

IMPORTANCE OF NUTRIENT MONITORING

What **nitrates** tell us about the water we rely on



WHAT IS NUTRIENT MONITORING ALL ABOUT?

Fresh Water is needed to sustain life

Freshwater represents only 3% of Earth's water, yet is needed to sustain life.

- » Surface water, although considered renewable, is largely dependent on precipitation, overland runoff, groundwater seepage, and tributary inflows.
- » Living organisms depend on their water supplies being safe for consumption.
- » Industrial systems in place also require clean, uncontaminated water supplies for various recreational and business applications.

What does nutrient monitoring currently look like, and where is it headed?



Current Trends	Future Trends
<p data-bbox="108 467 900 558">Low temporal frequency monitoring, often combined with modelling</p> <ul data-bbox="108 615 923 882" style="list-style-type: none"><li data-bbox="108 615 923 696">» Vulnerable to uncertainties because sites may be monitored less<li data-bbox="108 707 923 788">» Labor intensive to manually collect discrete samples<li data-bbox="108 799 923 882">» Not equipped to measure episodic events, which are time sensitive and unpredictable	<p data-bbox="985 467 1591 554">Continuous monitoring of nitrate measurements</p> <ul data-bbox="985 615 1731 788" style="list-style-type: none"><li data-bbox="985 615 1731 656">» Increased spatial data density<li data-bbox="985 663 1731 704">» Improved models for strategic investment<li data-bbox="985 711 1731 788">» Effective prioritization of infrastructure investments <p data-bbox="985 846 1798 933">Rising importance of nutrient status among stakeholders</p>

WHY IS NUTRIENT MONITORING IMPORTANT?

What is the scope of the issue?

- » Human activity increases natural amounts of nitrate in water to create **nitrate loading**, which can affect plant growth, reproduction cycles, and the life of species.
- » Some nutrients applied to the land surface infiltrate into underlying **groundwater**, which can eventually run into streams and lower existing levels of dissolved oxygen.
- » Nitrate can cause rapid increases in **algae population** which can kill organisms and submerged plants, with serious negative impacts on shore lines and aquatic organisms.

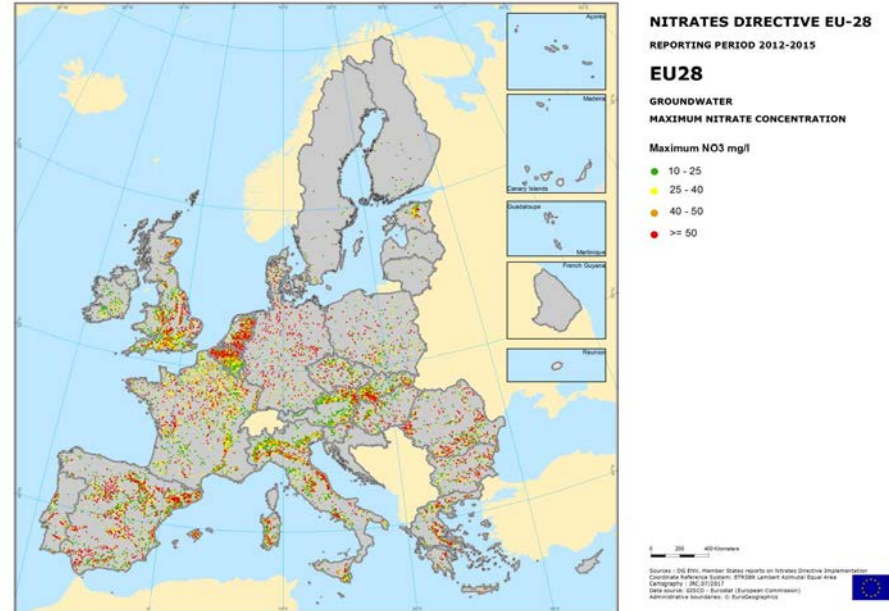
What is the source?

- » Waste water – other anthropogenic sources
- » Leaching from manure or artificial fertilizers
- » Storm water runoff

Maximum nitrate concentrations in groundwater for the reporting period 2012-2015

By observing the flow of nitrate loading to groundwater sources, we can determine:

- » which areas are most affected
- » where to focus data monitoring and conservation efforts



Credit: Europa.eu - the official website of the European Union (EU).
<https://eur-lex.europa.eu/legal-content/de/TXT/?uri=CELEX:52018SC0246>

THE IMPORTANCE

Identifying high nitrate concentrations is critical for assessing how nitrates are processed in surface water and for protecting the environment and lives.

Proactive alerts

- » It is far more cost-effective to prevent contamination in the first place than treat existing contamination.
- » Smart monitoring is essential to be aware of dangerous nitrate levels and anticipate upcoming issues.

How effective are current pollution reduction strategies?

- » Room for improvement – current reduction is highly dependent on costs, sensor technology, maintenance requirements, and data management capability.

What is being done?

Current monitoring programs typically rely on

manual spot checking

for discrete samples from the field on a weekly or monthly basis for laboratory analysis

Weekly or monthly sampled data is

less representative

of waterbody being measured when it comes to nitrate concentrations and trends observed in the water

When data is less representative, it may

decrease the effectiveness

of practices and insights towards controlling nitrate contamination



The background is a scenic landscape photograph of a lake at sunset. The sun is low on the right horizon, casting a warm orange glow across the sky and reflecting on the water. In the distance, there are silhouetted mountains and a small town with a prominent church spire on the left. The water in the foreground is calm, reflecting the sky and the distant landscape.

WHAT CAN BE DONE?

Increasing need for **continuous** data driven by necessity for more effective water management and conservation practices to improve quality of life and the environment



More temporal data = Capture variability and lower uncertainty

- » Utilizing more data than ever, both spatial and temporal, to improve management and quality of water resources



New technology = Low maintenance UV sensors that measure nitrate in **real-time**

- » By monitoring nutrient concentrations 24/7/365, you can see fluctuations from seasonal runoff, precipitation, and episodic events

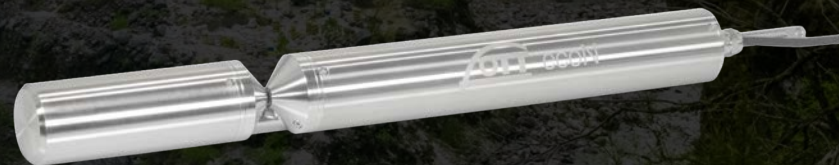


Lower cost = Time series data at a **lower cost per data point**

- » Accurately identifying every peak in nutrient concentration is key

Introducing the OTT ecoN

NEW GENERATION OF UV NITRATE SENSORS

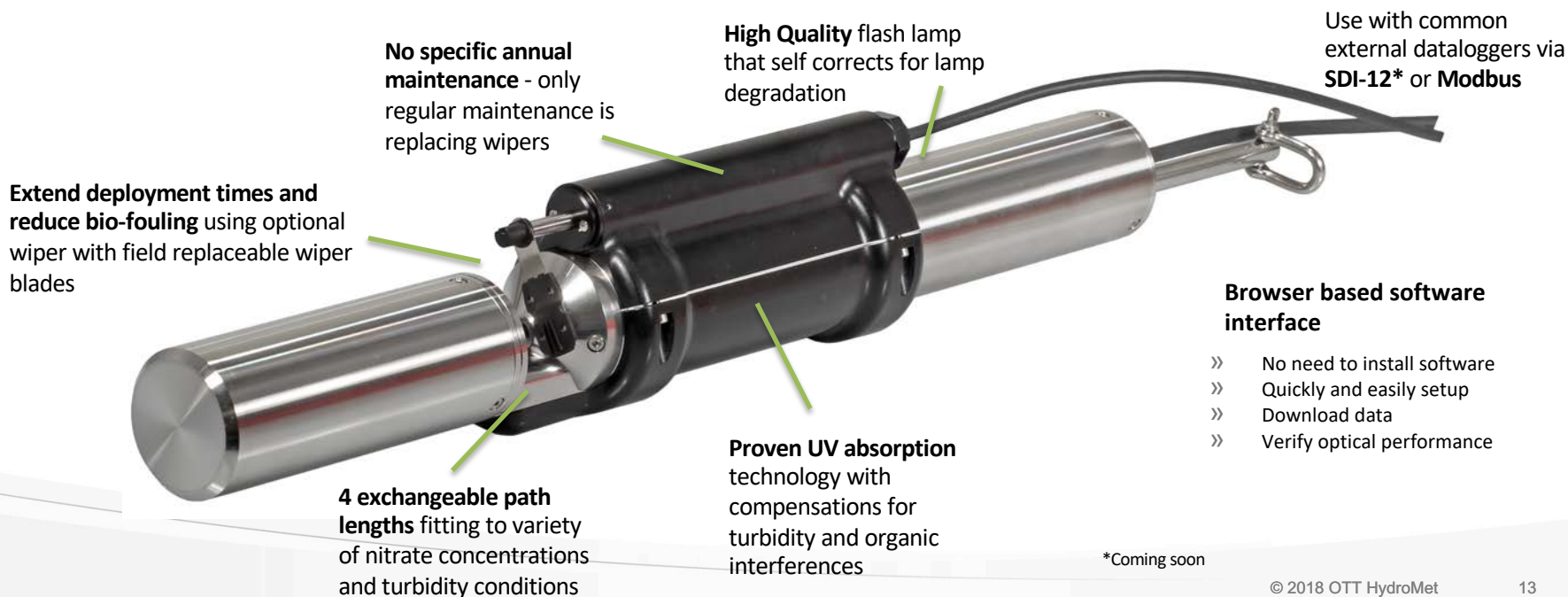


The OTT ecoN UV Nitrate sensor is designed for optical determination of nitrate ($\text{NO}_3\text{-N}$) in fresh surface and groundwater

- » **Proven field reliability** using the absorption method which provides high accuracy, minimizes drift and eliminates bias.
- » **Easy-to-operate** with browser-based software and modular design.
- » **Reduces annual maintenance** requirements to typical cleaning and exchange of wiper blades (if using optional wiper).
- » **Ensures data quality** by including quality indicators with each measurement.

Key Features

Advancing the legacy of industry-leading nutrient sensors, the OTT ecoN UV nitrate sensor for continuous use in fresh water combines field reliability and low maintenance with browser-based software to deliver lower operational cost.



Synoptic measurements for nitrate source detection

- » Supports mobile applications with use of 2-GB internal datalogger and light-weight design
- » **Example:** Use from a boat or kayak for monitoring nitrate while moving upstream



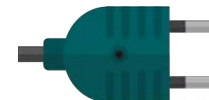
Short-term monitoring deployments

- » Easily deploy from bridge or river bank mounted rail system for seasonal nitrate monitoring or during storm events
- » **Example:** Temporarily install in vertical pipe connected to 12 V DC battery and 30 W solar panel



Long-term continuous monitoring

- » Install from river bank rail mount or bridge for year-round monitoring
- » **Example:** Connect sensor to Sutron SatLink or OTT netDL to collect and transmit measurement and quality data remotely



Field Operation

1



Place the sensor in the field. ecoN features include:

- » Detection of NO₃-N using absorption at 212 nm
- » Measure timing of < 10 seconds
- » SQI - signal quality indicators available

Verify sensor readings using
common nitrate standards

2



Connect to program logger to collect measurements
at desired measurement frequency and trigger wiper.

Field Operation

3



4



Connect to a datalogger via SDI-12* or Modbus**
Operate with 12 V DC battery and 30 W solar panel



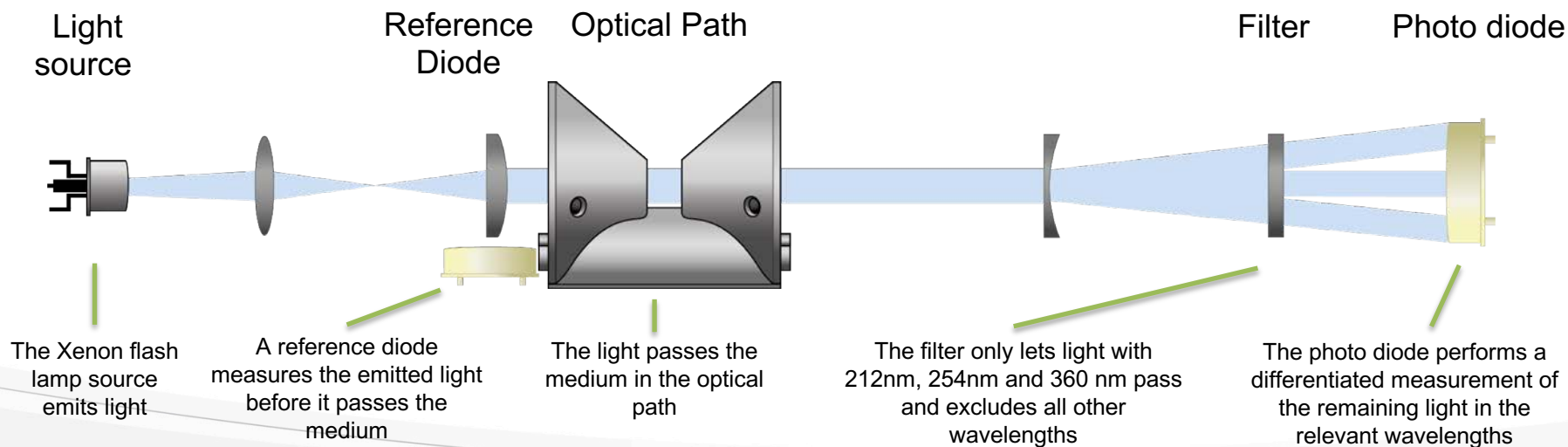
Connect directly to the sensor using
browser based software and G2 interface.

Cable with pigtail for connecting to datalogger
– additional segments to increase length.

* Coming soon

** Python scripts available for use with Sutron SatLink or XLink 100 / 500

- » Reference signals provides greater accuracy by minimizing drift and eliminating bias
- » Self corrects for variation of lamp output
- » Helps ensure data quality

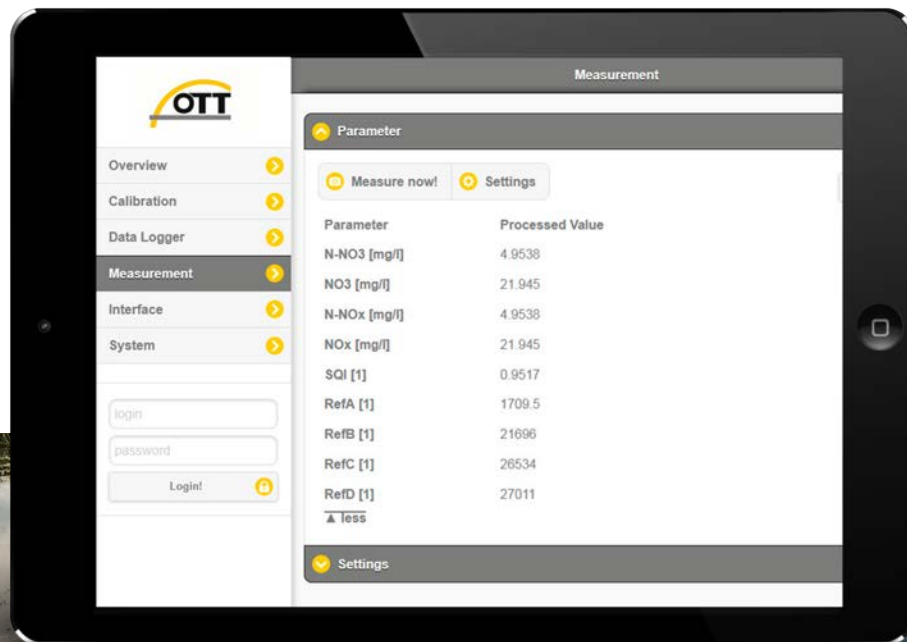


Signal Quality Indicator (SQI) available with each measurement

- » Reference scale 0.000 to 1.000
- » > 0.800 will typically provide good data
- » Transmit with measurement data to identify blocked pathway or build-up on lens from back in the office

Calibration verification for quality assurance

- » Use standard solutions to verify performance and provide traceability
- » Verify zero baseline using ultrapure water



Decreases total cost of ownership and improves data quality using optional wiper

- » Increases deployment times and reduce number of site visits for routine cleaning or maintenance due to bio-fouling
- » Minimizes likelihood of noisy data
- » Nano coating also reduces biofouling and prolongs life of the lens



Simple to exchange wiper blades on-site



Easy-to-use wiper blade kit

WHY USE THE ecoN

The OTT ecoN for continuous use in fresh water combines field reliability and low maintenance with browser-based software to reduce drift and eliminate bias.

By generating **instantaneous insights on environmental water quality**, you can establish baseline ranges and capture general trends over time. These datasets are key for pollution reduction/control strategies and protecting water resources for a better future.



**Contact us for more information
on Nutrient Monitoring Solutions**

OTT HydroMet GmbH

Ludwigstr. 16
87437 Kempten
Germany

Tel +49 831 5617-0

euinfo@otthydromet.com
www.otthydromet.com



References

Nutrient Loading. (n.d.). Retrieved from <https://enviroliteracy.org/ecosystems/drivers-of-biodiversity-loss/nutrient-loading/>

Perlman, H. (2016, December 2). The Water Cycle: Freshwater Storage. Retrieved from <https://water.usgs.gov/edu/watercyclefreshstorage.html>

Phillips, S. W., Focazio, M. J., & Bachman, L. J. (1999). Discharge, nitrate load, and residence time of ground water in the Chesapeake Bay watershed(USA, USGS). Baltimore, MD: U.S. Dept. of the Interior, U.S. Geological Survey.

USA, USGS, WaterQualityWatch. (n.d.). CONTINUOUS MONITORING FOR NITRATE IN USGS WATER SCIENCE CENTERS ACROSS THE U.S. Retrieved from <https://water.usgs.gov/coop/features/real-time.nitrate.summary.pdf>