Royal HaskoningDHV Digital

Aquasuite®

Digital Technology for wastewater systems

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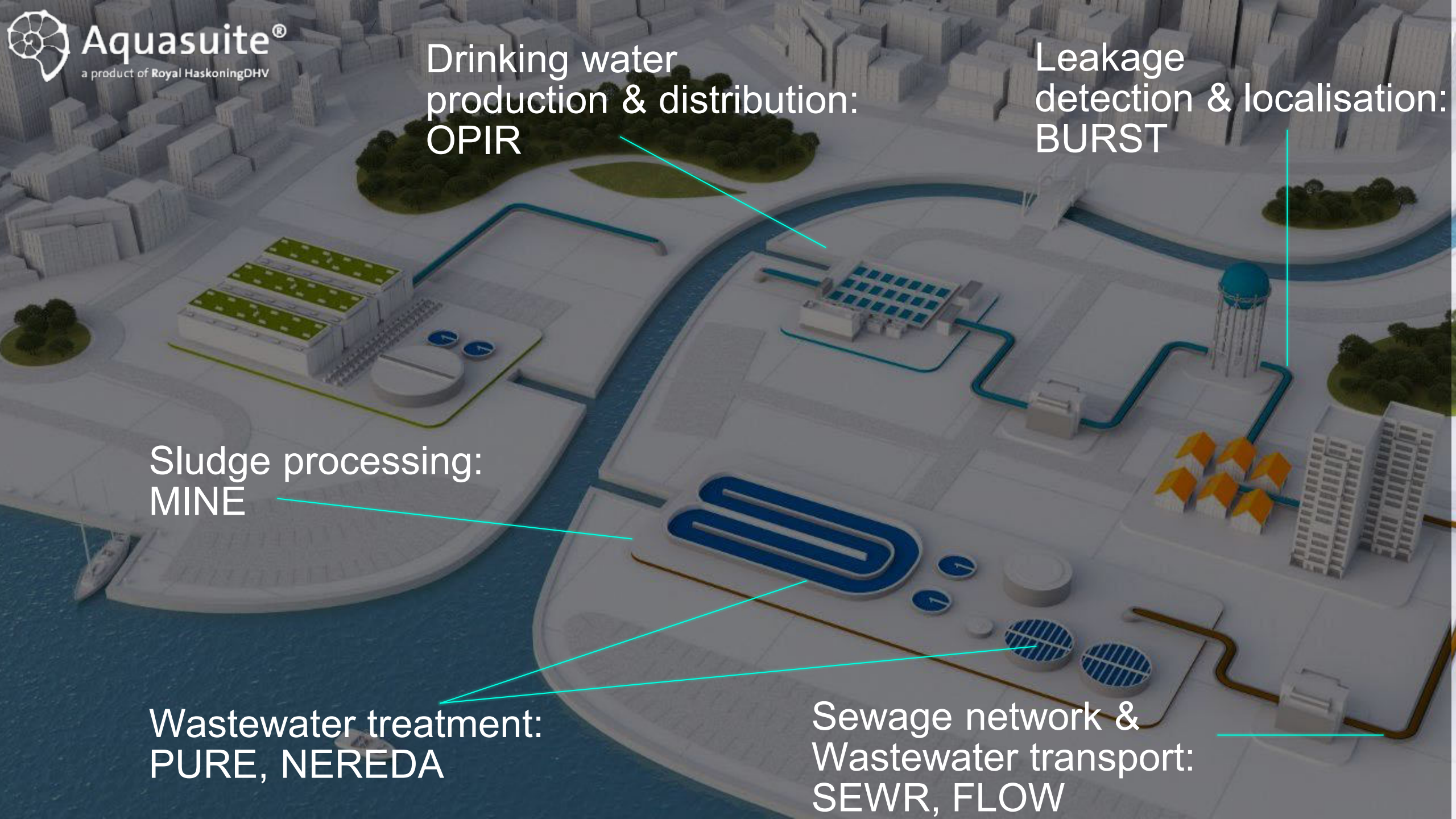
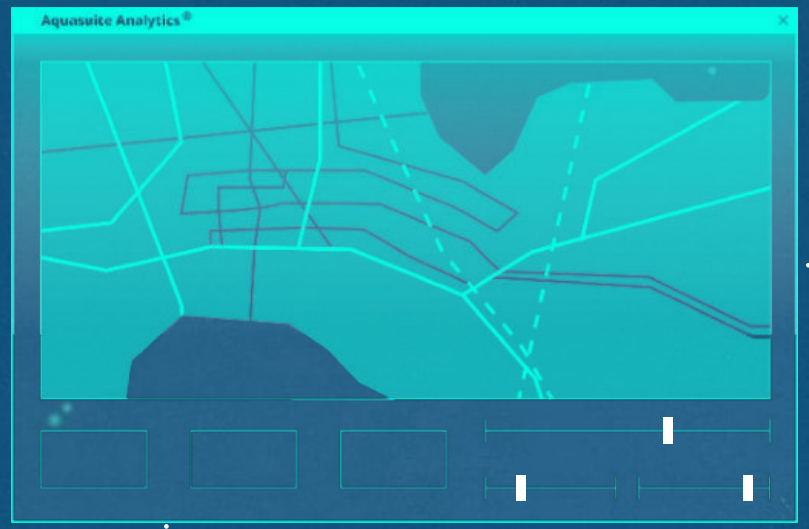
Aquasuite®

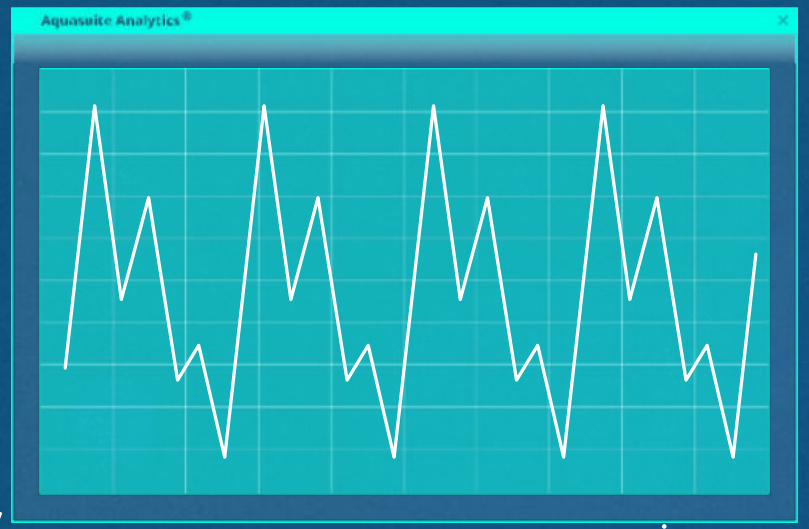
a product of Royal HaskoningDHV

A UNIQUE COMBINATION OF WORLD CLASS WATER EXPERTISE AND SMART IT KNOWLEDGE

Aquasuite smart water software provides unique **analytics,** supports **predictive maintenance** and **real-time holistic control** lowering operating costs, reducing capital investment and enabling proactive warning of leaks, bursts, overflows & pollution incidents.


Aquasuite®
a product of Royal HaskoningDHV
Drinking water production & distribution: OPIR
Leakage detection & localisation: BURST
Sludge processing: MINE
Wastewater treatment: PURE, NEREDA
Sewage network & Wastewater transport: SEWR, FLOW





Virtual Operator

1) LEARN

2) PREDICT

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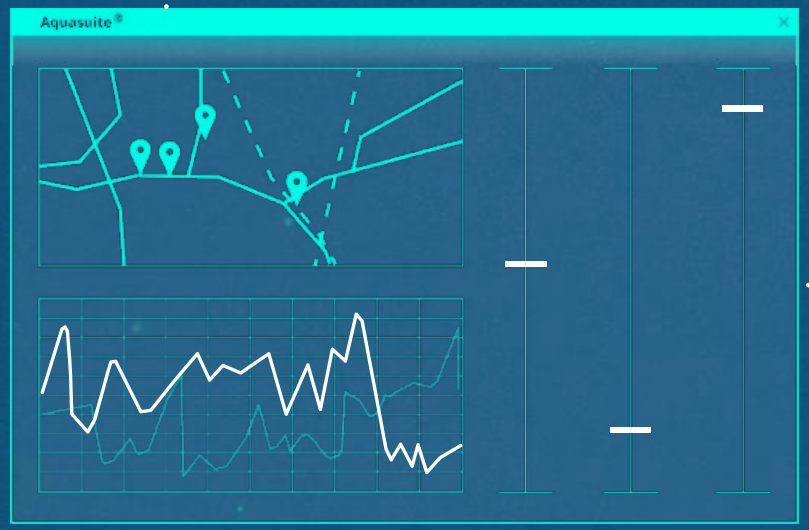
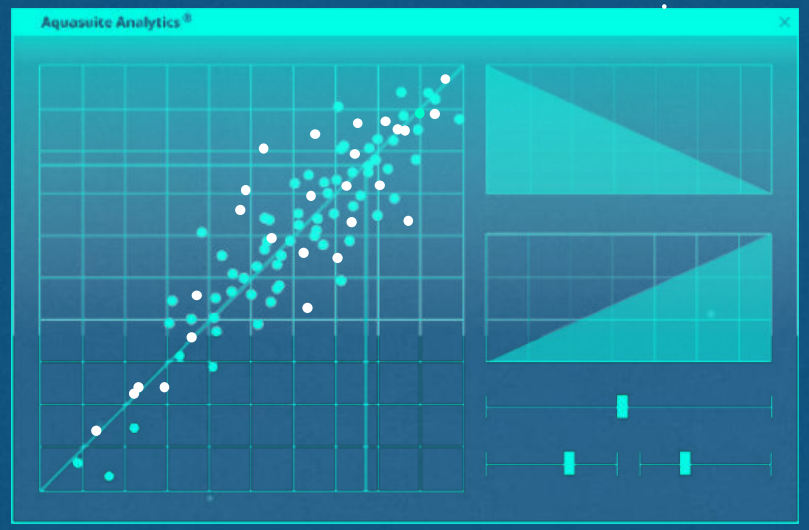
4) CONTROL

3) ANALYSE

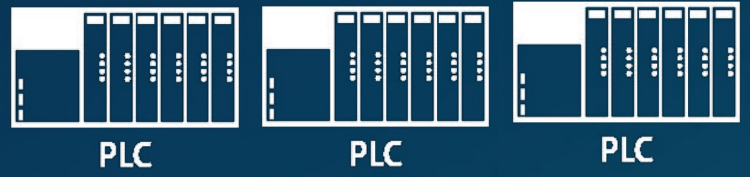




TOMORROW

Virtual Operator

KPI's & targets



Pumps, valves, processes, etc.

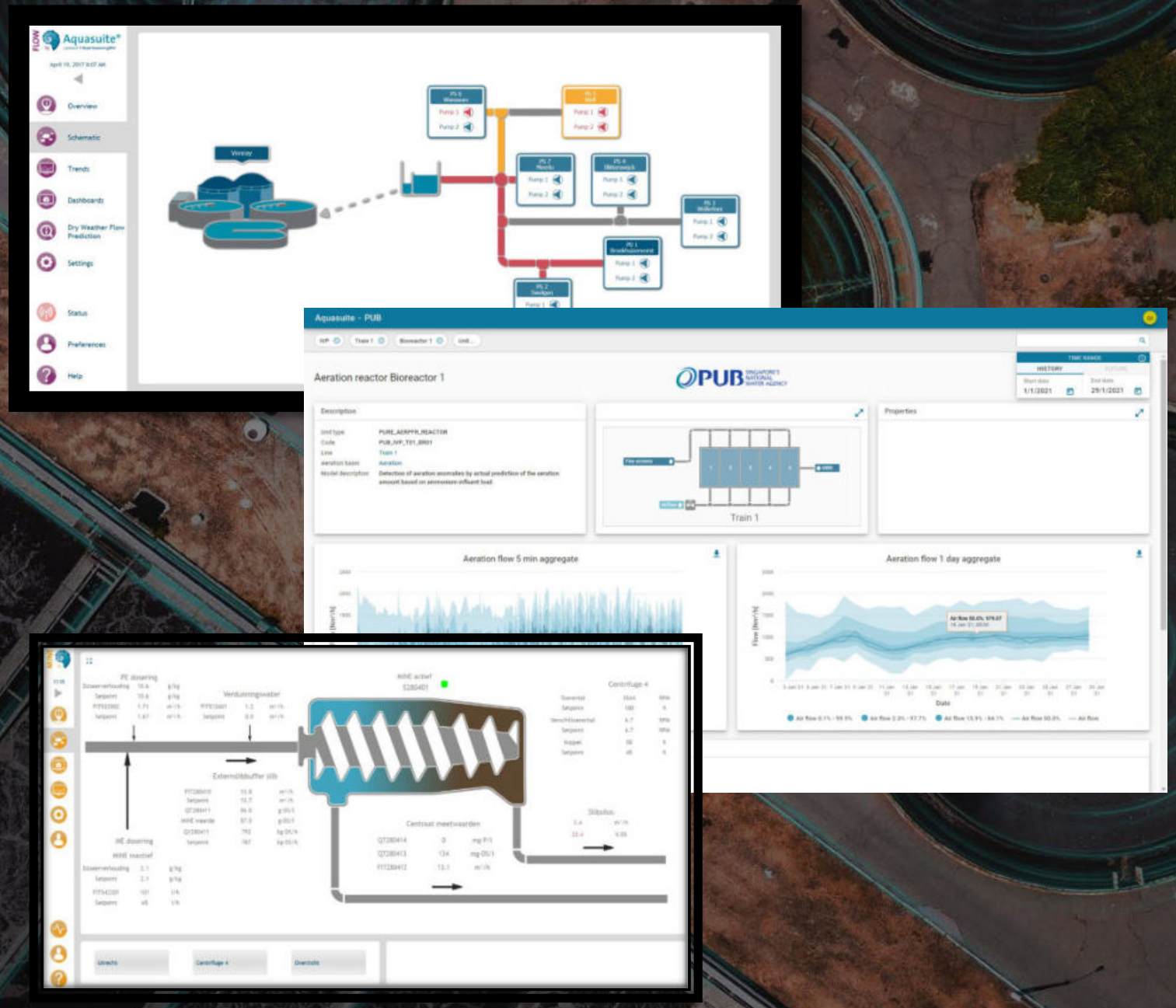
Virtual Operator for wastewater

Energy-efficient wastewater transport and treatment for reuse & recovery and meeting environmental compliance.

Holistic Control & optimisation for wastewater systems and sludge processing

Machine learning to optimise sewer system, improve effluent stability and compliance:

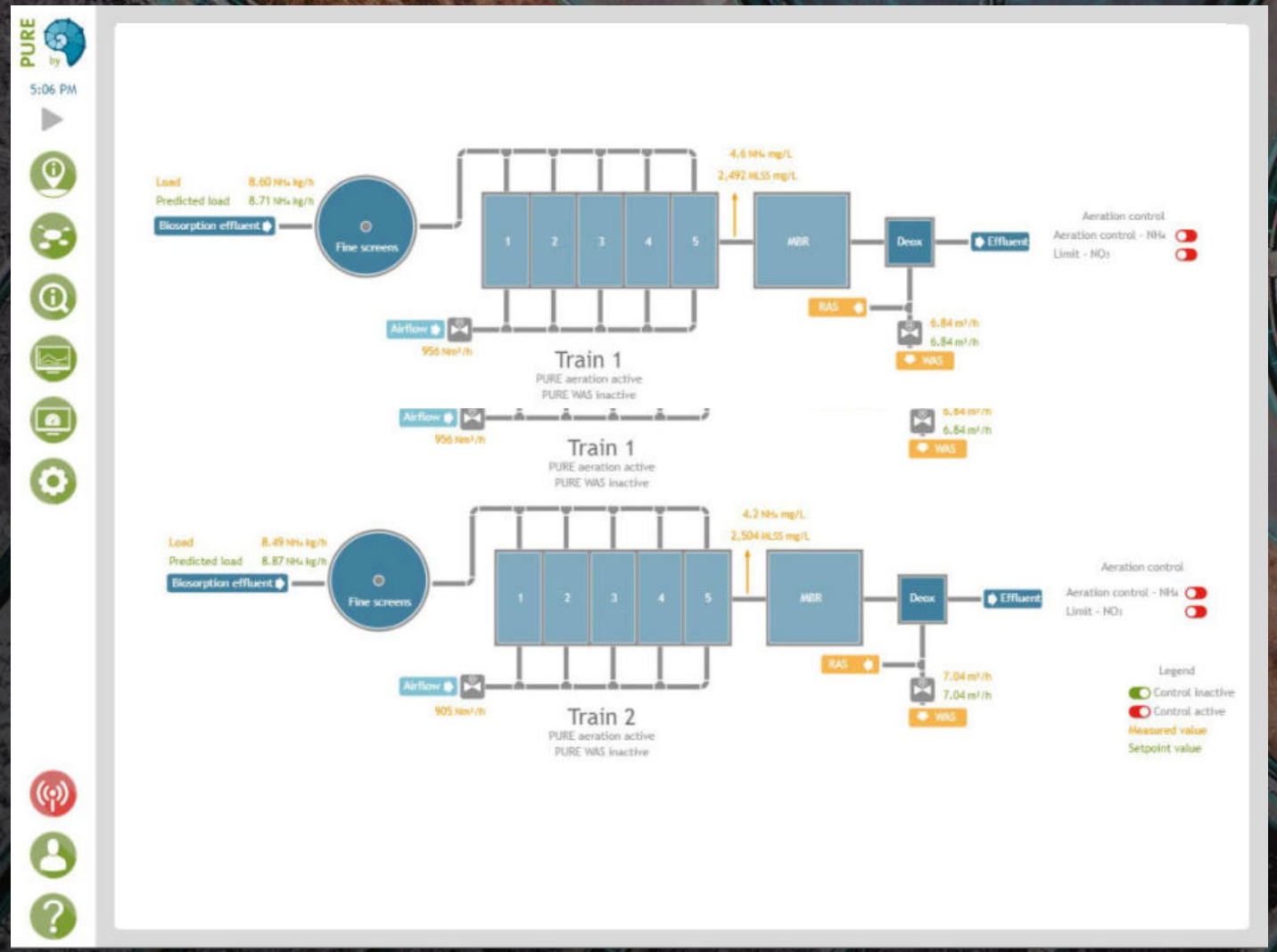
- Reduce Peak flows, combines weather forecast
- Load predictions, process optimisation e.g. aeration, chemical dosing
- Anomaly detections & early warnings e.g. CSO spills, clogging, instrument drifts
- Sludge processing optimisation



Aquasuite® PURE

Optimised wastewater treatment

Virtual operator for wastewater treatment



Machine learning to improve effluent stability and compliance

- Aeration optimisation
- Efficient Chemical dosing
- Anomaly detection
- Early warnings

Virtual Operator – Wastewater Reuse
PUB (Singapore)

PUB

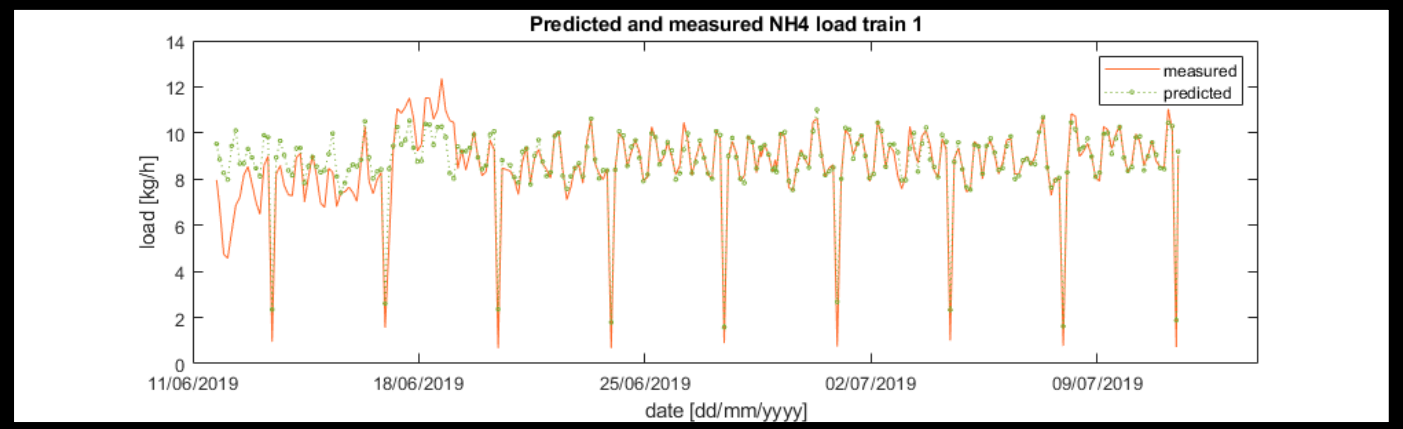
Aquasuite®
a product of Royal HaskoningDHV

Client
Ulu Pandan Integrated Validation Plant (IVP)

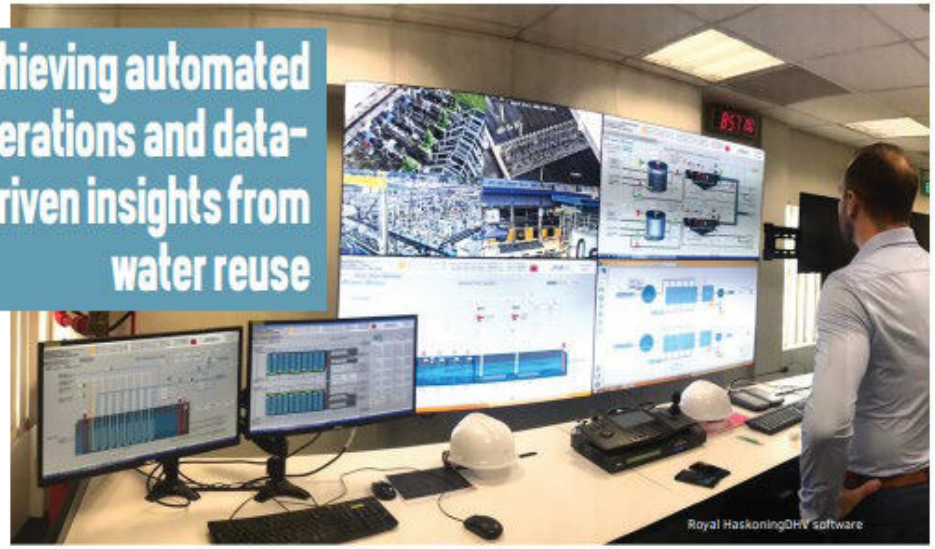
Characteristics
12,000 m³ per day for 96,000 people

Benefits
- Smart autopilot with 48 hr forecast
- Accurate load prediction of 88%
- Up to 15% aeration reduction
- Stable operation and effluent quality
- Anomaly detection
- Increased Automation, productivity & upskilling

Start — 3 months — Installation — 3 weeks — Control — Add. Analytics, etc



Achieving automated operations and data-driven insights from water reuse


Royal HaskoningDHV software

Whether solving society's challenges such as water scarcity, access to drinking water, protecting water resources, or reducing its water footprint, Royal HaskoningDHV provides technological solutions that meet these challenges.

With Royal HaskoningDHV's digital innovation, Aquasuite®, a software built with deep domain knowledge, utilities and industry are able to automate their operations and gain actionable insights on their water infrastructure.

Aquasuite® is a proven smart water technology that monitors, analyses, visualises and controls the performance of water and wastewater infrastructure through predictive analytics and machine learning. Its AI-powered analytics and autopilot provide full real-time visibility across the complete water and wastewater network and treatment, and controls day-to-day operations.

Aquasuite® consists of five products, each addressing a different challenge in the drinking water and wastewater process. The products work separately, yet integrate seamlessly to create a powerful tool to control drinking water and wastewater proficiently. Aquasuite PURE, which is optimised for wastewater treatment, is implemented in a pilot project with PUB, Singapore's National Water Agency.

> "In the near future smart cities will have their complete water cycle optimised and operated holistically from one integrated solution: from source to tap and back again."

HOW AQUASUITE® PURE WORKS

Aquasuite PURE collects real-time data on the plant's flows and qualitative measurements, including those for ammonia, nitrates, oxygen, phosphates and dry solids. The system uses this information to build a historical database. It will then make use of algorithms to predict the plant's wastewater flows and loads, oxygen needs, chemical dosing needs and other requirements. The system can also detect abnormalities in the plant's processes and is capable of controlling key treatment processes, automatically optimising them in real-time based on its predictions and the plant's historical performance data. This will result in predictive rather than reactive control of the plant. This leads to more stable and robust operations, better effluent quality, lower energy and chemical consumption and help enhance operators' productivity.

ULU PANDAN IVP: RESULTS

In a pilot project with PUB, Singapore's national water agency, Aquasuite® PURE was installed at the Ulu Pandan Integrated Validation Plant (IVP), and preliminary results of the project have shown that Aquasuite® is well capable of predicting the load entering the treatment plant, learning its operational performance and controlling treatment processes as it has successfully taken over control for the past few months.

Prediction accuracy increases over time as the software is learning, now already reaching a prediction accuracy of 88%. While Aquasuite is controlling key treatment processes such as aeration, it learns how the process performs. It is automatically shifting control from reactive to predicted control set-points, making it less sensitive to e.g. measurement failure as it predicts control with a 48-hour horizon. This gives the operator ample time to fix an issue before it becomes a problem.

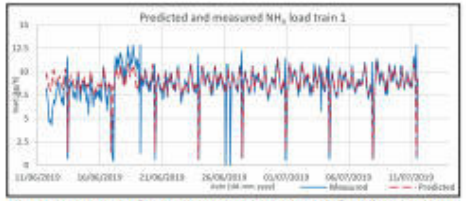


Figure 1: Screengrab of prediction and actual load trends from the pilot project at PUB's Ulu Pandan Integrated Validation Plant

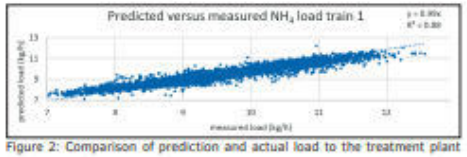


Figure 2: Comparison of prediction and actual load to the treatment plant

Results show that Aquasuite is able to learn and predict operations several days ahead and it can function as autopilot, able to perform unattended operation. Preliminary results up till now show that a reduction of aeration flow with predictive compared to conventional control of up to 15% is achieved. This aeration flow reduction results in corresponding energy savings.

AQUASUITE'S AUTOPILOT

The solution demonstrates it can learn the process in such a way, that it provides two-day-ahead predictive insight while optimising and controlling the plant in real time. This means the self-learning system can act as an autopilot to the operator, increasing the operator's productivity. It saves operational costs and increases operational resilience as it delivers a more robust system which is less sensitive to e.g. measurement failures. It provides timely insights and anomaly detection to the operator, reducing the risk and effect of undesirable events.

The approach of predicting water and integrally optimising assets on a holistic level is key to this solution and can be applied across the whole water loop.

Michel de Koning, associate director of Aquasuite said, "We believe that data-driven solutions can deliver an efficient, reliable and resilient water infrastructure. In the near future smart cities will have their complete water cycle optimised and operated holistically from one integrated solution: from source to tap and back again. We have built Aquasuite with that vision and are proud to see this demonstration project being implemented with PUB, one of the most forward-thinking utilities in the world." WWA

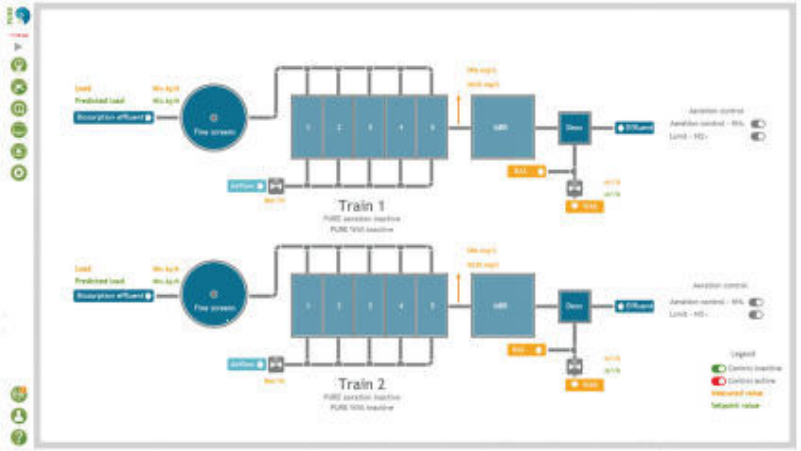


Figure 3: Aquasuite PURE pilot trial with its controls enabled – note that red is enabled

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