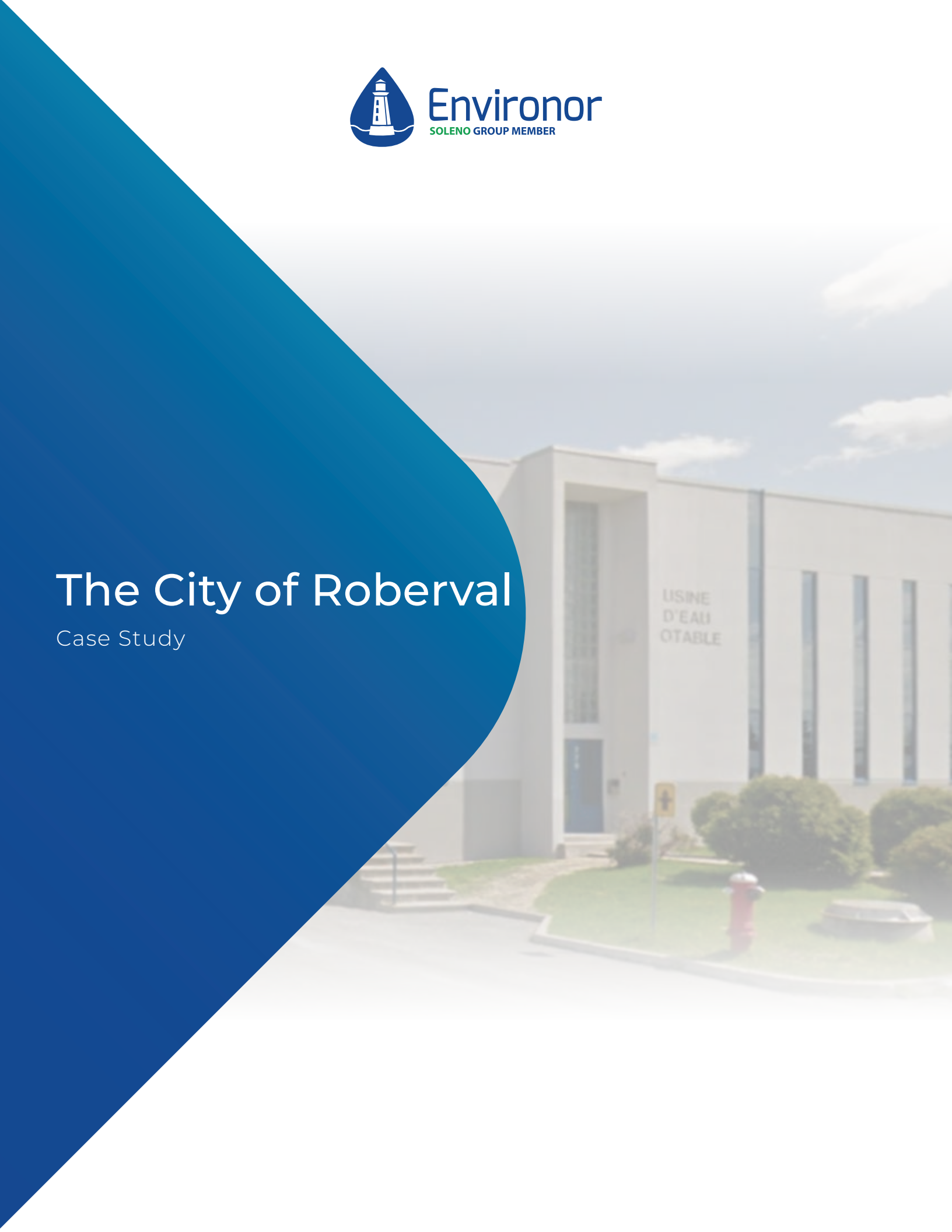
Environor
SOLENO GROUP MEMBER

The City of Roberval

Case Study



CASE STUDY

The City of Roberval

Context

The City of Roberval, nestled along the shores of Lake Saint-Jean, sources its raw water directly from this lake renowned for its natural richness. The raw water is then treated at the municipal filtration plant. It supplies nearly 9,500 residents.

This installation ensures the production of high-quality potable water that fully complies with the requirements of the Drinking Water Quality Regulation (RQEP). In addition to meeting regulatory standards, the water is also distinguished by its excellent aesthetic quality.

Consequently, the performance of the filtration plant itself was never in question. The issue was located within the distribution network, where challenges related to potable water quality could arise once the water reached users.

Problem Statement

Between 2015 and 2016, the City of Roberval recorded exceedances of the regulatory standard for trihalomethanes (THM) in its distribution network, with average concentrations surpassing the limit of 80 µg/L. These exceedances, combined with numerous citizen complaints regarding discolored water, led the municipality to implement a series of technical measures and convene meetings aimed at gaining a clearer understanding of the situation.

Initial discussions began in 2016. A comprehensive study was conducted in February 2018, which enabled the planning and implementation of a corrective treatment in November 2018.

Tests and observations indicated that the problems did not stem from the filtration plant, but rather from the distribution network, where the aggressive nature of the water caused adverse effects on the cast iron pipes.

Problem Statement (continued)

Two major issues were then identified:

1. **Formation of Chlorination ByProducts (CBPs)**

   The raw water from Lake Saint-Jean naturally contains a certain amount of organic matter. Although the water undergoes treatment, some organic matter remains. During chlorination, the residual organic compounds react chemically with chlorine, leading to the formation of trihalomethanes (THMs). Average concentrations observed in the distribution network exceeded the provincial standard of 80 µg/L.

2. **Corrosion and iron deposits in the distribution network**

   Iron released from pipe corrosion entered the water supply, leading to ferrous deposits and pipe fouling. This led to aesthetic issues, such as water discoloration and staining of surfaces. Moreover, the presence of iron diminished the free chlorine residual, thereby reducing the distribution network's capacity to safeguard against bacterial growth.

In summary, these findings underscore the importance of adapting the water treatment process to minimize THM formation and mitigate corrosion within the distribution network, thereby safeguarding optimal water quality right up the consumers' taps.

Solutions

To address the THM (THMs) exceedances and discolored water issues observed in Roberval's distribution network, Environor adopted a dual strategy: reduce corrosion while optimizing operational parameters to limit the formation of these by-products.

The first step had for objective to protect the water distribution network against corrosion by preventing the release of iron into the water and maintaining the free chlorine residual. To achieve this, Environor implemented a corrosion control treatment using phosphate and zinc, ensuring pipe passivation and stabilization of corrosion iron.

Monitoring data (see Figure 1) demonstrate a significant reduction in iron concentrations following the introduction of this treatment. Initially elevated levels decreased and stabilized below the aesthetic guideline of 0.3 mg/L Fe, while orthophosphate residuals were consistently maintained, ensuring ongoing protection of the network.

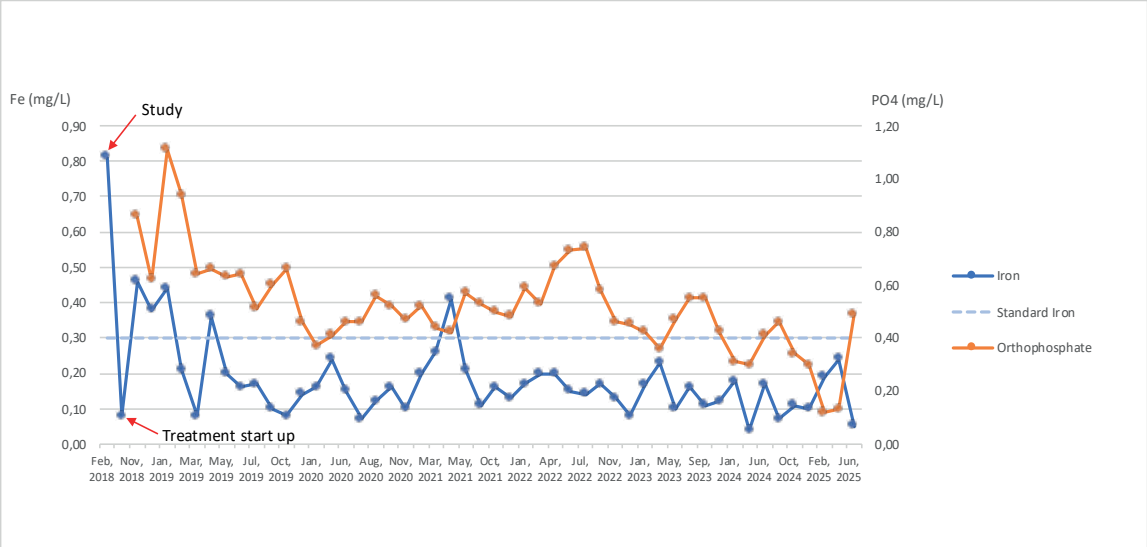


Figure 1: Evolution of iron and orthophosphate

This stabilization of corrosion is a key element, as it created a more controlled environment within the network, allowing the treatment to be subsequently optimized more effectively.

Once corrosion was under control, Environor working closely with the filtration plant operators, adjusted key operational parameters to minimize the formation of THMs. This second step aimed, among other things, to limit the reaction between natural organic matter and chlorine.

The steps undertaken included:

- Lowering the pH of the treated water to enhance the disinfectant efficiency of chlorine
- Reducing the chlorine dosage in the distributed water to limit the formation of chlorination by-products

The effects of these adjustments are clearly reflected in the trends of THM concentrations (see Figure 2). Following the implementation of the treatment, the annual average dropped below the regulatory threshold of 80 µg/L and remained consistently stable over several years, with only minor fluctuations linked to maintenance activities or occasional network modifications.

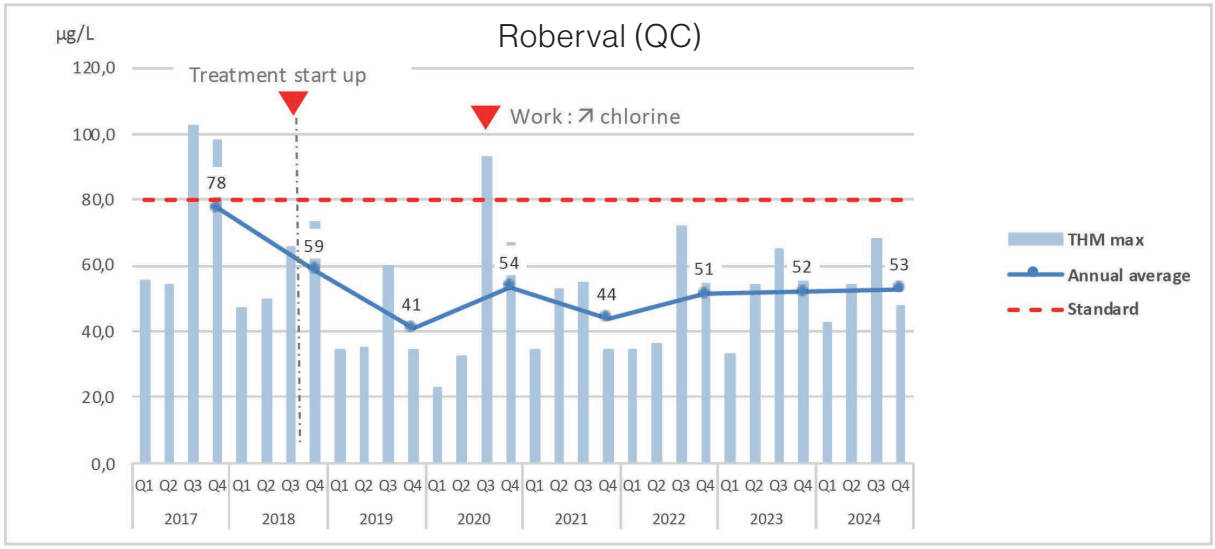


Figure 2 : Monitoring of trihalomethanes

Result

The optimization of pH and chlorine levels at the filtration plant, combined with the addition of the corrosion inhibitor, resulted in significant improvements throughout the distribution network. Indeed, THM concentrations decreased to below the provincial standard, confirming the effectiveness of the optimized treatment parameters (see Figure 3).

pH and THM fluctuations

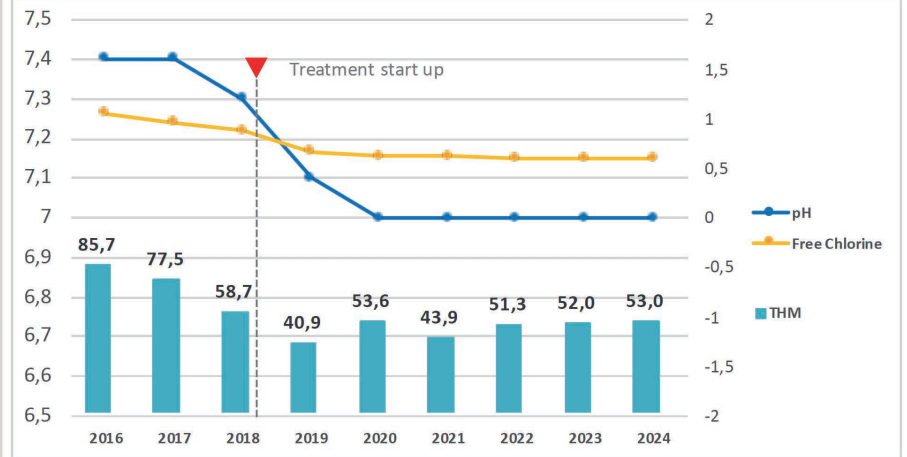


Figure 3: pH and trihalomethanes trends

In addition, lowering the chlorine dosage together with pH adjustment resulted in measurable reductions in chlorine consumption (see the table below) and in alkaline product use.

Table 1: Chlorine, pH, and THM trends

Years	pH	Chlore		THM
		Litre/1 000 m³	Cl_2 libre	
2016	7,4	20	1,05	**85,7**
2017	7,4	19	0,96	77,5
2018	7,3	19	0,88	58,7
2019	7,1	17	0,67	40,9
2020	7,0	16	0,62	53,6
2021	7,0	15	0,62	43,9
2022	7,0	15	0,60	51,3
2023	7,0	18	0,60	52,0
2024	7,0	16	0,60	53,0

Result (continued)

The quality of distributed water has stabilized, particularly regarding color and the presence of ferrous deposits. Across the network, incidents of discolored water have markedly decreased, as evidenced by a significant reduction in citizen complaints. By effectively controlling color and corrosion within the distribution system, municipal operations were streamlined. Flushing events became less frequent, and the annual network flushing could be performed more efficiently, requiring fewer interventions.

Benefits

Environor provides a personalized service, offering analyses and monitoring tailored to the specific needs of each network. Their high-performance products, selected based on the characteristics of the water, the protection of the pipes, ensure long-lasting water quality, and can also help reduce THM formation.

This approach fosters a relationship of trust with the municipal operator, while ensuring the long-term performance and durability of the infrastructure.

In addition, the reduction in water consumption allows the followings:

- It helps achieve the objectives of the potable water savings strategy;
- It results in energy and chemical savings, which account for a significant portion of operating costs;
- It reduces staff time required for unidirectional flushing operations.