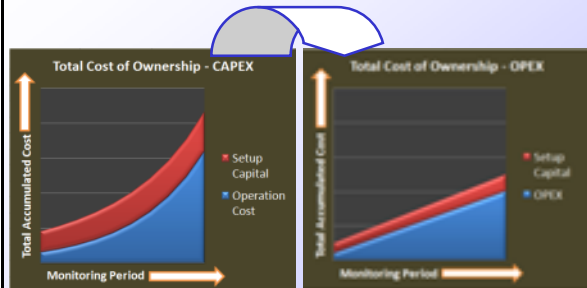
Benefits for stake holder in OPEX model:

- Pays only for service used
- Known projection of Operational Expense
- Shield from complex system integration and equipment obsolescence.
- Leverage on the expertise in service provider establishment
- Shorter lead time to deployment
- Ensure continuous support through the entire life span of monitoring

**KEY POINT:**  
*This allows the client to focus their valuable resources on analysis of data for prompt decision making in water qualities control strategies.*

**Real Time Water Quality Monitoring and Alert System**  
*Sustainable Monitoring with OPEX model*

Total Cost of Ownership (TCO) of Water Monitoring System



**Real Time Water Quality Monitoring and Alert System**  
*Conclusion*

- Water quality monitoring system requires detail planning in both system setup and operation considerations.
- To ensure sustainability of monitoring, the Critical operation resources need to be plan before execution:
  - specialized manpower
  - facilities
  - equipment and redundancies/spares
  - A service-support organization structure
- An option for sustainable monitoring operation is OPEX service model, which stake holder can leverage on the service provider's establishment and **focus their limited resources on result analysis and formulation of water qualities control strategies.**

**Thank You**

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