

LIFE RUBIES

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

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.





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.



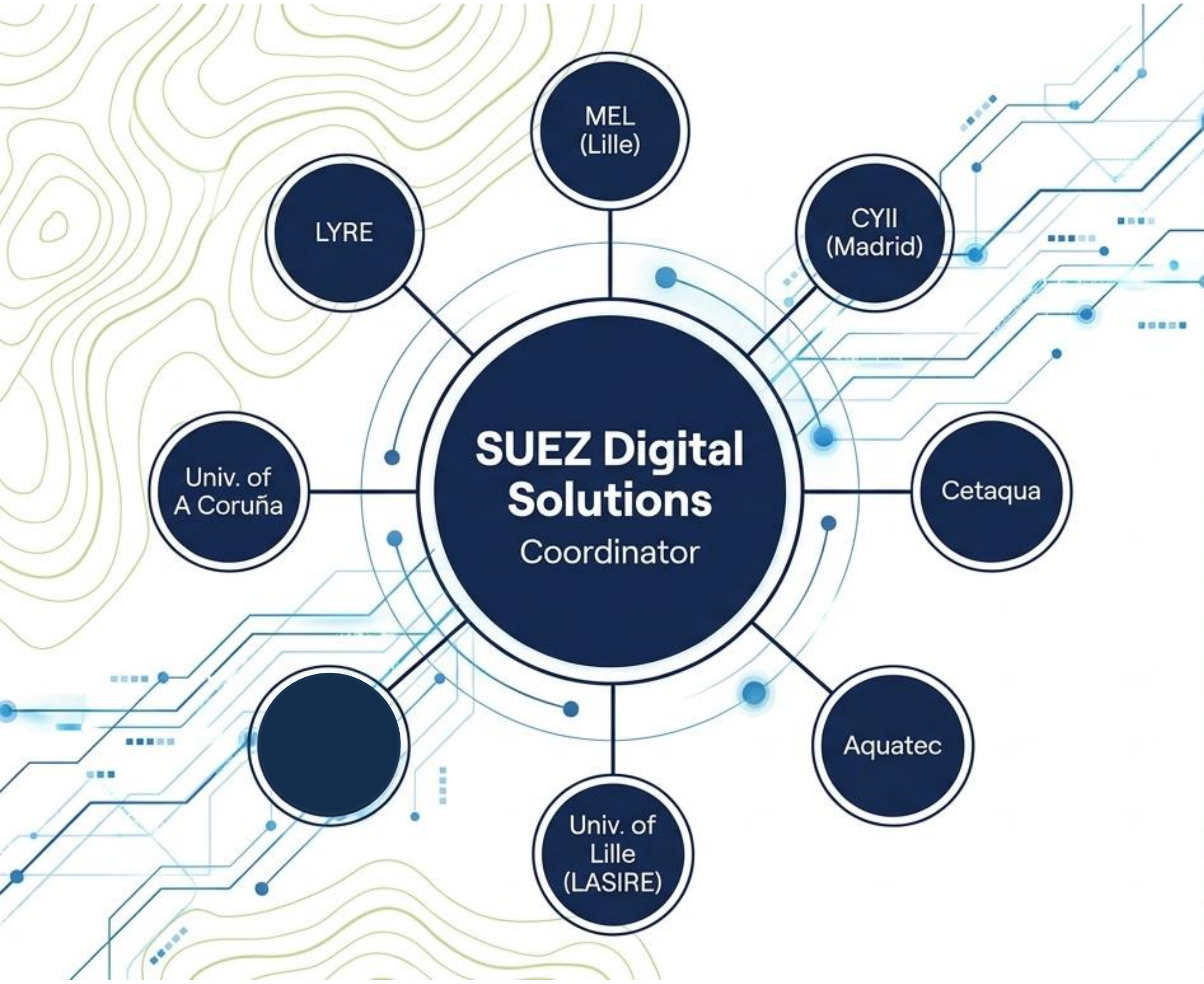
The 1:17 Benchmark

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.



Timeline

Oct 2021 – Dec 2025

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.

1. Physical Network & Actuators

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

2. Sensory Layer

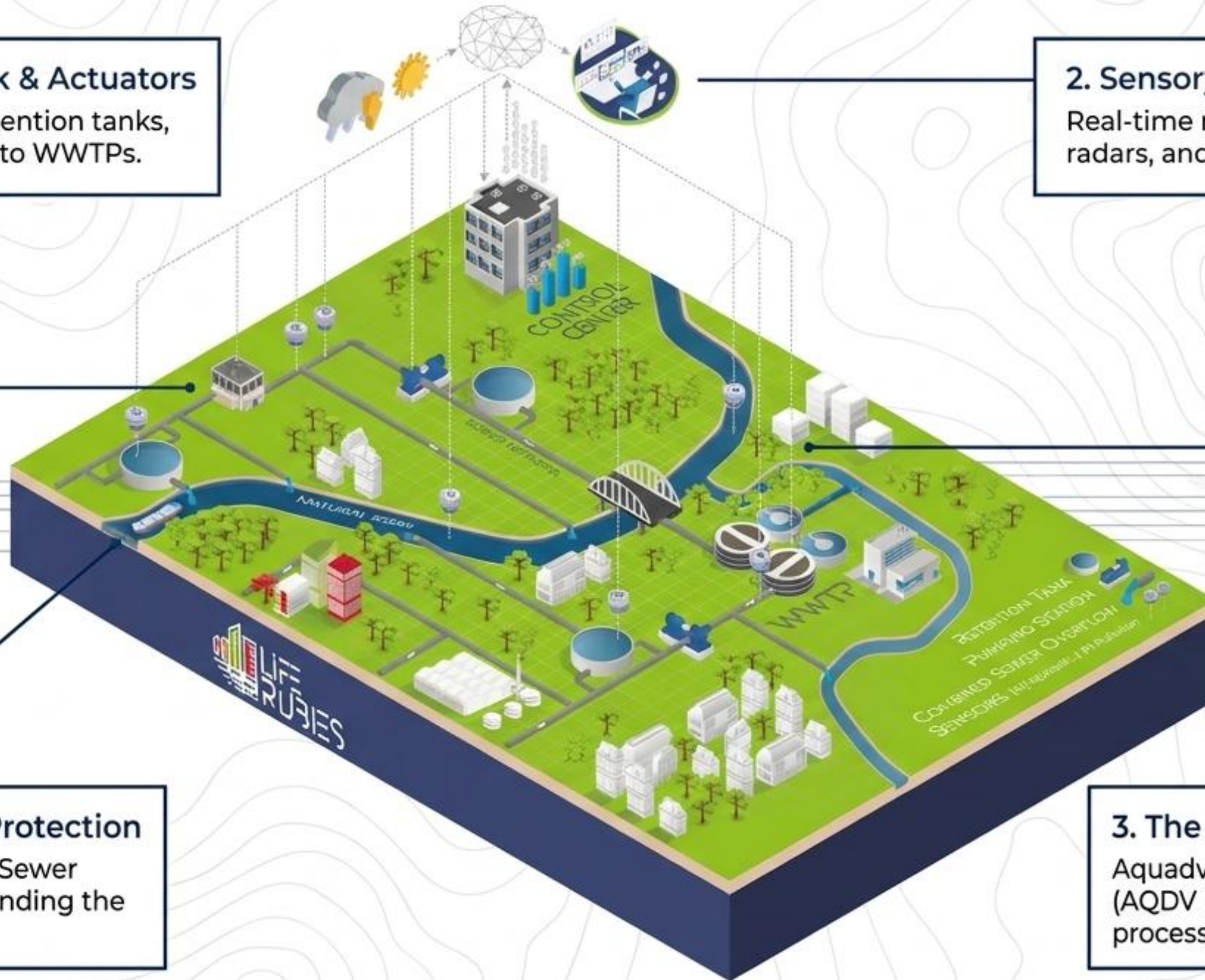
Real-time rain gauges, weather radars, and sewer quality probes.

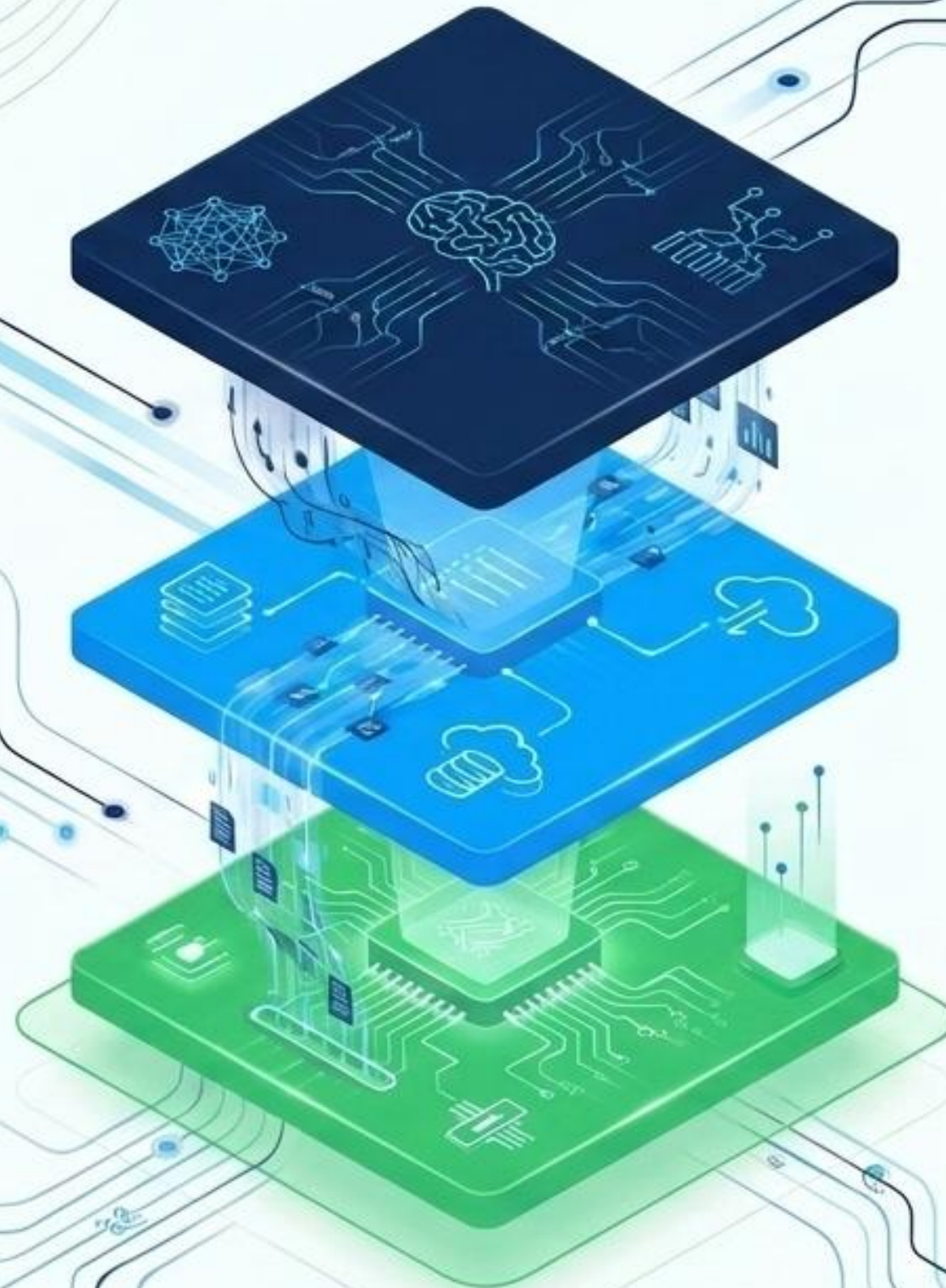
4. Environmental Protection

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

3. The Digital Brain

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





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-world actuation. Powered by MPC (Madrid) or MV Curve (Lille).

Middle Tier: Platform

AQDV UD

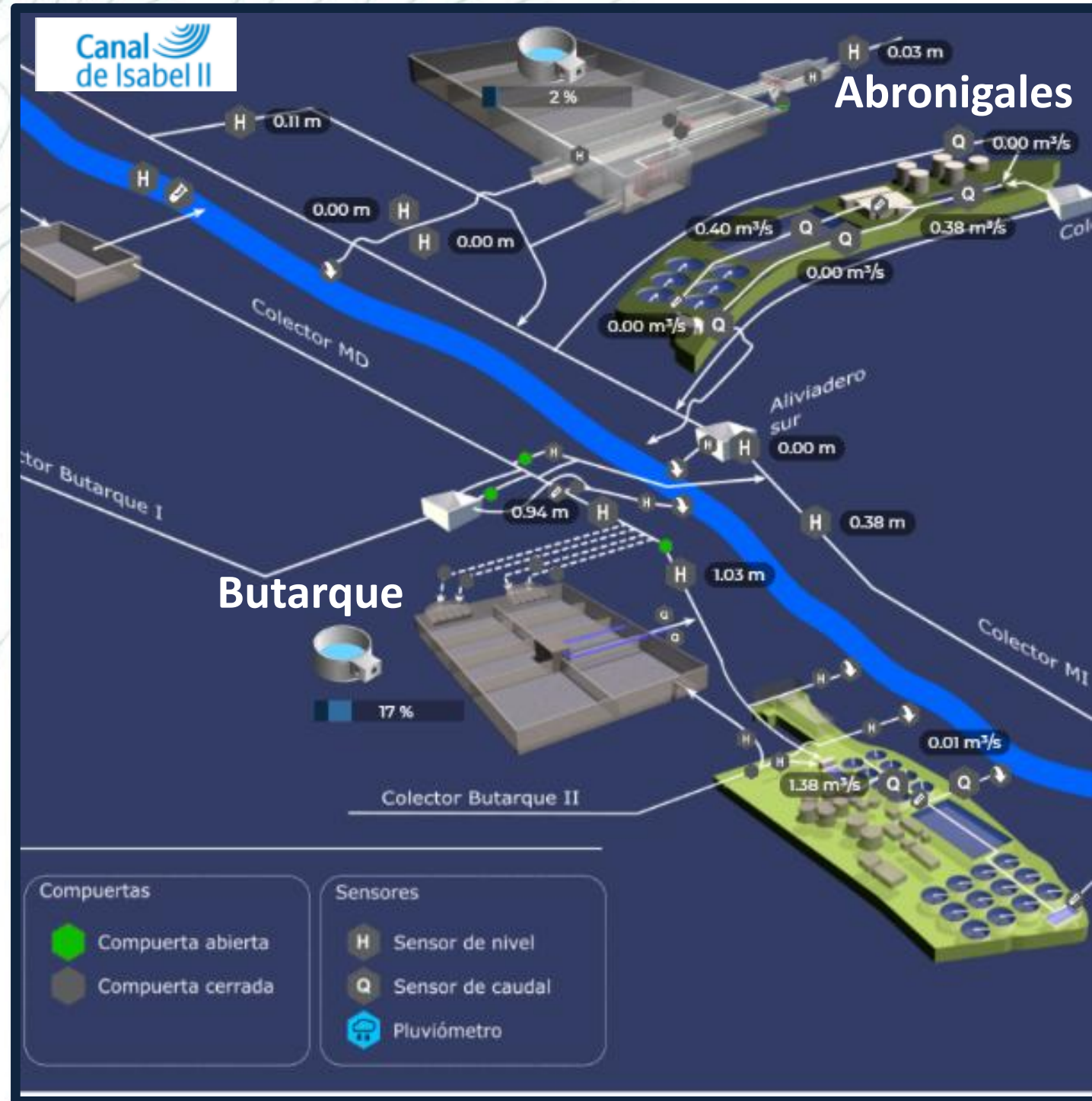
A centralized software platform integrating SCADA, real-time weather forecasts, and complex hydraulic/quality models to compute optimal setpoints.

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	Model Predictive Control (MPC) via GAMS.	MV Curve Approach (expert system via INSA Lyon).
 Digital Action	Protecting Aliviadero Sur from premature discharge.	Implementing 'Volume Substitution'.



The Setup

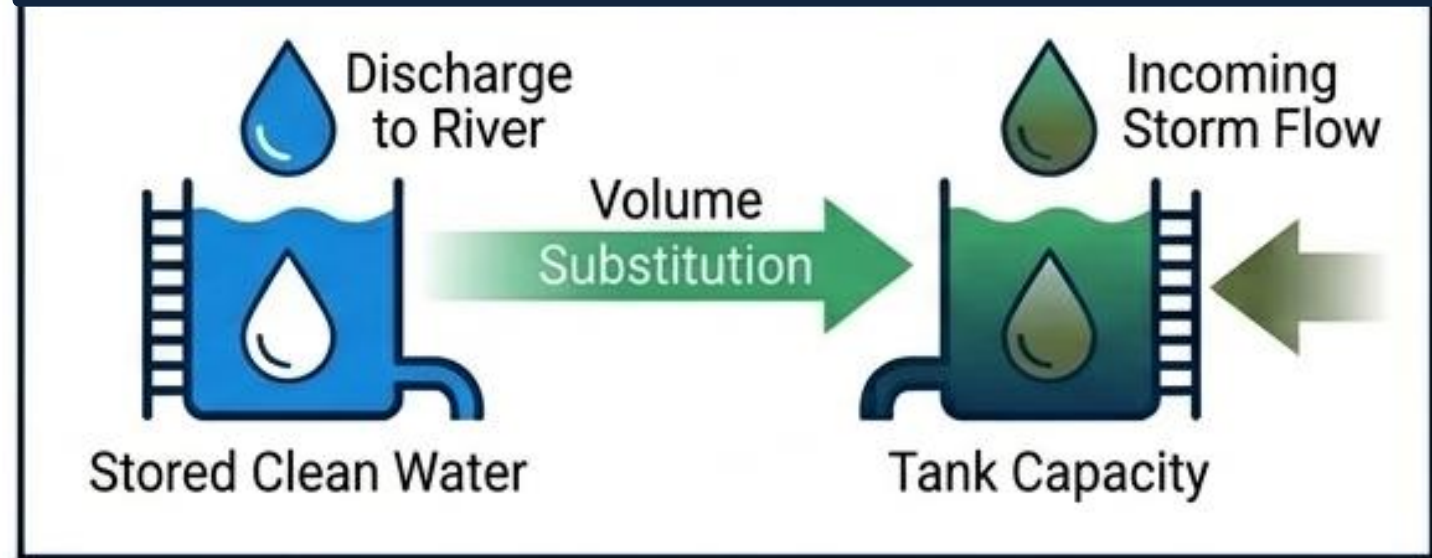
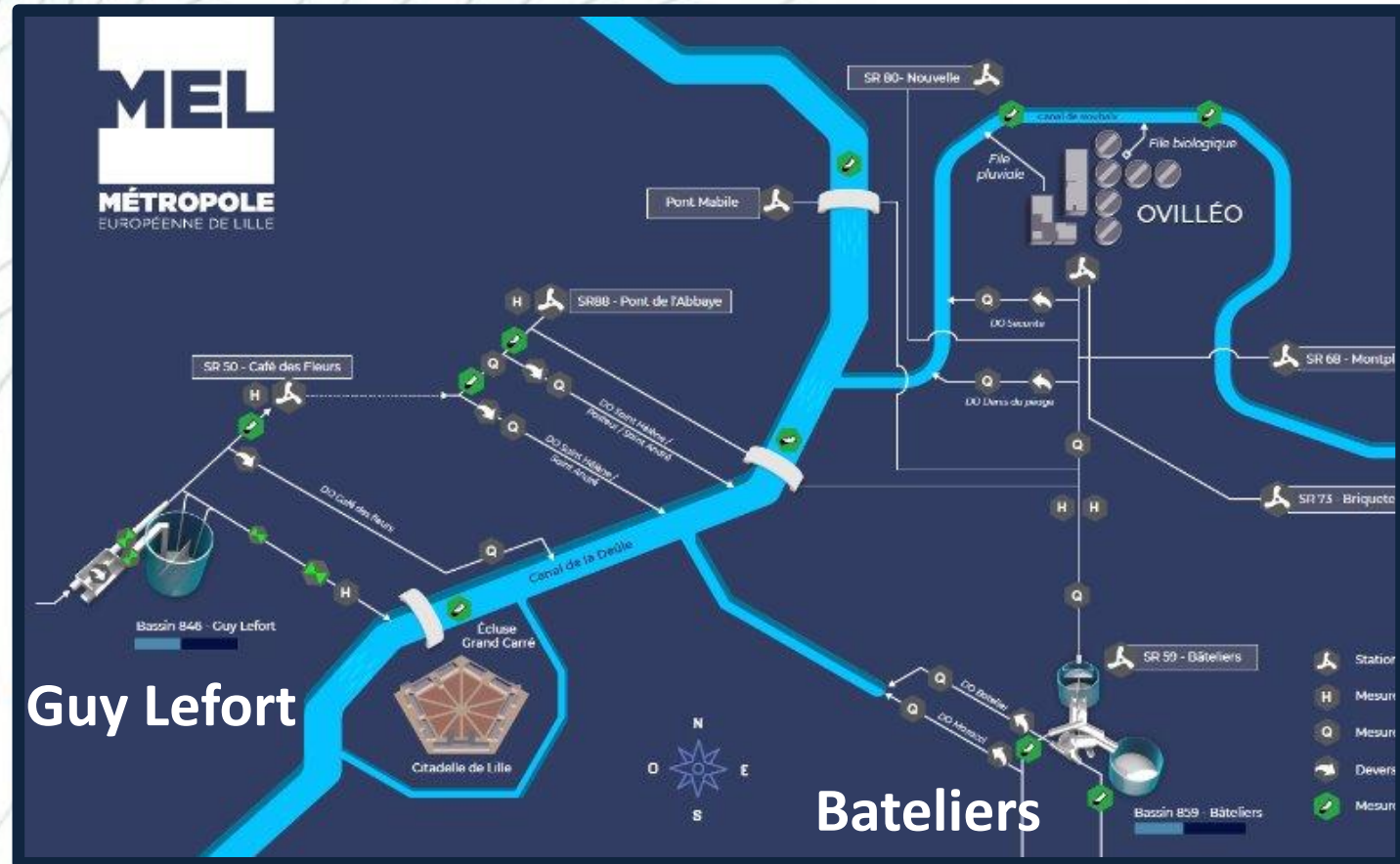
The downstream system manages flows from the entire city, utilizing the massive **Butarque** and **Abroñigales** tanks alongside 39 **sensors** and 20 **actuators**.

The Challenge

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

The Action

The **MPC 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.



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 **MV Curve 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 concentrated incoming storm flow).

The Result

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

Madrid Impact (Manzanares)

 **-35.6%** reduction for DBO5

 **-25.4%** reduction for TSS
(Total Suspended Solids)

Lille Impact (Deûle/Marque)

 **-23%** reduction for TSS

 **-25%** reduction for DBO5

 **-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: Les résultats sont basés sur des gains obtenus sur les périmètres finaux des pilotes et non toute la métropole.



Traditional Solution (Grey Concrete)

Cost: ~€1,000 per m³ of new storage.

To avoid 2.43M m³ of CSO in Madrid would require an **unaffordable, massive** capital investment.



LIFE RUBIES (Digital Storage)

Primary Benefit: **Massive CAPEX Avoidance.**

Efficiency: €0.064 per m³ 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.



Concluding The Paradigm Shift Achieved

LIFE RUBIES successfully transforms autonomous, volume-based infrastructure into a centralized, pollution-based digital network—**protecting our natural water bodies** while **saving millions** in infrastructure costs.

Call to Action

Access the full Layman's Report and download the Qualification Form for your city at the official project website.

