

Aqua Membranes Cuts RO Cleaning by 83% at Legacy Mine

Background

A former mine in the United States is undergoing a major groundwater remediation effort. After 140 years of mining operations, the water is contaminated with high levels of total dissolved solids, with sulfate concentrations exceeding U.S. Environmental Protection Agency (EPA) limits of 500 mg/L.

To effectively treat groundwater and meet EPA regulations, the water treatment plant (WTP) uses reverse osmosis (RO) technology. However, due to high flow rates (3.5 million gallons per day) and challenging feed waters, the system was experiencing rapid membrane fouling. This resulted in more frequent cleanings, increased chemical and energy consumption, and higher operating costs.

The WTP team needed a more efficient solution and turned to Aqua Membranes' innovative Printed Spacer Technology®, **which reduced membrane cleaning frequency by 83%.**

Understanding the Problem: Feed Spacer Fouling

Spiral wound RO membranes are made up of multiple layers, including feed channel spacers that allow water to flow through the system. The design and material of these spacers play a critical role in membrane performance, directly impacting maintenance costs and operational efficiency.

Most spacers use mesh netting, which is prone to trapping solids and biological growth. At the mine site, the team was forced to clean their membranes monthly just to maintain system performance.



Figure 1:
Example of
mesh feed
spacer fouling



Seeking a Better Solution

After learning about Aqua Membranes' Printed Spacer Technology®, the plant operators saw an opportunity to eliminate their problems caused by mesh feed spacers. They partnered with Aqua Membranes which manufactures an RO element featuring 3D-printed spacers built directly on the membrane surface.

After detailed modeling, the team selected the ECOBW505 membrane design, which met treatment and regulatory needs while fitting seamlessly into their existing RO system. The retrofit was completed **within three days** in October 2024.



Figure 2: Printed spacers on an industry-standard membrane



Advantages of 3D-Printed Spacer Technology®

Higher performance: Increases water flow rates by up to 20%, and extends membrane life through reduced fouling

Greater energy efficiency: Lower pressure drop delivers up to 30% energy savings

Compact and scalable: Results in more membrane surface area (>500 sq ft)

Standard dimensions: Allows for seamless integration and plug-and-play retrofits

The Results

After eight months of operation, the benefits were undeniable:

- First membrane cleaning occurred **170** days after installation
- Cleaning intervals increased from **1 month to 6 months**
- Cleaning rate was reduced by **83%**

This dramatic improvement in cleaning intervals resulted in measurable savings across the board:

1. **Reduced chemical usage** – less purchasing and handling of cleaning agents
2. **Decreased downtime** – 15 fewer days per year spent cleaning
3. **Longer membrane life** – infrequent cleanings resulted in lower replacement costs
4. **Improved operational efficiency** – better water quality and stable production

With just cleaning-related savings, the plant expects a **16-month return on investment (ROI)**. Factoring in extended membrane life and fewer unplanned shutdowns, total lifetime savings are expected to reach **hundreds of thousands of dollars**.

In a field where reliability, cost control, and compliance are critical, Aqua Membranes is helping customers rethink what is possible with RO.

