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WATER LAB

SAVONIA

University of Applied Sciences



SCAN ME

Introduction to the WaterLAB

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SAVONIA

**Environmental
Engineering
expertise areas**

1010
1010

SMART WATER

Digitalisation in water sector



ZERO EMISSION

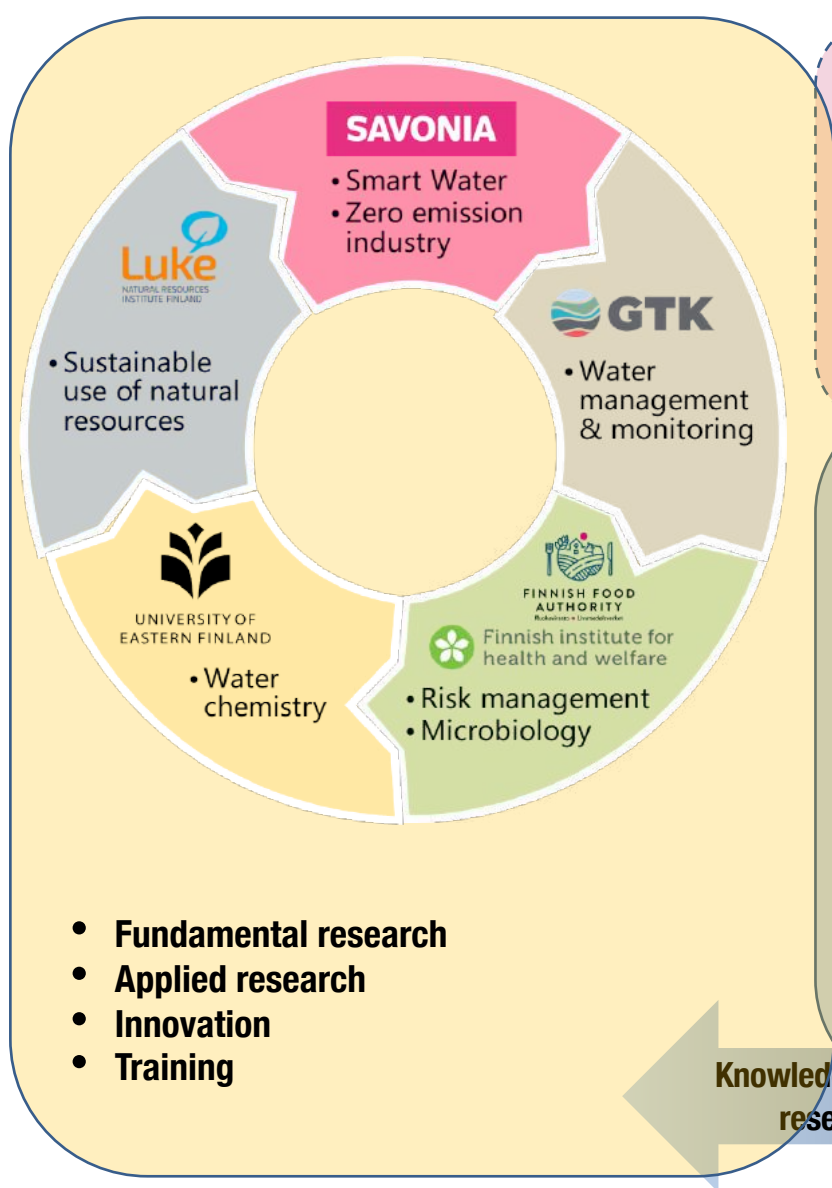
Zero emission industry

How small companies can be innovative?

- To innovate companies needs **experts support** + access to the versatile **facilities**, quality **equipment** and **data** repositories + **fast-track to prototype demonstration** (in order to secure RDI support, venture capital)
- Open data culture is fuelling new products and services **driving true cooperation between research organisations and companies based on real-world challenges**

Examples of key Smart Water development areas (2021)

 Digital Water Metering	 Non Revenue Water
 Asset Health Inspection	 Adaptive Pressure Mgmt
 Predictive Intelligent Alarming	 Water Quality Management
 Flood Abatement	 Adaptive Energy Management
 Predicting Waste Water Blockages	 Field Force Enablement



DiGiCENTERNS
THE DIGITAL INNOVATION HUB OF NORTHERN SAVO REGION

- Digitalization competence centre
- R&D in digitalisation
- Solve business problems together with customers by using means of digitalization

BUSINESS CENTER
POHJOIS-SAVO

- Business services
- Startup accelerator
- Business development
- Commercialisation

KUOPIO WATER CLUSTER

- Testing and product development
- Piloting and product demonstration
- Proof of Concept
- Development space and hardware resources
- Coordination of business cooperation



Research
TRL 1 - 4

Development
TRL 5 - 8

Commercialisation
TRL 9

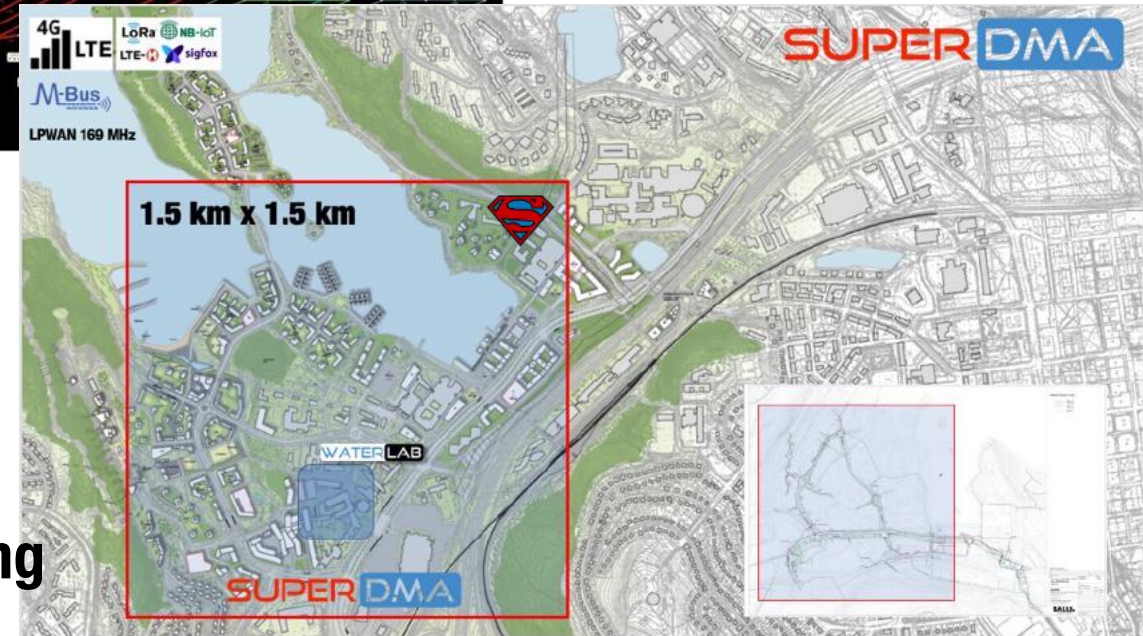
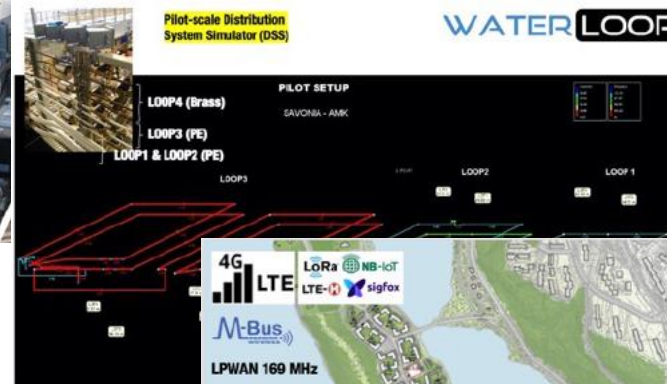
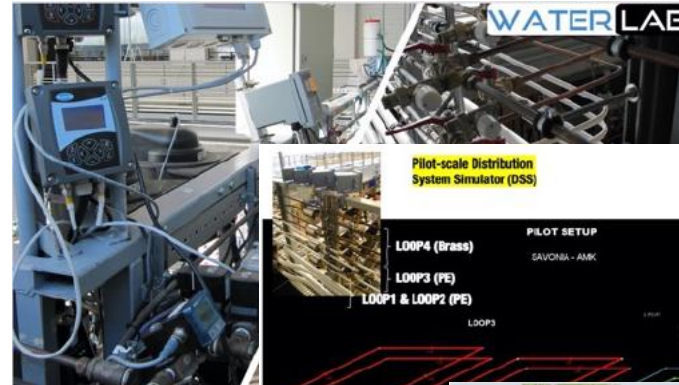
The unique testbed and demonstration sites – combination of **lab-**, **pilot-** and **full-scale** facilities (water + wastewater + stormwater networks)

What we can offer?

Lab- & pilot-scale development

Scale-up

Demonstration Full-scale testing



Research
TRL 1 - 4

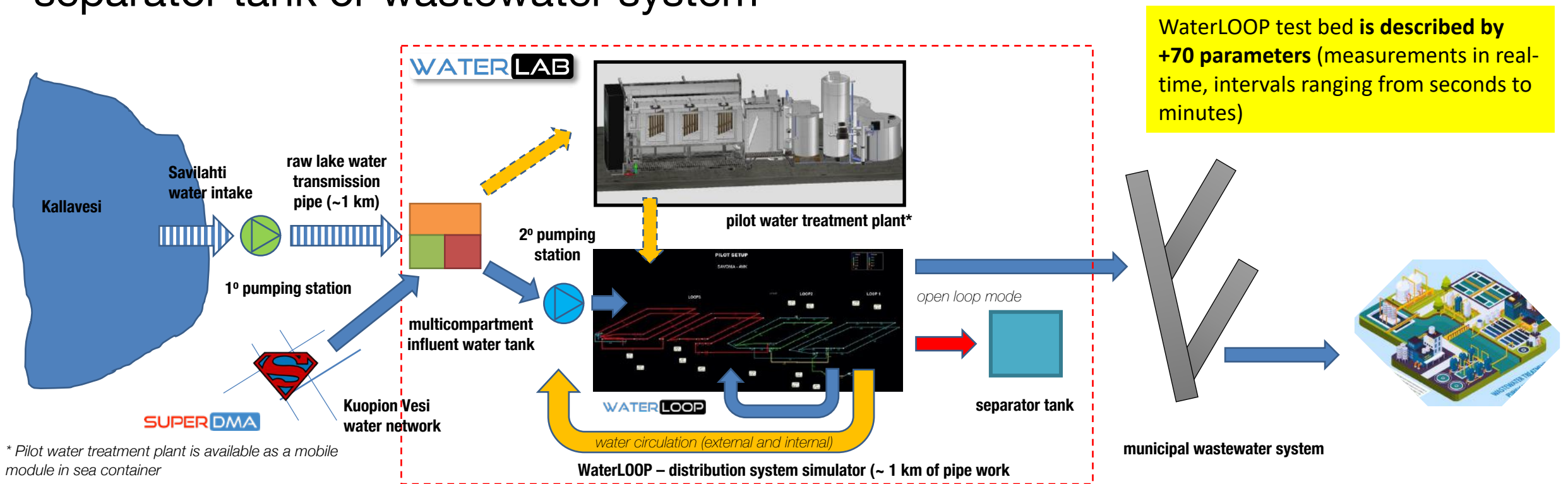
Development
TRL 5 - 8

Commercialisation
TRL 9

WATER LOOP

- Distribution System Simulator (DSS)

Physical model of water network (fresh water intake ⇒ first stage pumping station ⇒ raw water transmission line ⇒ influent water tank ⇒ pilot water treatment plant* ⇒ clean water tank ⇒ secondary pumping station ⇒ main (trunk) system ⇒ distribution network ⇒ customers/leakages/overflows/ ⇒ separator tank or wastewater system)



* Pilot water treatment plant is available as a mobile module in sea container

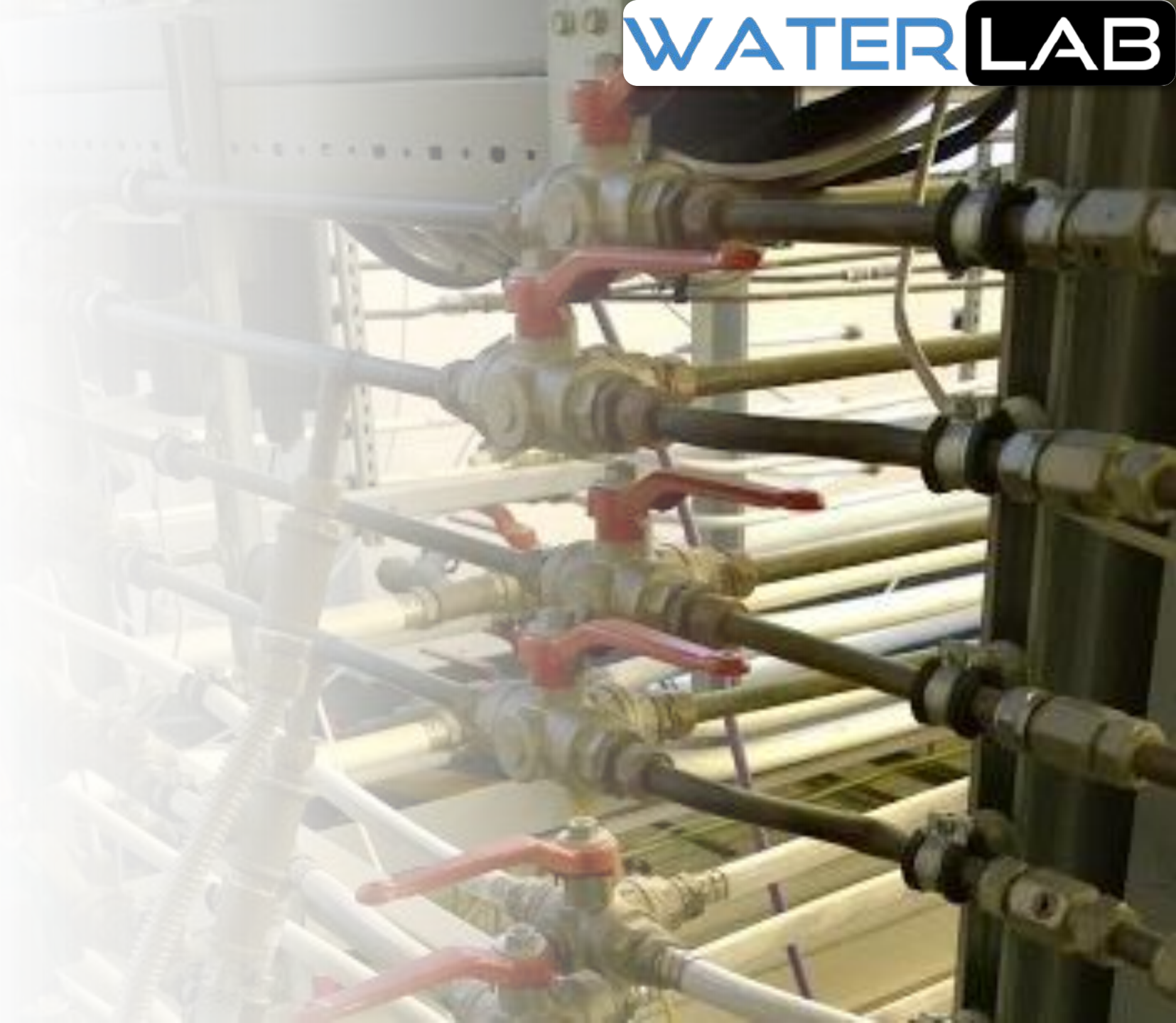
WaterLOOP - pilot-scale water distribution network with on-line sensors

- **Measurements (on-line):** flow rate, pressure, tank level, temperature, conductivity, pH, turbidity, free and total chlorine, DO, UV254, particle counting, particle classification, refractive index etc. – **comprehensive water chemistry fingerprint (+70 parameters measured)**
- **Grab sample** measurement with laboratory grade instruments
- **Other measurements (microbiology) – on-demand**
- Several collectors for **biofilm sampling** in different parts in every pipeline
- Several **points of discharge** (leakage simulation)
- Several **points for automated dosage** (dosing contaminations and disruptive substances – cross-contamination simulation)



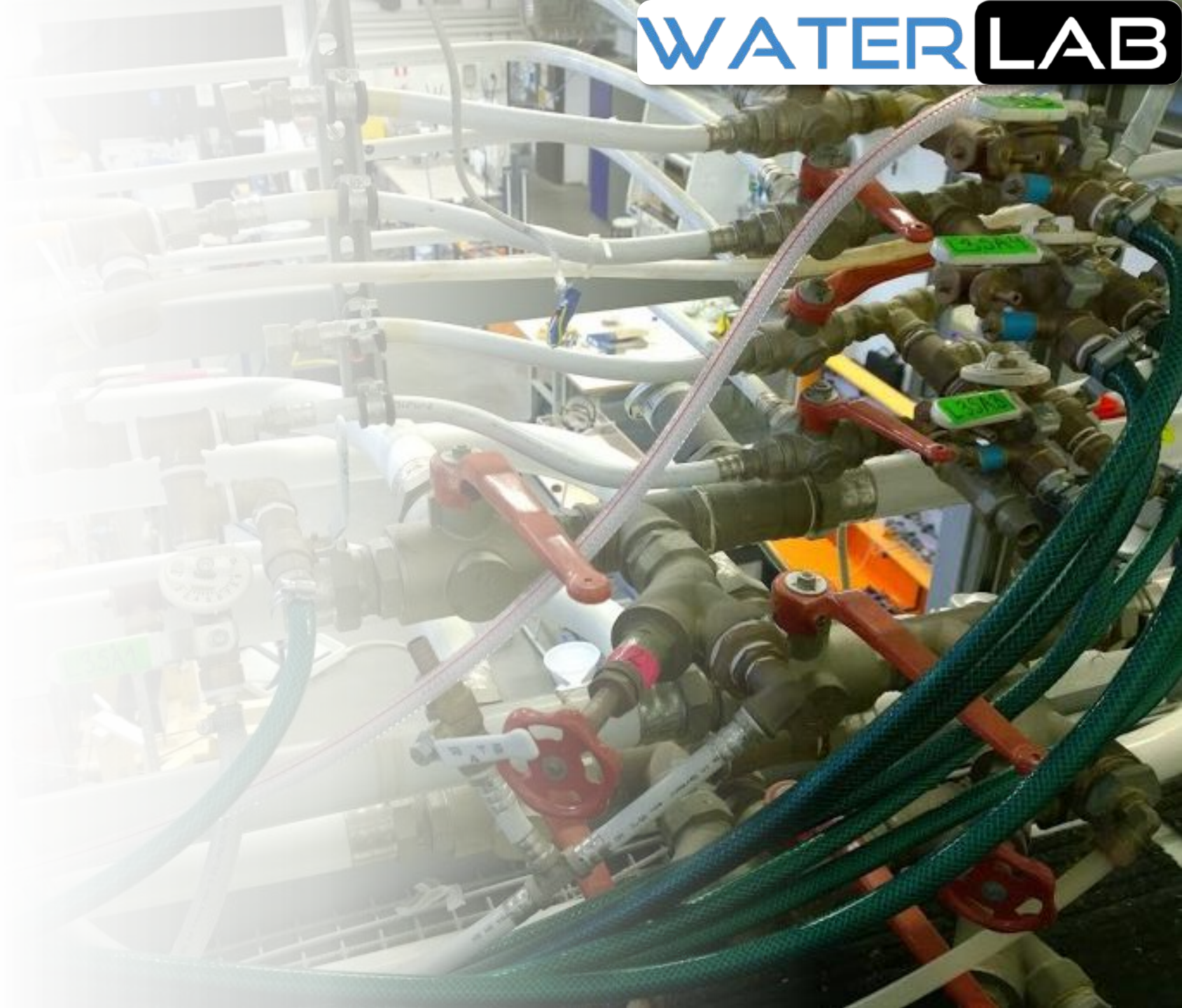
WaterLAB and WaterLOOP

- **WaterLOOP is the open system**
– custom setups, sensor deployment and modifications can be prepared in short time
- **Sandboxed system** –
WaterLOOP is fully isolated from municipal water and wastewater network
- **Open or closed** circulation system
- Circulation loops can be operated as **one system** or **separately**



WaterLAB and WaterLOOP

- **Significant changes** in water composition are prepared in main tank (using one or more compartments). **Minor changes** are introduced with automated dosing pumps (variable flow, concentration, time pattern) directly to WaterLOOP or in the tank
- **Separate sewage system** - dedicated underground tank for contaminations not suitable for direct discharge to municipal wastewater network



WaterLOOP - examples of usage

- **Simulating intentional or unintentional contamination events** - triggered by changes in water treatment process, network pipe system interventions, flushing, pipe damages, cross-contamination or intentional attack on water source
- Simulating **chemical contamination** (altering physical-chemical composition of water), **microbiological contamination** (cooperation with THL – e.g. e.coli, viruses), **hydraulic “contamination”** (e.g. steady/unsteady flow/velocities changes, inducing controlled pressure surges)
- **Baseline water quality conditions monitored** continuously in real-time by multiple laboratory grade instruments and grab sampling (offline)
- **Precise experiment plan execution** or inducing **random water quality** changes

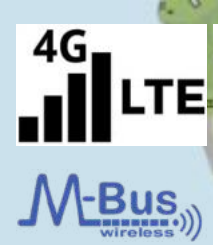
WaterLOOP - examples of usage

- **Sudden, mid- or long-term change in water quality parameter(s)** – tests of single or multiparameter changes (custom matrices of parameters affecting water quality)
- Operation scenarios aim to test effectiveness in identifying the onset of anomalous water quality events
- All experiments contain **meta-data describing precisely the system condition**
- WaterLOOP can be used for preparing training and validation data set for artificial intelligence applications

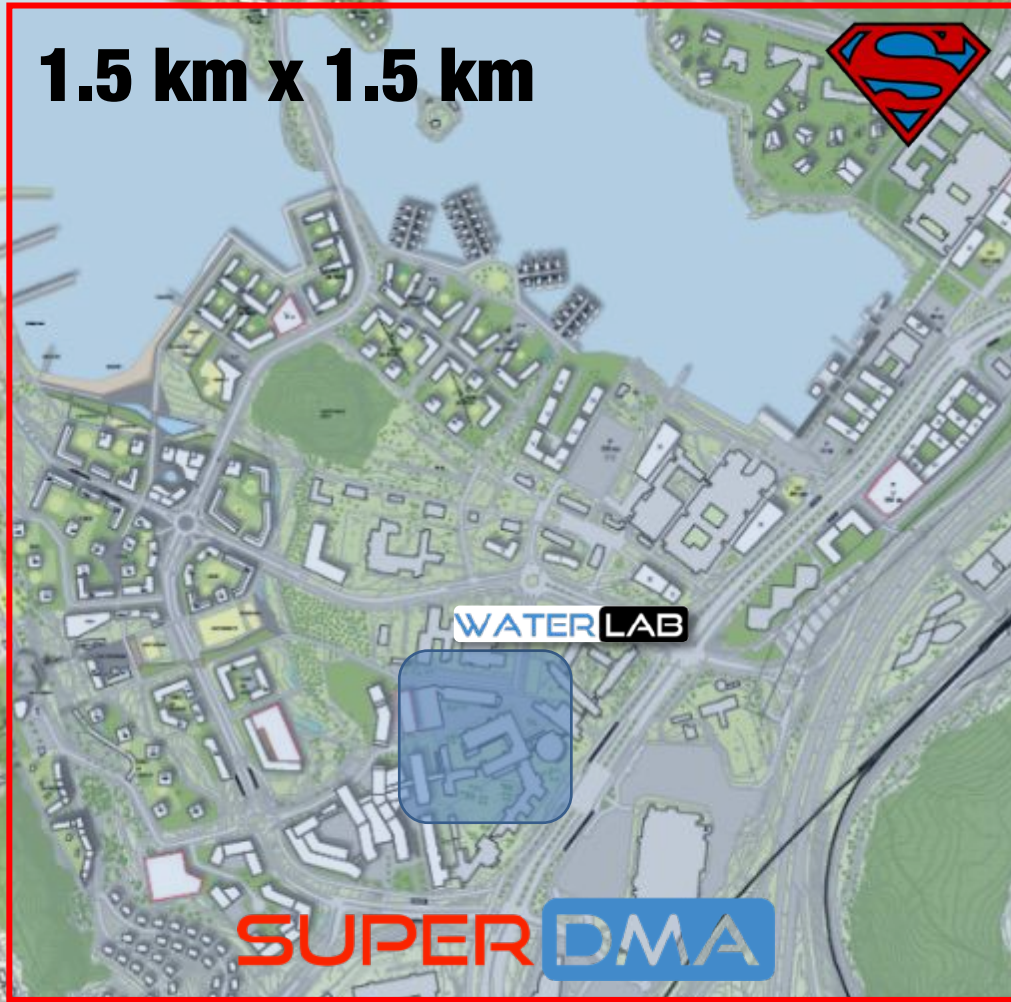


WaterLAB and WaterLOOP

- **WaterLOOP** is comprehensively rigged with telemetry and automation
- The laboratory setup allows for **combining online monitoring with real-time modelling** for the development of tools such as DSS, network awareness and detection of abnormal system operation, testing of new devices or services, water quality studies.
- **Sandboxed physical simulation scenarios-based testing**, including leakage, water hammer, faulty valves, water contamination.
- **Applications range from municipal water systems** (water network, stormwater, wastewater) **to industrial processes** and specific applications.
- WaterLOOP applications can be simultaneously scaled-up to **SuperDMA**



Kuopio Smart City - Savilahti area by 2030:
 15 000 students
 13 000 jobs
 6 000 residents

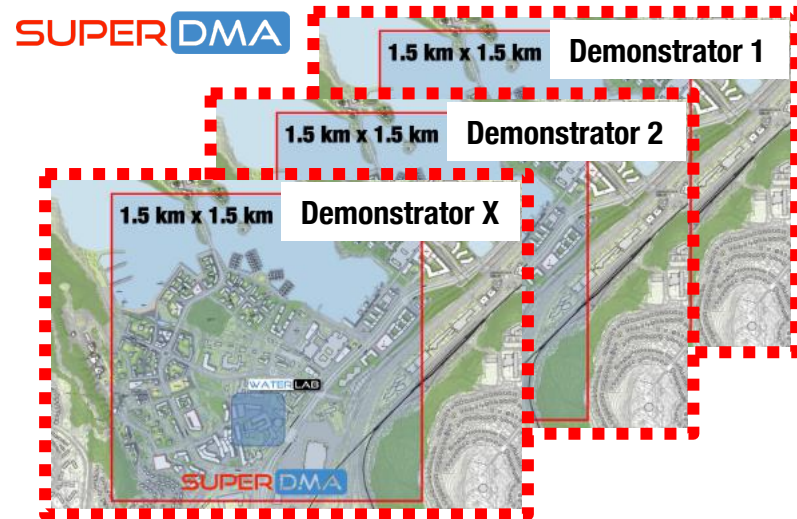
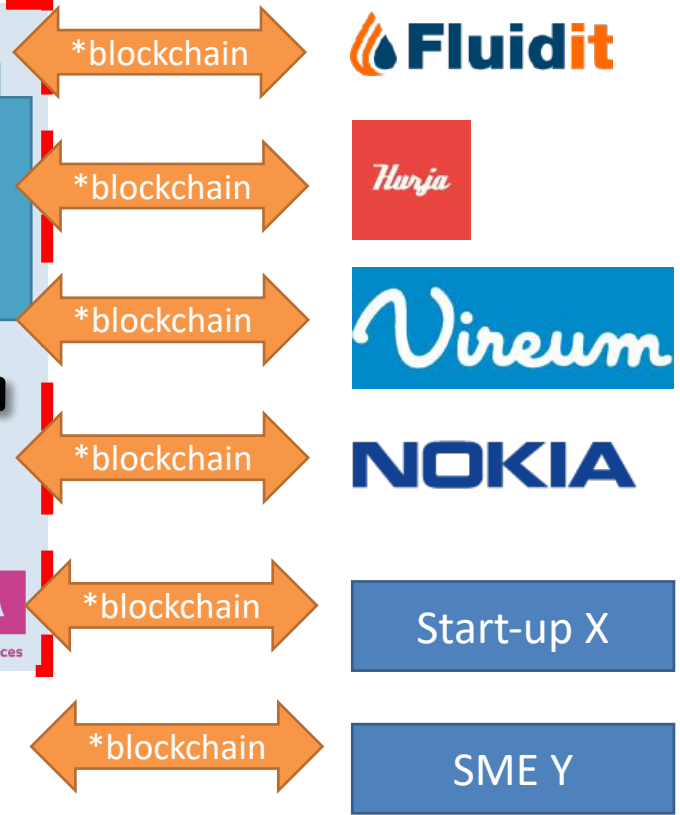
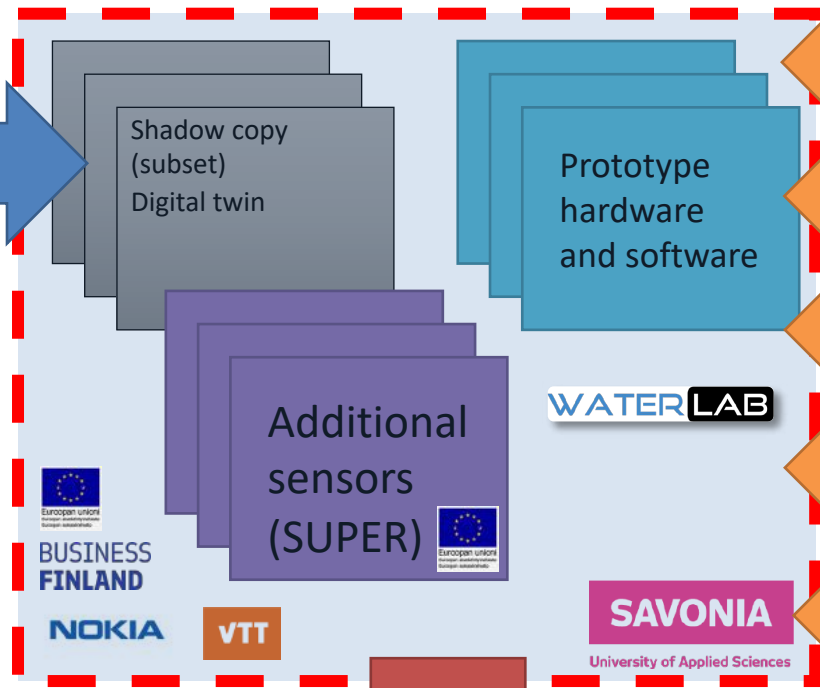


- **SuperDMA** is located in Kuopio, Finland
- **SuperDMA** is a full-scale representative **District Metering Area** (in terms of area, number of water consumers, consumers profile, terrain variability etc.) including underground infrastructure (water network, wastewater and stormwater network)
- **SuperDMA** allows for rapid scale-up from WaterLOOP (lab and pilot-scale: **TRL < 6**) and long-term product testing and demonstration in real environment (**TRL > 6**)
- **SuperDMA** and WaterLOOP are within range of **NB-IoT (LTE B31 450 MHz)** and **mmW 5G NR private test network**

Utility data repositories
(e.g. GIS, SCADA, hydraulic model)



Cybersecure enclave



SuperDMA is in range of Savonia private **NB-IoT** (B3, B20, B31) and **5G NR mmWave** (n257 and n258) test network



Workshop



Chemical Lab





Analytical instruments



Piloting services

We have built a number of modular, containerized, plug & play, pilot setups in 12 m sea containers for industrial and municipal applications, each with a nominal capacity of approx. 1 m³/h:

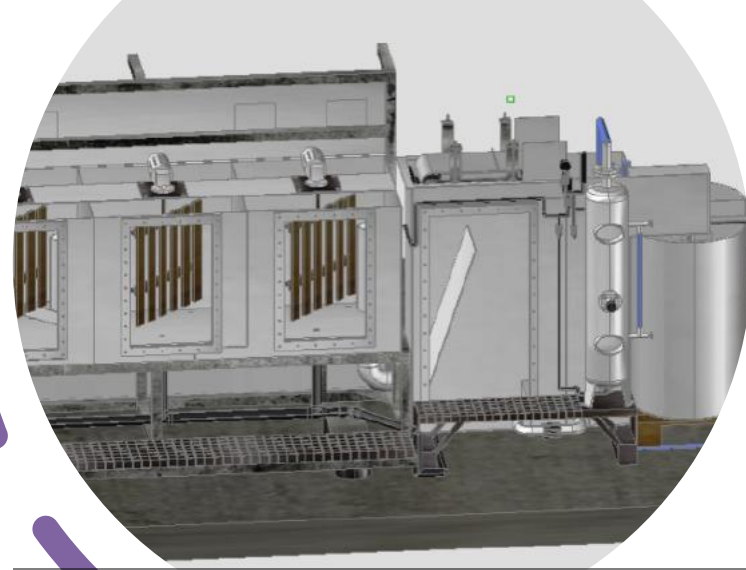
- **Customizable conventional water treatment plant**
- **Nitrogen + Sulphur removal / recovery plant**
- **Sulphate recovery / removal unit**
- **Valuables (REE) recovery unit (Morecovery)**
- **Separation pilot-plant (container housing all separation techniques)**
- **Biogas production pilot plant**

Each setup can be customized for the application and deployed in a real environment. It is possible to combine more than one container pilot to build a bespoke arrangement.

We have our own 36 kW/45 kVA power generator housed in a container to power the setups in the field.

Pilot-scale water treatment plant ($Q_{\text{nom}} = 1 \text{ m}^3/\text{h}$)

- **Process description:** rapid mixing, flocculation in three stages, flotation, rapid sand filtration, disinfection (chlorination and/or UV-radiation and/or ozone), adjustment of pH and alkalinity
- **Maximum capacity:** $3 \text{ m}^3/\text{h}$
- Possibility to utilise multiple different chemicals and process parameters including filter media, flocculants, disinfection agents etc.
- Pilot-scale water treatment is containerized and available as a mobile plug and play stand-alone module or combined with other pilots and on-site pre- / post- treatment




3D-model of the plant



Pilot treatment plant in sea container



This is only one example from our machine park – ask me for more information



We offer
laboratory
booths for rent
during testing



Our Team



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