AQUAMESH

Current Aquamesh Product Offerings:

AquaSpectra Sensor Probe

AQUASPECTRA Mκ1

Capabilities:

- Measure **absorbance** in the **190-440nm** range & **fluorescence** in the **340-850nm** range all-in-one, real time. Additional parameters such as petroleum and specific types of algae can be added easily.
- **Onboard camera** allows remote site monitoring and minimizes maintenance visits
- The first spectral sensor probe to enable **over-the-air updates**, custom firmware capabilities allow sensors to improve over time with minimal downtime and manual intervention.
  - Includes **tunable compensation** for temperature, ambient light, turbidity, IFE and more.

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- - - Potential future feature examples: Dynamic change in compensation coefficients, switch data output format, add AI/ML signal processing features network wide.
  - **Robust antifouling:** Self-cleaning wiper, UV leds & on-board monitoring camera minimizes expensive manual maintenance.
  - Integrates smoothly with the rest of AquaMesh communications and AI cloud platform stack factory wide.
  - **Easy setup, Full control.**

Dimensions (Subject to Slight Changes & Customizable):
- 129mm Width
- 148mm Height

Parameters (expected, range, minimum, and accuracy, are subject to change):
- Absorbance:
  - Nitrate (DOM compensated, salinity uncompensated)
    - Range: 0 to 30 mg/L (-N)
    - Min. 0.5 mg/L (-N)
    - Accuracy: ±10% of reading or ±0.3 mg/L, whichever is greater.
  - TOC (Total Organic Carbon)
    - Range: 0 to 30 mg/L TOC
    - Min. TBD (expected ~0.5 mg/L)
    - Accuracy: ±10% of reading or ±0.5 mg/L, whichever is greater.
  - SAC254 (Spectral Absorption Coefficient)
    - Range: 0–50 m^{-1}
    - Min. 0.5 m^{-1}
    - Accuracy: ±5% of reading or ±0.05 m^{-1} (whichever is greater)
  - CDOM (Colored Dissolved Organic Matter)
    - Range: 0–50 m^{-1} (a254)
    - Min. 0.5 m^{-1}
    - Accuracy: ±5% of reading
- Fluorescence:
  - fDOM (Fluorescent Dissolved Organic Matter)
    - Range: 0–1,000 QSU (Quinine Sulfate Units)
    - Min. ~1 QSU

- - - Accuracy: ±5% of reading
  - TLF (Tryptophan-like Fluorescence)
    - Range: 0 to 1000 ppb (dilute Tryptophan)
    - Min. 10 ppb (Tryptophan)
    - Accuracy: ±5% or ±5 ppb (whichever is greater)
  - HLF (Humic-like Fluorescence)
    - Range: 0–1,000 QSU
    - Min. ~1 QSU
    - Accuracy: ±5% of reading
  - Chlorophyll-a
    - Range: 0–400 µg/L (Chl-a equiv.)
    - Min. 0.05 µg/L equiv.
    - Accuracy: ±5% or ±0.05 µg/L equiv. (whichever is greater)
  - Phycocyanin
    - Range: 0–300 µg/L (equiv.)
    - Min. 0.1 µg/L equiv.
    - Accuracy: ±10%
  - Phycoerythrin
    - Range: 0–300 µg/L (equiv.)
    - Min. 0.1 µg/L equiv.
    - Accuracy: ±10%
  - RWT (Rhodamine Water Tracer)
    - Range: 0 to 1000 µg/L (RWT)
    - Min. 0.01 ug/L (RWT)
    - Accuracy: ±10% of reading or ±0.01 µg/L,(whichever is greater)
  - FI (Fluorescence Index)
    - Range: 1.2–1.9 (dimensionless)
    - Accuracy: ±0.05 FI
- Nephelometric:
  - Turbidity ISO 7027 (FNU)
    - Range: 0 to 1000 FNU (Formazin Nephelometric Units)
    - Min. 0.5 FNU
    - Accuracy: ±2% of reading or ±0.5 FNU (whichever is greater)

Optically Supported Parameters (specs are subject to change and performance may vary):

- Oil / Hydrocarbon (Fluorescence)
    - Range: 0–100 ppm (diesel-equivalent)
    - Min. 0.5–1 ppm
    - Accuracy: ±20%
- Algal Pigment Composite Index
    - Excitation: 460–530 nm
    - Emission: 680–700 nm
    - Range: Relative fluorescence units to µg/L equivalent
    - Accuracy: ±10–15%
- Fluorescence Quenching Index
    - Excitation: ~590 nm
    - Metric: Signal suppression vs baseline
    - Use Case: Interference detection, toxicity screening

Instruments:
- Digital Temperature Sensor (±0.5°C)
- Ultrawide Camera Sensor
- UV/VIS Spectrometer Emission Sensing Modules (190 nm to 850 nm)
- 12 Parameter LED Excitation Source Array (w/Active Brightness Compensation)
- 6x 275nm UV Anti-Fouling LEDs
- Built-in Servo Wiper
- Material: Stainless Steel or Titanium enclosures (customizable , sapphire lenses.

Power (Customizable):
- 9V to 28V @ 500 mA DC Input
- Internal 3200 mAh 3S 11.1V Li-Ion Battery Pack

Data/Cable (Customizable):
- Configurable Sampling Rate, Serial Sampling Trigger
- RS485 half-duplex serial interface (115200 baud rate)
- 4-wire Cable (A, B, PWR, GND)

AquaLink Hub

Capabilities:

- Enables **real-time wide scale monitoring** and deployments with easy setup.
- Compatible with AquaSpectra and majority of 3rd party sensors (easily include pH, TSS, DO, flow sensors etc)
- Integrating Starlink Direct to Cell technology to get **affordable connectivity backhaul virtually anywhere**. Enabling off-the-grid connectivity on land, lakes or coastal waters.
- Can be configured for factory or remote use
- Nearby AquaLink nodes **create** their own 2.4 GHz **mesh network**: enhanced security, control and **easy scaling with low data fees.**
- Designated gateway nodes uplink to Cloud Platform.
- Takes minutes instead of weeks to configure a whole network. No technical knowledge needed.

Dimensions (Subject to Change & Customizable):

- Sealed Metal or Plastic Enclosure (200 mm x 200 mm x 50 mm)

- Ports:
    - 2 Terminal DC Input

- 2 Terminal Battery Input
- RJ45 Ethernet Link
- LTE Antenna SMA Egress

Wireless/Wired Connectivity (Customizable):
- Ethernet PHY (10BaseT/100BaseTX)
- M.2 Cellular Modem (LTE CAT-1)
- Integrated 2.4 GHz Wi-Fi (802.11b/g/n)
- GNSS

Mesh (optional):
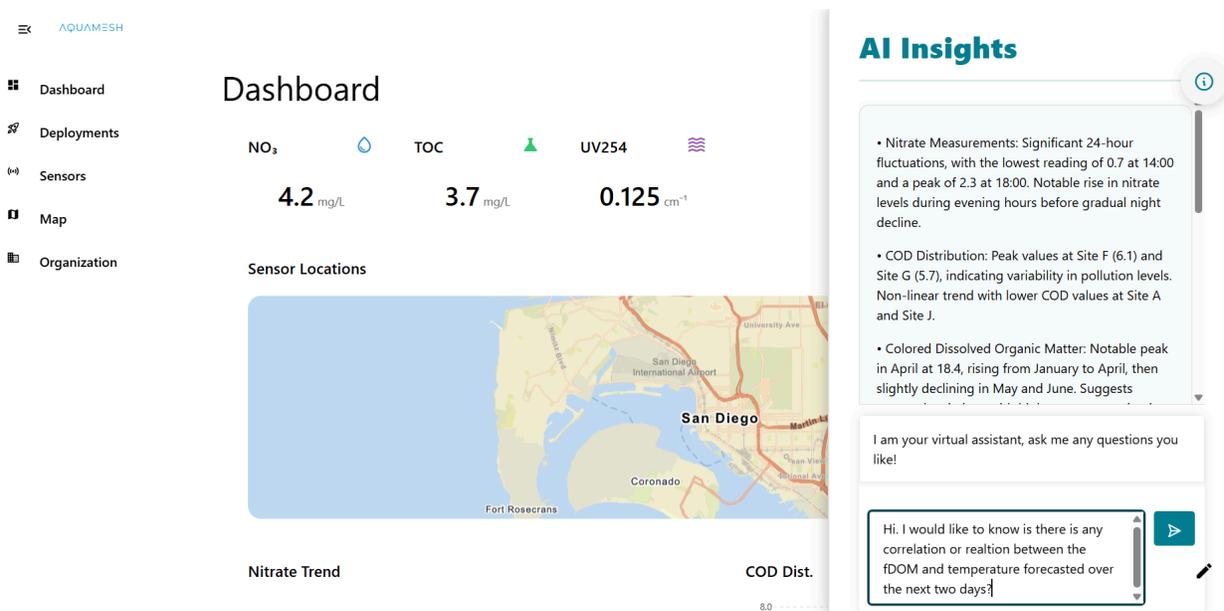- 27 dBm 2.4 GHz LoRaMESH Module (4 km range)

Power (Customizable):
- 9V to 28V @ 1A DC Input, Solar Possible
- 4S 12.8V LiFePO4 External Battery Input (Optional)

Data/Cable (Customizable):
- 4x RS485 half-duplex serial interfaces
- 4x 4-wire Cable Connections (A, B, PWR, GND)
- Onboard MicroSD Logging

AquaView Cloud Platform

Early Internal Version of AquaView

Real-Time Intelligence for Process and Environmental Monitoring

- **Integrated Data Engine** – Consolidates sensor, spectral, weather, and process-line/plant data into one secure cloud platform.
- **Predictive Analytics** – AI models detect shifts in organic load, turbidity, or by-product chemistry before they affect process stability or effluent quality.
- **Actionable Insights** – Converts raw numbers into operational guidance:
  - Identifies early trends in contamination or reaction imbalance.
  - Quantifies cause-and-effect between process parameters and discharge quality.
  - Recommends adjustments to maintain compliance and minimize waste.
- **Instant Visualization** – Live dashboards, spectral overlays, and alarm thresholds for rapid decision-making.
- **Easy Integration** – Connects with RS-485 / Modbus instruments, SCADA systems, and AWS IoT infrastructure.
- **Scalable & Secure** – Multi-site management, encrypted cloud storage, and over-the-air updates.

Technical Snapshot

- Hosting: AWS (99.99% uptime)   •   Low Latency   •   Interfaces: Web / API / Mobile
- Analytics: Trend forecasting, anomaly detection, correlation mapping
- Output: Automated compliance reports and maintenance triggers

Result:

AquaView™ transforms continuous measurement data into **predictive process control**—enhancing quality assurance, reducing unplanned downtime, and cutting response time from hours to seconds.

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AquaMesh™ Industrial Application Examples:

1. Process Water Quality Assurance

- **Use:** Continuous monitoring of rinse, cooling, and feedwater lines.
- **How:** AquaSpectra™ sensors track organics, color, and turbidity while AquaView™ merges existing flow, pH, and conductivity data from plant sensors.
- **Value:** Detects contamination or resin exhaustion early, reducing downtime and preventing off-spec batches.

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2. Wastewater & Discharge Compliance

- **Use:** Real-time TOC/COD and nutrient monitoring at outfalls or neutralization tanks.
- **How:** AquaLink™ collects data from AquaSpectra™ probes and existing analyzers, sending it to AquaView™ for automatic trending and alerting.
- **Value:** Early warning before permit exceedances; automated reporting for regulators.

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3. Reaction and Batch Endpoint Monitoring

- **Use:** Track optical or color changes indicating reaction completion or impurity rise.
- **How:** Inline AquaSpectra™ data is fused with temperature, pressure, and flow data from plant PLCs.
- **Value:** Faster batch validation, reduced lab sampling, tighter process control.

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4. Cooling Tower and Boiler Feed Optimization

- **Use:** Detect scaling and biofouling indicators through fluorescence and absorbance trends.
- **How:** AquaView™ correlates organic and thermal data with dosing system outputs.
- **Value:** Optimized chemical dosing, reduced energy loss, extended equipment life.

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5. Spill or Leak Detection Network

- **Use:** Monitor containment areas, drainage channels, or stormwater discharge.
- **How:** Rapid-deploy mesh sensors integrate with site alarms and flow meters.
- **Value:** Instant identification of leaks or cross-contamination events, enabling quick containment.

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6. Multi-Site Oversight & Benchmarking

- **Use:** Aggregate water, process, and discharge data from several facilities.
- **How:** AquaLink™ gateways and AquaView™ Cloud unify plant and lab data into one dashboard.
- **Value:** Centralized performance tracking, predictive analytics, and simplified ESG reporting.

AquaMesh™ Environmental Application Examples:

The Problem (Why Current Solutions Fail):

Government water managers are flying blind between samples.

Most monitoring programs still rely on **periodic grab sampling**, **single-parameter probes**, or **fixed stations** that are expensive, sparse, and slow. That creates four structural failures competitors can't fix:

1. **Low spatial density** – Too few stations to see what's actually happening across a watershed or coastline.
2. **Delayed detection** – Lab turnaround times mean events are discovered after the damage is done.
3. **Siloed data** – Sensors, weather, imagery, and third-party datasets live in separate systems that don't talk.
4. **Operational fragility** – Fouling, power constraints, and maintenance overhead limit long-term deployment.

Legacy vendors optimize for **instrument accuracy at a point**.
Government agencies need **situational awareness across space and time**. That gap is the problem AquaMesh solves.

Government-Relevant Use Cases (Abstracted, No Agency Names)

1. Basin-Scale Early Warning for Contamination Events

Problem:
Nutrient spikes, organic loading, or discharge events propagate faster than sampling schedules.

Why competitors fail:
Single-point sondes + weekly sampling miss transient events entirely.

AquaMesh advantage:
Dense, low-cost nodes + continuous sensing reveal anomalies as they emerge, not days later.

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2. Post-Storm Impact Assessment

Problem:
Storms cause rapid, spatially uneven water quality changes that traditional stations can't resolve.

Why competitors fail:
Fixed stations and manual sampling can't scale during short, high-impact windows.

AquaMesh advantage:
Distributed probes capture **before / during / after** conditions across the system, enabling defensible impact analysis.

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3. Long-Term Trend Detection Under Climate Variability

Problem:
Gradual shifts in baseline water chemistry get buried in noisy, sparse datasets.

Why competitors fail:
Infrequent sampling + disconnected datasets prevent statistically meaningful trend analysis.

AquaMesh advantage:
High-frequency optical data combined with weather and hydrology inputs produces trend clarity without expanding field staff.

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4. Remote or Infrastructure-Limited Monitoring

Problem:
Many priority sites lack power, backhaul, or safe access for frequent servicing.

Why competitors fail:
Cell/Sat-only architectures and high-maintenance sensors become cost-prohibitive.

AquaMesh advantage:
Low-power mesh networking + local storage keeps data flowing even when infrastructure doesn't.

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5. Multi-Modal Environmental Intelligence (Not Just Sensors)

Problem:
Agencies increasingly need to correlate in-water data with external drivers.

Why competitors fail:
Most platforms stop at raw sensor charts.

AquaMesh advantage:
Designed from day one to fuse **spectral data, weather, hydrology, and third-party datasets** into a single operational view.

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