

Wireless Water Quality Monitoring Solutions

Environmental monitoring is crucial in combating pollution in surface water such as rivers, lakes, reservoirs, and coastal waters.



The UK Environment Act 2021 mandates hourly water quality data uploads, highlighting the need for robust monitoring solutions to detect and manage pollution events, including those from combined sewage overflows (CSOs). Traditional methods face high costs and logistical challenges, but CSignum's EM-2 wireless platform offers a groundbreaking solution by enabling reliable, cable-free communication for underwater and underground sensor data.

GLOBAL NEED FOR WATER QUALITY MONITORING

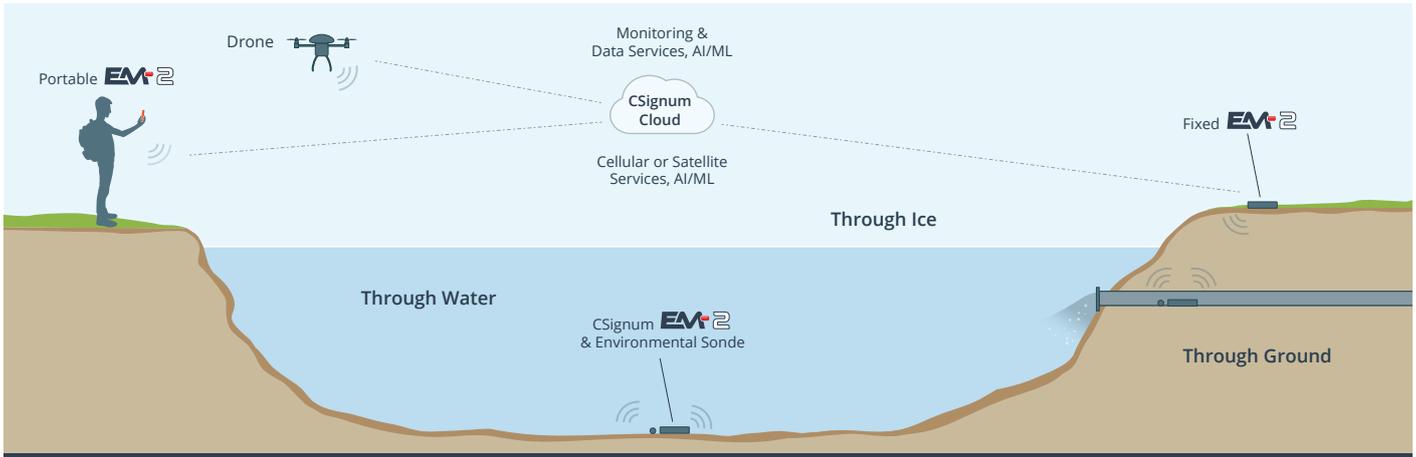
Globally, surface water quality monitoring has become a pressing issue due to increasing pollution levels in rivers, lakes, and coastal areas. Effective monitoring is the first step in implementing quantifiable improvement programs aimed at combating pollution. Continuous data collection is essential for understanding pollution patterns, implementing mitigation strategies, and ensuring compliance with environmental regulations. The ability to deploy robust monitoring systems in environmentally sensitive and remote areas is critical to achieving these goals.



THE EM-2 ADVANTAGE FOR SURFACE WATER QUALITY MONITORING



- **Rapid Deployment:**
EM-2's wireless technology enables quick and easy deployment of sensor packages near the riverbed, eliminating the need for extensive riverbank infrastructure
- **Reliable Communication:**
Utilizing electromagnetic field signaling (EMFS), EM-2 ensures dependable data transmission from submerged sensors to topside devices, even through challenging mediums including fresh and salt water, ice, concrete, and rock
- **Minimal Environmental Impact:**
The system is designed to be environmentally friendly and non-disruptive to existing ecosystems
- **Flexibility:**
EM-2 easily integrates with various sensor packs, including multiparameter sondes and security systems. The topside unit can be installed up to 100 meters away, offering significant flexibility in locating the communication relay point.



WATER QUALITY MONITORING APPLICATIONS AND BENEFITS

Riverbed Data Harvesting

Suitable for scenarios where real-time data is not required, such as broader environmental monitoring. For efficient data harvesting, an EM-2 communications system connected to a sonde is deployed on the riverbed. Water quality measurements are taken at regular intervals and logged on the EM-2 device. No permanent topside equipment installation is necessary.

When required, an operator, standing on the riverbank, carrying a second EM-2, requests upload of logged time series data from the riverbed system. This system allows for the deployment of multiple sensors along a river, providing continuous data logs that reveal when and where pollution events occur. This data can be used as evidence to deter polluters and drive environmental improvements.

The system removes the need for civil engineering projects and the risk of theft or vandalism of riverside equipment. In addition, overall system costs are lower, since a single portable topside EM-2 can communicate with many individual riverbed wireless monitoring systems.



Wireless Online Water Quality Monitoring

Ideal for applications requiring continuous, real-time monitoring, such as compliance with the UK Environment Act 2021. CSignum's EM-2, connected to a multi-parameter sonde, is deployed on the riverbed. The system can be recovered for sensor calibration by remote command from the riverbank inflating a recovery bag. A second EM-2, installed on the riverbank, provides the cellular interface and enables measurements to be published online. The system offers the following benefits:

- **Ease of Deployment:**
Rapid setup with minimal, or no, civil engineering/construction, reducing deployment time and costs
- **Flexibility:**
The topside unit can be placed in various locations, providing optimal positioning for data transmission without the constraints of cables or terrain
- **Mobility:**
The semi-permanent system can be moved to new locations as needed, providing flexibility in addressing emerging pollution concerns
- **Enhanced Project Margins:**
Using the EM-2 system can increase project margins by overcoming high-cost traditional monitoring options.

Addressing Combined Sewage Overflow Impacts

The EM-2 system is particularly effective in monitoring the impacts of combined sewage overflows (CSOs). These events, which discharge untreated sewage and stormwater into rivers during heavy rainfall, pose significant environmental risks.

By deploying one combined EM-2 and sensor system upstream from the discharge pipe and a second system downstream, continuous sensor monitoring can detect the timing and location of CSO events and seamlessly relay the captured data to a single topside EM-2 which publishes the measurements online.

This data is crucial for compliance with environmental regulations and for implementing timely mitigation strategies.

Impact on Coastal Waters

Pollution in inland waterways eventually flows into the sea, impacting coastal waters. Effective monitoring of rivers and lakes with EM-2 helps track pollutants from their source and into coastal waters, providing essential data to mitigate downstream effects on coastal ecosystems.

CSignum wireless water quality monitoring systems are equally applicable to monitoring the littoral zone along the seashore. The EM-2 can be interfaced with water quality sensors on the seabed communicating measurements directly to a second EM-2 on the shore.

This holistic approach ensures that both inland and coastal waters are protected, improving overall water quality, and safeguarding marine life.

Monitoring Around Offshore Wind Farms

Offshore wind farms represent a significant aspect of renewable energy development but also necessitate careful environmental monitoring. The construction and operation of wind farms can impact marine ecosystems, including seabed disturbance, noise pollution, oil and toxic material leakages, and potential changes in water quality.



The EM-2, paired with water quality sensors, can be deployed on the seabed around the monopile of the wind turbine. Measurements are

wirelessly communicated to a second EM-2 mounted on the tower and interfaced to a satellite uplink for publishing the measurements online.

The EM-2 system provides a robust solution for monitoring these impacts, offering several key advantages:

- **Continuous Monitoring:**
EM-2 enables continuous data collection around wind farm installations, providing real-time insights into environmental conditions
- **Flexible Deployment:**
Sensors can be deployed on the seabed around wind turbines, ensuring comprehensive monitoring without the need for extensive infrastructure
- **Compliance and Reporting:**
Continuous monitoring ensures compliance with environmental regulations and helps in reporting the environmental impact of wind farm operations
- **Mitigation and Management:**
Data collected can be used to implement mitigation strategies and manage the environmental impact effectively.

EM-2 INNOVATIVE FEATURES

- **Electromagnetic Field Signaling (EMFS):**
EM-2 employs electromagnetic fields to transmit data, bypassing the limitations associated with acoustic, optical, and traditional wired communication methods. This technology allows data transmission through water, ice, concrete, and rock, making it suitable for a wide range of environmental and industrial applications
- **Reliable Communication Through Water:**
Traditional acoustic and optical methods cannot communicate through the water surface and are affected by turbidity and biofouling. EM-2's EMFS technology seamlessly transmits data from underwater sensors to above-surface devices without signal degradation. EM-2 supports bidirectional data transfer, enabling both data collection from and control of underwater devices
- **Communication Through Ice and Subterranean Environments:**
The EMFS technology is effective through ice, making EM-2 ideal for monitoring in polar regions and other icy environments. EM-2 can also transmit data through rock and soil, supporting underground monitoring and control in mines, tunnels, and other subterranean settings
- **Integration with Widely Used Sensor Systems:**
EM-2 is compatible with a wide range of industry-standard sensors, including multiparameter sondes, ADCPs, and security systems. The system can be easily integrated with existing sensor packs, enhancing its applicability across different monitoring scenarios
- **Environmental Resilience:**
Unlike acoustic and optical methods, EMFS is not impacted by biofouling, turbidity, or environmental noise, ensuring consistent performance in diverse conditions. The wireless nature of EM-2 reduces the physical footprint of monitoring systems, minimizing disruption to natural habitats and aquatic life
- **Airbag Inflation on Demand:**
For easy maintenance, the system can be deployed with an integrated airbag that brings the submerged EM-2, battery, and sonde system to the surface. This feature allows technicians to clean sensors and change batteries from the riverbank or sea by simple retrieval, avoiding the need for divers to enter the water.

APPLICATIONS ACROSS DIVERSE ENVIRONMENTS

Rivers, Lakes, and Coastal Waters:

Ideal for environmental monitoring, pollution tracking, and compliance with regulations such as the UK Environment Act 2021.

Offshore Wind Farms:

Ensures continuous monitoring of marine ecosystems around wind farms, helping to mitigate environmental impacts.

Subsea and Underground:

Supports a wide range of applications from offshore energy infrastructure monitoring to underground mining operations.

CONCLUSION

CSignum's EM-2 wireless platform revolutionizes environmental monitoring by providing a flexible, reliable, and cost-effective solution for surface water quality monitoring.

Designed to overcome the limitations of traditional wired and wireless communication methods, the EM-2 utilizes innovative electromagnetic field signaling (EMFS) to transmit data through challenging mediums, ensuring reliable and efficient communication.

Its robust features enable the deployment of numerous sensors with minimal environmental impact, offering continuous, real-time data that is critical for identifying pollution events and implementing effective mitigation strategies.

By proactively complying with regulatory initiatives, such as the UK Environment Act 2021, and effectively addressing the impacts of CSOs, the EM-2 system ensures the protection of both inland and coastal waters, promoting a sustainable future for our planet.



APPLICATIONS

- Internet of Underwater Things (IoUT)
- Under Ship & Propulsion Monitoring
- Offshore Environmental & Structural Monitoring
- Underground Data Monitoring
- AUV/ASV Data Harvesting
- Inland & Coastal Environmental Monitoring
- Defence & Security