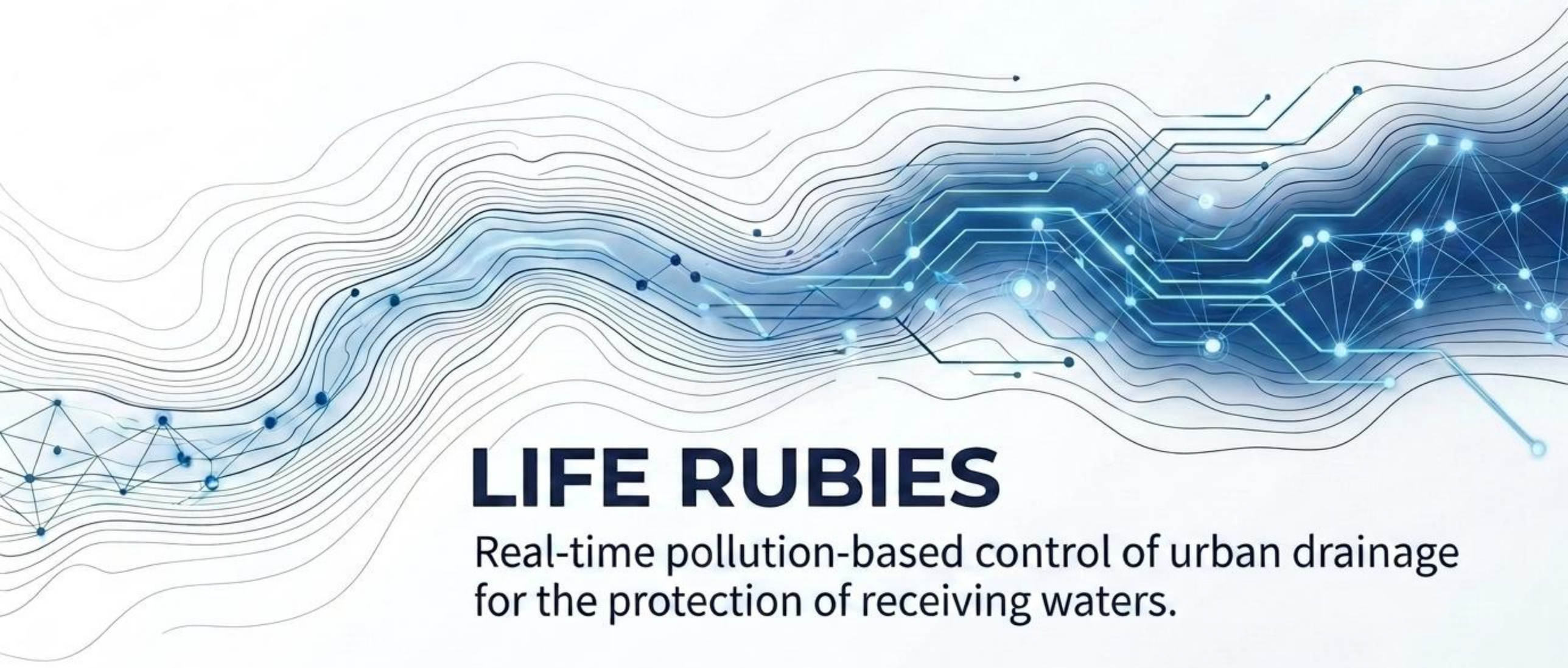


LIFE RUBIES

Real-time pollution-based control of urban drainage for the protection of receiving waters.

Project Overview & Layman's Report Summary | LIFE20 ENV/FR/000179

Problem statement

THE PAST

THE PROBLEM

Urban density and erratic rainfall strain legacy Urban Wastewater Systems (UWS).

THE TRAP

Managing strictly by water volume requires building **costly** "grey" infrastructure (concrete tanks).

THE IMPACT

Combined Sewer Overflows (CSOs) cause **toxic environmental shock** and **anoxia** in sensitive rivers.

THE FUTURE

THE SOLUTION

Pollution-Based Real-Time Control (PBRTC).

THE SHIFT

Transitioning from passive volume containment to **actively minimizing the pollutant mass** discharged during storms.

PROBLEM STATEMENT

Water Framework Directive (WFD)

Urgent mandate to achieve **'Good Ecological Ecological Potential'** in heavily modified bodies (e.g., Manzanares and Marque rivers) by 2027.

DERU 2 Readiness (2025)

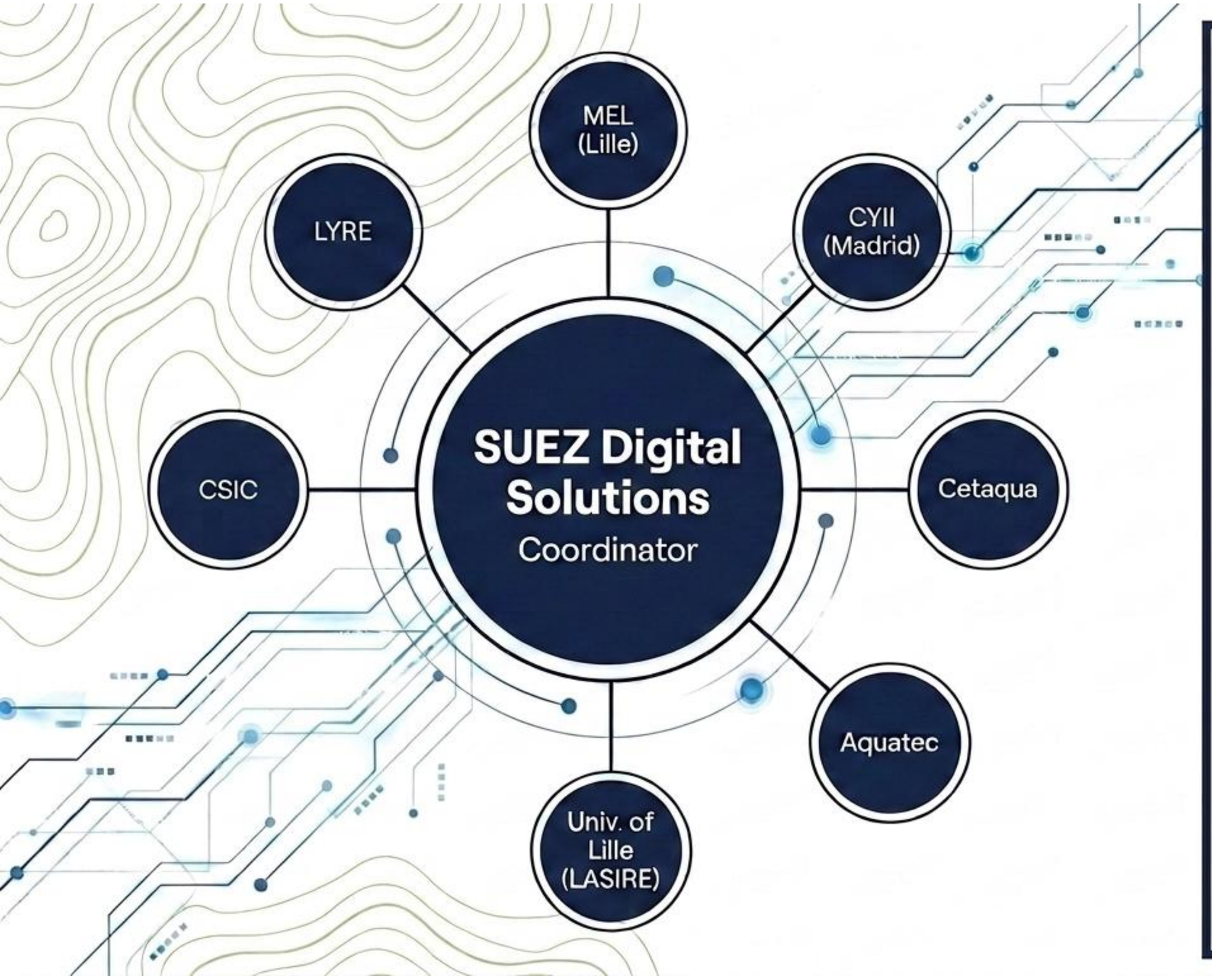
Strict alignment with the revised **Urban Wastewater Treatment Directive,** demanding higher hydraulic efficiency and discharge monitoring.

The 1:17 Benchmark

Engineering compliance requiring that flows with a **dilution factor less than 17x** the peak Dry Weather Flow (DWF) must be intercepted and treated.

Ecosystem Protection

Preventing acute **toxicity:** Ammonium **levels often exceed 20 mg/L** in storm CSOs, **destroying aquatic life** in rivers lacking natural dilution.



LIFE RUBIES

Project description

Investment

€3.33M

(55% EU LIFE funded)

Core Ambition

Reduce CSO volumes by 15–50% and Total Suspended Solids (TSS) mass by 25–45% via digital optimization of existing infrastructure.

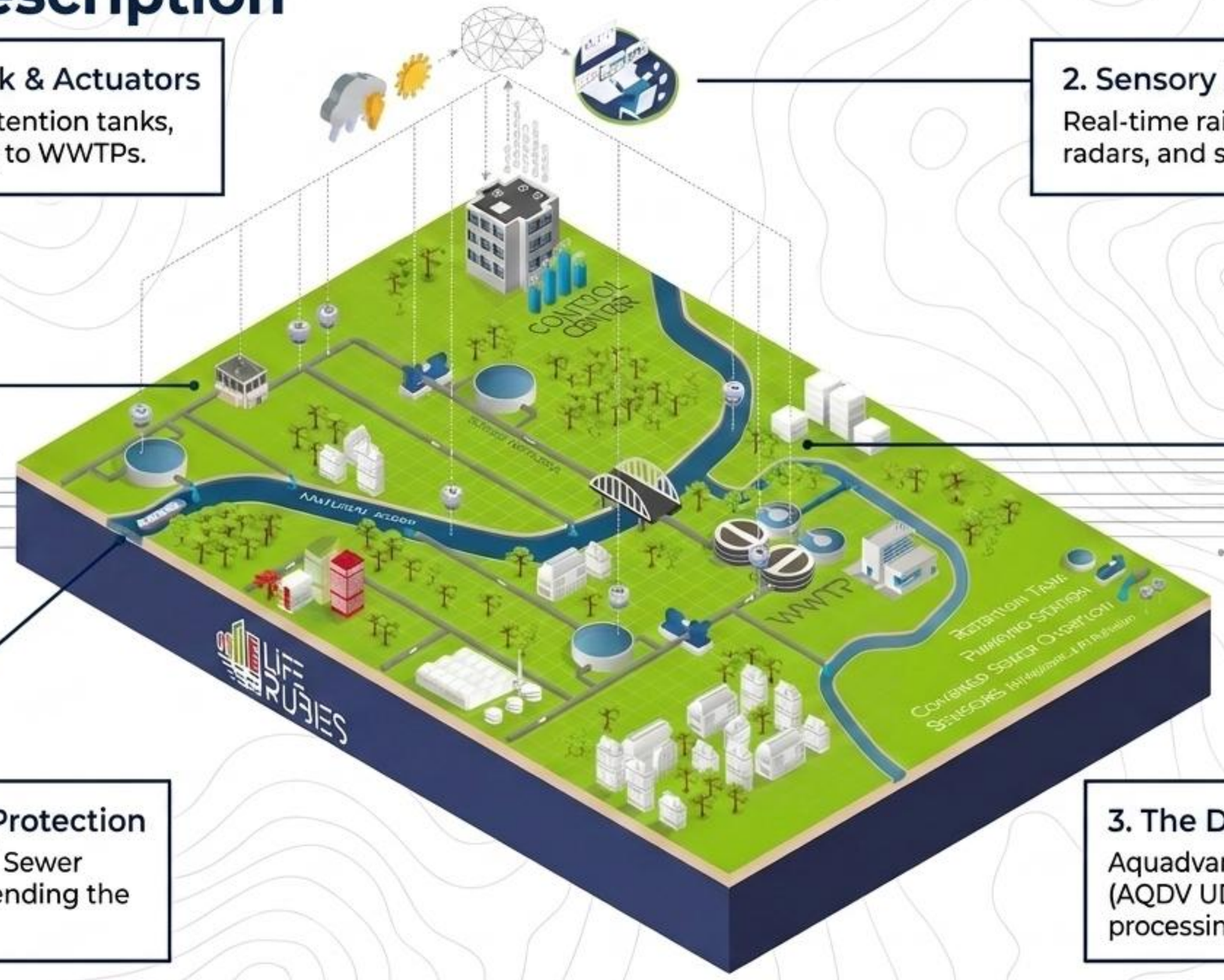
Project description

1. Physical Network & Actuators

Pumping stations, retention tanks, and dynamic routing to WWTPs.

2. Sensory Layer

Real-time rain gauges, weather radars, and sewer quality probes.



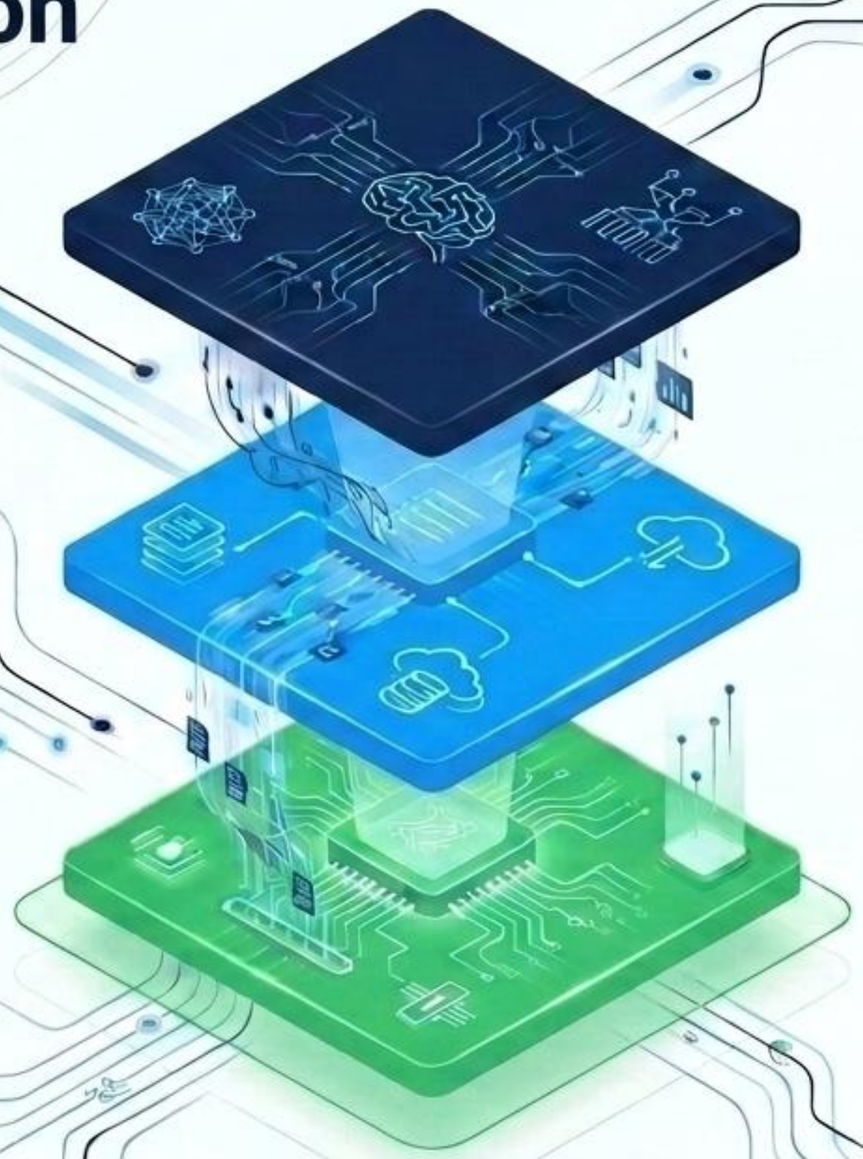
4. Environmental Protection

Minimized Combined Sewer Overflows (CSOs) defending the natural water body.

3. The Digital Brain

Aquadvanced Urban Drainage (AQDV UD) control center processing predictive algorithms.

Project description



Top Tier: Logic & Simulation

Closed-loop Simulation Algorithm (CLSA)

Enables 'Virtual Testing' to validate strategies against a simulated network model, ensuring zero risk of flooding before real-worid actuation. Powered by quality-based real-time control.

Middle Tier: Platform

AQDV UD

A centralized software platform integrating SCADA, real-time weather forecasts, and complex hydraulic/ quality models to compute optimal setpoints.

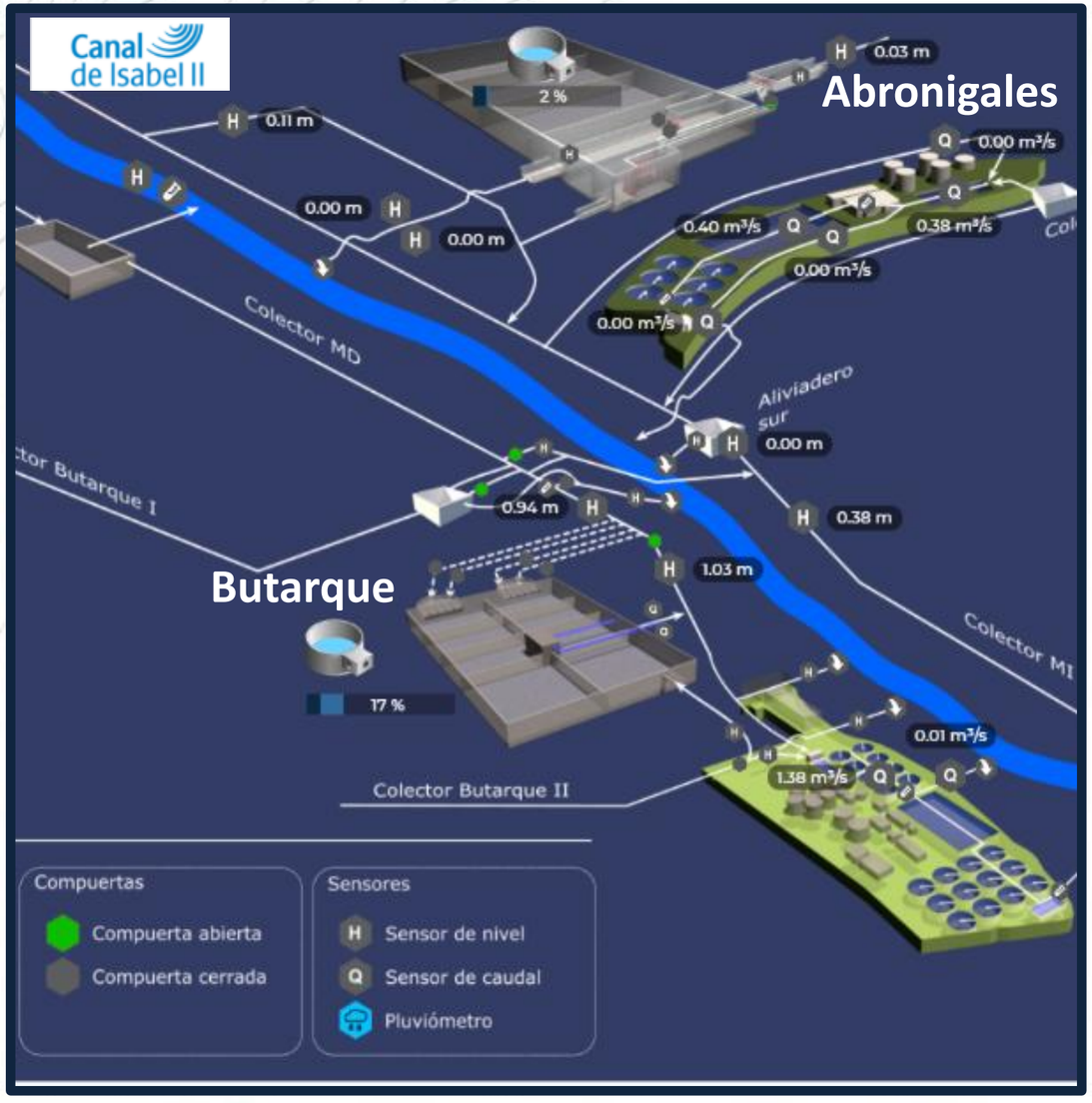
Bottom Tier: Hardware & Sensing

Multiparameter Probes & Radars

X-Band radar for precipitation forecasting. Probes measuring turbidity, conductivity, O2, and pH to act as proxies for particulate pollutants and nutrients.

	Madrid Pilot	Lille Pilot
Network Profile	Entire city downstream network.	Marquette WWTP agglomeration (5 strategic weirs).
Target Rivers	Manzanares River (highly polluted, heavily modified).	Deûle Canal & Marque River.
Core Algorithm	Linearized hydraulic/quality model optimized with genetic algorithms	Full hydraulics/quality model used for decision-based control
Digital Action	Protecting Aliviadero Sur from premature discharge.	Implementing 'Volume Substitution'.

Pilot sites



The Setup

The downstream system manages flows from the entire city, utilizing the massive Butarque and Abroñigales tanks alongside 39 sensors and 20 actuators.

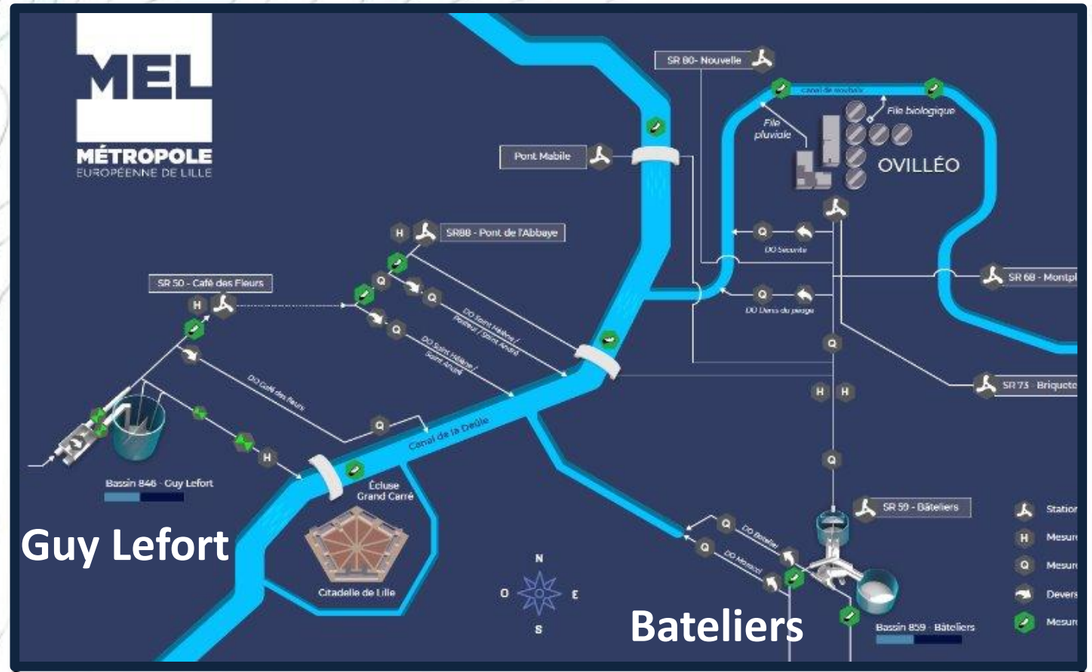
The Challenge

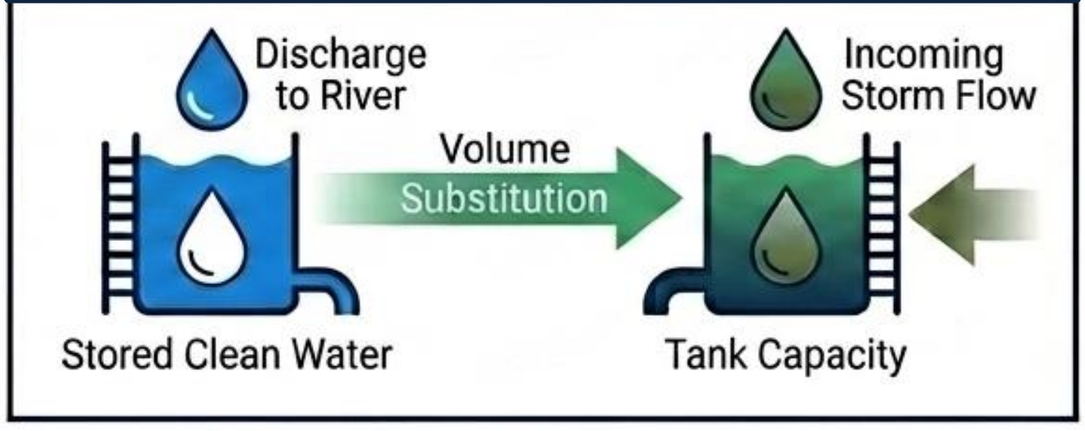
The Manzanares River is highly stressed, operating essentially as a diluted sewage effluent with frequent anoxic conditions.

The Action

The control strategy actively protects the Aliviadero Sur from premature discharge. Unlike old autonomous systems, it waits until the Abroñigales tank is truly full, drastically cutting toxic ammonium and BOD5 impacts on the river.

Pilot sites





The Setup

Targeting five strategic weirs responsible for 40% of the area's wet-weather discharges into the fragile Deûle and Marque rivers.

The Action

Implementation of the control algorithm utilizing 'Volume Substitution'.

The Mechanism

The system actively discharges cleaner, already-stored water to make room in the tanks for the most polluted volume (highly concent incoming storm flow).

The Result

A direct trade of total volume for a massively reduced overall pollution load.

Main results

Madrid Impact (Manzanares)

- -35.6% reduction for BOD5
- -25.4% reduction for TSS (Total Suspended Solids)

Lille Impact (Deûle/Marque)

- -23% reduction for BOD5
- -8% reduction for discharged volumes

The Golden Rule

By utilizing real-time sensors, the system **prioritizes** the storage of the most polluted volume, minimizing **toxic shock** and **allowing only the most diluted** water to overflow.

Note: Results are based on gains achieved in the final pilot perimeters, not the entire metropolis, in such case savings numbers would be lower. Volumes reduction is lower than foreseen at the beginning of the project because the controller gives more weight to pollutant mass reduction than volume, overall pollution is still reduced according to the objectives.

Main results

Traditional Solution (Grey Concrete)

Cost: ~€1,000 per m^3 of new storage.

To avoid 2.43M m^3 of CSO in Madrid would require an **unaffordable, massive** capital investment.

LIFE RUBIES (Digital Storage)

Primary Benefit: **Massive CAPEX Avoidance.**

Efficiency: €0.064 per m^3 of CSO avoided in Madrid (€2.29 in Lille).

Pollutant Efficiency: €232 per ton of TSS avoided in Madrid.

Operational Bonus

Centralized automation **saves 50% of the time** previously spent on regulatory reporting.

Ready for Europe

Feasibility studies confirm transferability to other major cities, including Porto and Alicante.

The Qualification Form

A technical guide developed for interested municipalities. It evaluates:

- Local network context and receiving body sensitivity.
- Prerequisite infrastructure and sensor requirements.
- Estimated deployment costs based on existing assets.

Digital solutions have fixed deployment costs—scaling the software across multiple city assets significantly drives down unit costs.

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