App note

The WTW Drinking Water Panel at the drinking water plant Mörscher Wald near Karlsruhe, Germany

In this application note on the new WTW Drinking Water Panel, you will learn how Xylem ensures satisfaction with continuous drinking water monitoring at the Mörscher Wald waterworks near Karlsruhe. The WTW Drinking Water Panel was tested for over a year and delivered highly reliable and reproducible measurement results with low maintenance requirements. During the test phase, the flow rate was reduced down to 10 liters per hour—the recommended minimum for operation without chlorine sensors—in order to maximize drinking water savings.

Read on to learn more about the new WTW Drinking Water Panel and its application at the Mörscher Wald waterworks near Karlsruhe. For further background information, take a look at our first application note, in which we share our experiences from a year-long test phase at the Aschaffenburg drinking water plant. You can find this and more on our website, which contains all the information about the WTW Drinking Water Panel.

1. The Mörscher Wald waterworks

Built in 2022, the plant supplies the city of Karlsruhe and surrounding areas with up to 60 million liters of drinking water per day and is operated by Stadtwerke Karlsruhe. The waterworks' catchment area is located in the Mörscher Wald, a protected forest and nature reserve southwest of Karlsruhe.

Due to the calcareous sands in the aquifer through which the water flows, the hardness of the groundwater is approximately 3 mmol/L (~17 °dH). The sulfate concentration has decreased since 1990 from an original level of approximately 70 mg/L to approximately 45 mg/L today. The sodium concentration of approximately 8 mg/L is considered low, as is the chloride concentration of approximately 15 mg/L.

Due to the reducing conditions, the iron and manganese concentrations are elevated, averaging approximately 1.5 mg/L and 0.1 mg/L, respectively. Therefore, the groundwater must be treated to remove iron and manganese before it can be supplied as drinking water.

Drinking water treatment essentially consists of an aeration and a filtration stage. Aeration raises the oxygen level of the raw water from 1 to 8 mg/L, enabling the oxidation of iron and manganese, which are then separated in eight double-layer pressure filters. A mobile disinfection system using sodium hypochlorite can be used if necessary.

Capacity: 60 Mio L drinking water per day

Treatment of iron, manganese and oxygen concentrations

Parameter	Raw water	Drinking water at plant outlet
Iron	1.5 mg/L	< 0.01 mg/L
Manganese	0.1 mg/L	< 0.005 mg/L
Oxygen	1 mg/L	8 mg/L

Fig. 1 (above, source: Stadtwerke Karlsruhe GmbH): View of the Mörscher Wald waterworks near Karlsruhe

Table 1 (below): Comparison of the parameters treated in raw water and drinking water at the Mörscher Wald waterworks

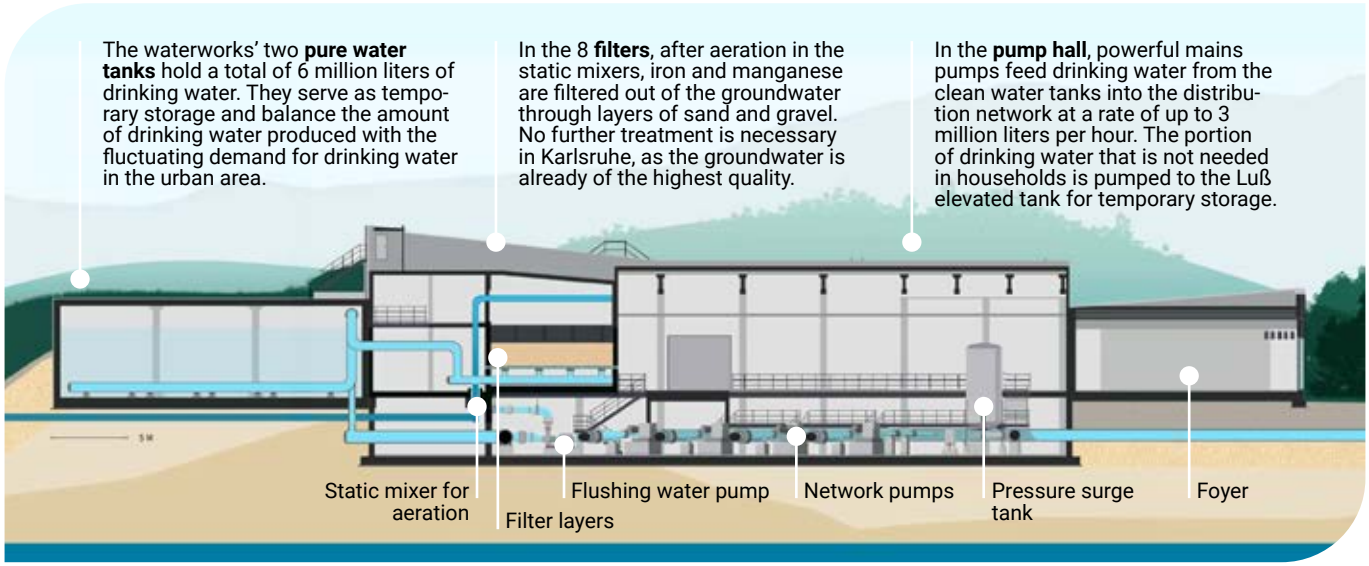

Fig. 2: Process diagram of the treatment process at the Mörscher Wald water plant near Karlsruhe (source: Stadtwerke Karlsruhe GmbH, modified)

The treated water is then temporarily stored in a drinking water tank and fed from there via the pumping station into the drinking water network of the city of Karlsruhe. Figure 2 shows a diagram of the process flow.

2. The WTW Drinking Water Panel

The new WTW Drinking Water Panel combines our continuous IQ SENSOR NET measuring system with a configurable selection of our compact and proven IDS sensors (Intelligent Digital Sensors), well known in the laboratory sector. In addition, the panel can be equipped with a chlorine sensor and a turbidity analyzer.

The setup installed at the Mörscher Wald waterworks (see Figure 3) consists of an IQ SENSOR NET system 2020 3G with four IDS sensors and can measure the parameters pH value, dissolved oxygen (O_2), conductivity, and redox (reduction-oxidation potential). Sensors for temperature-dependent parameters come with integrated temperature measurement and automatic temperature correction. The temperature measurement value can also be read out. The panel is installed at the outlet of the plant, where it continuously monitors the drinking water quality.

The test setup was installed and commissioned on November 8, 2023. The flow rate was initially set to the upper limit of 40 L/h and subsequently reduced to the lower limit of 10 L/h. Since the measurement is performed in the bypass and discarded, reducing the flow rate can help to discard less treated drinking water, thereby increasing energy efficiency and saving costs.

In accordance with the standard maintenance interval on site, a detailed device inspection with accompanying documentation was generally performed every 4 weeks. The oxygen sensor was calibrated with fresh air and the pH value was calibrated with buffers 7.0 and 4.0. Conductivity and redox showed very slight deviations from a reference, which is why no adjustments were made during

Fig. 3: Test bench for the WTW Drinking Water Panel at the Mörscher Wald waterworks near Karlsruhe with IQ SENSOR NET system 2020 3G and four IDS sensors

> "Energy saving and sustainability are very important issues that influence purchasing decisions."
>
> Elke Chemelli-Franz
> (responsible for the online measurement technology at Stadtwerke Karlsruhe)

the entire period. The test installation was monitored by Xylem until the end of 2024 and then taken over by Stadtwerke Karlsruhe.

5. Measurement results

According to the operator, the test setup delivered good measurement results that are reproducible in comparison to laboratory analyses by a contract laboratory and existing online measurement technology. It made no difference whether the flow rate was set to 40 or 10 liters per hour.

Figure 4 shows an excerpt from the recorded measurement data for conductivity, oxygen, pH, and temperature. It shows the chronological progression of the data from the WTW instrumentation and an existing measurement technology for comparison. The data from the existing measurement technology was obtained at a constant flow rate of approximately 60 liters per hour, while the data from the WTW instrumentation was obtained at approximately 40 L/h (left) and approximately 10 L/h (right).

It can be seen that the results of the WTW instrumentation are almost identical to those of the existing measurement technology, both at a flow rate of approximately 40 L/h and at a flow rate of approximately 10 L/h. Fluctuations in the measurement data over the course of the day may result from the addition of raw water of varying quality from different wells and are considered uncritical in the respective orders of magnitude.

> “The maintenance required for the measuring panel is minimal and can be easily handled with technical expertise.”
>
> Elke Chemelli-Franz
> (responsible for the online measurement technology at Stadtwerke Karlsruhe)

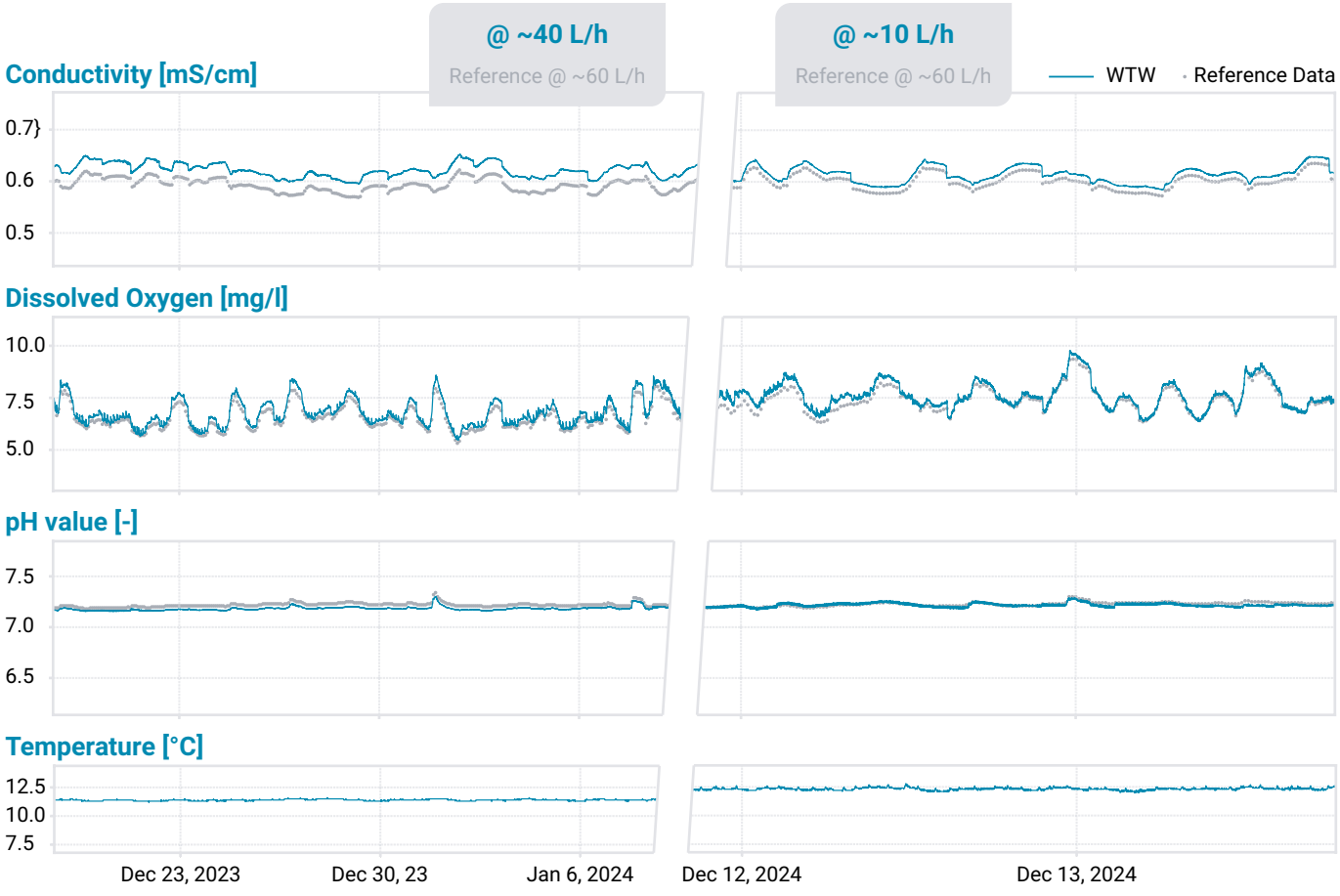

Fig. 4: Measurement results from WTW instrumentation at ~ 40 L/h (left) and ~ 10 L/h (right) flow rate, compared with existing technology.

> “The test installation is running optimally and very reliably. The reproducibility of the measured values determined in relation to the measuring devices already in place on site is also very good and largely corresponds to the laboratory analysis of the contract laboratory.”

Elke Chemelli-Franz (responsible for the online measurement technology at Stadtwerke Karlsruhe)

5. Summary

With the test installation at the Mörscher Wald waterworks, we were able to successfully demonstrate that our new WTW Drinking Water Panel meets operational requirements and impresses with its reliable and low-maintenance operation. Reducing the flow rate to 10 L/h to save drinking water—the recommended minimum for operation without a chlorine sensor—showed no reduction in performance compared to measurements at 40 L/h and the results of laboratory analysis and existing measurement technology. The WTW Drinking Water Panel can therefore help to save treated drinking water, and thus energy and money.

Key Takeaways

- The WTW Drinking Water Panel was installed in November 2023 at the Mörscher Wald waterworks near Karlsruhe and impressed with its precise and low-maintenance measurements.
- The flow rate was reduced from an initial 40 L/h to 10 L/h, saving treated drinking water, energy, and money, while the monitoring continues to run smoothly.
- The WTW Drinking Water Panel combines our intelligent IQ SENSOR NET system with a configurable selection of our compact and proven IDS sensors (Intelligent Digital Sensors), well known in the laboratory sector.

Products used in this application:

- DW/P Drinking Water Panel for 4 IDS sensors
- IQ SENSOR NET controller MIQ/TC 2020 3G with the modules: MIQ/IDS4, MIQ/PS
- IDS sensors SenTix® 945-P, SensoLyt® 900 ORP-P, TetraCon® 925, FDO® 925

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Xylem Analytics Germany Sales GmbH & Co. KG, WTW
Am Achalaich 11
82362 Weilheim

Tel + 49 881 1830
Fax + 49 881 183-420
xylemanalytics.com

xylem
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