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EXPERTISES

Structural and functional diagnostics of an Industrial Water network

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CFP ZIBAC - DKarbonation project - Building a Territory that Leads Industrial Decarbonisation

1. Introduction

Since 1973, the industrial water service has supported the industrial development of the Dunkirk region by ensuring the water supply for major companies in the port area. This network, supplied with raw water taken from the Bourbourg Canal, makes it possible to substitute drinking water in industrial processes, thereby helping to preserve this resource. Managed by the Dunkirk Water Syndicate (SED), it now serves 16 industrial users in the Dunkirk industrial and port zone, with a production volume reaching 22.6 million m³ in 2024.

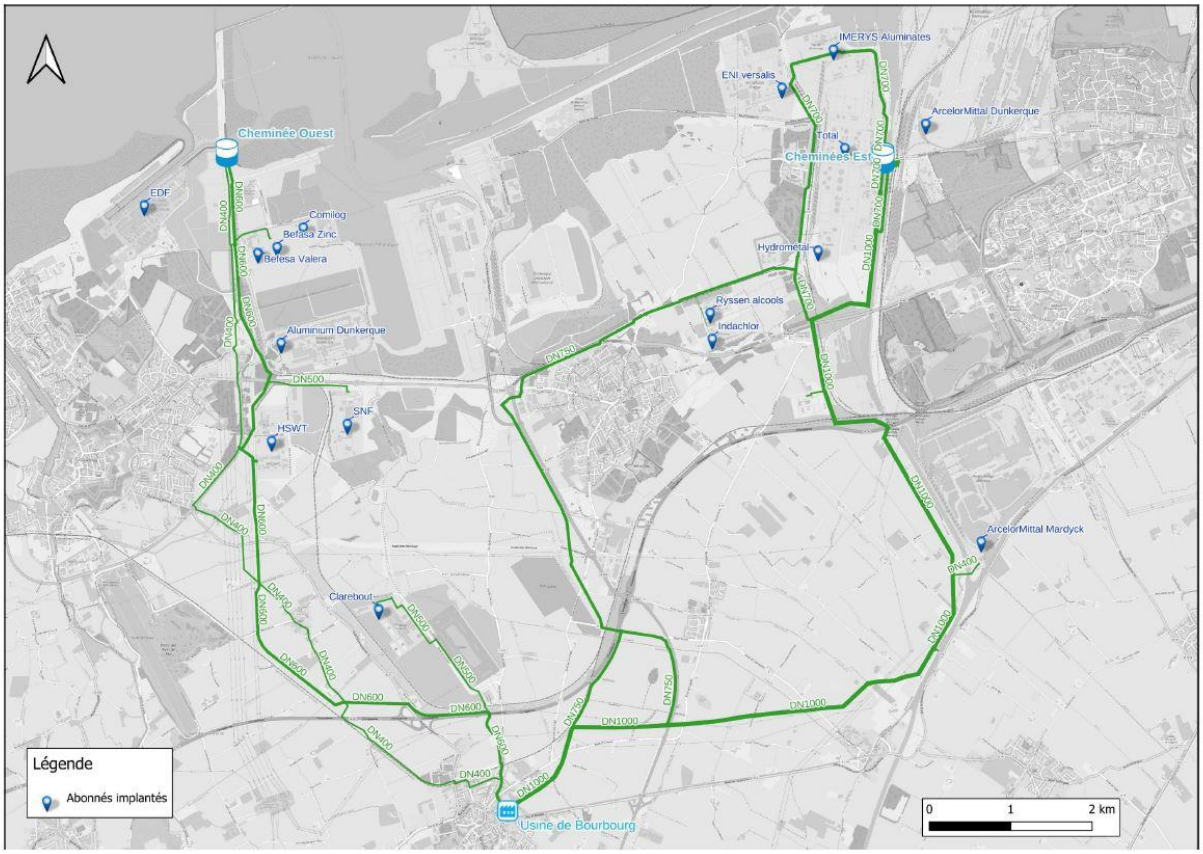

Figure 1 Industrial Water Network with the East Branch and the West Branch

écosystème

l'eau du Dunkerquois SYNDICAT

2. Context and objectives of the stufy

The SED manages a 60-km industrial water network, independent from the drinking-water system, supplying 16 major industrial subscribers in the area. This network, built in the 1970s, shows an excellent performance level (97% in 2023) but now faces ageing-related challenges and increasing demand. The study aims to deepen the understanding of the network's structural and functional condition and to anticipate future actions to ensure its long-term sustainability and guarantee water supply to the territory's industrial users.

The study is structured around two components:

- Structural diagnosis
- Functional diagnosis

To identify the most appropriate action pathways aligned with the defined objectives, and to support the SED in monitoring and steering the diagnostic process, a project management assistant (AMO) accompanied the SED throughout the entire study phase.

3. Description of the supply network and current status

Industrial water is sourced mainly from the Bourbourg Canal (authorised flow: 3,500 m³/h). The plant located in Bourbourg provides minimal treatment and distributes the water through a set of pumps and main pipelines (DN1000, DN750, DN600, DN400).

The network is divided into three branches (West, East, Central), made up of steel mains (DN1000, DN750, DN600, DN400) and equipped with regulation devices (balancing chimneys, bypasses, valves, sensors). The average age of the network is 32 years, but some sections are up to 50 years old and require particular attention.

The network crosses a complex rural, agricultural and industrial environment (Dunkirk port area, nuclear power plant, railway lines, corrosive soils, proximity to numerous third-party networks). These factors increase the risks of corrosion and failure.

In 2024, annual consumption reached 22 million m³, mainly by ArcelorMittal (66%), Versalis (15%) and Clarebout (6%). Future needs (ongoing industrial projects) could raise annual demand to 25 million m³

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4. Investigation program

Following the initial assessment, several diagnostic methods were identified to build a comprehensive investigation programme. The following actions were selected:

- **Pressure-measurement campaigns** (standard and high-frequency)
- **Internal leak detection** (PIPERS® technology)
- **External structural diagnostics** (pressure waves, scanning techniques)
- **Targeted cleaning of clogged pipelines**

- **Environmental and spot analyses on critical sections**

A first investigation campaign, detailed below, was carried out.

5. Results of the diagnostics

5.1 Pressure-measurement campaign and analysis and analysis of transient phenomena

Measurements on the main pipelines show widespread fouling (a reduction of the internal diameter by 15 to 20%), although head losses remain low due to the low flow velocities observed. The energy savings from a full cleaning operation would therefore be limited, but certain sections require particular attention.

Transient phenomena (water hammer) are frequent, especially on the West branch, mainly caused by flow-rate variations from certain users (Clarebout, Aluminium DK, HSWT, BEFESA). Although these events have moderate amplitude, they occur very frequently (>50 per day for Clarebout) and could affect the long-term durability of the network. Specific recommendations have been made to mitigate these phenomena (facility audits, anti-hammer devices, valve-closure protocols).

Corrective actions have already been defined.

5.2 Leak detection and anamaly identification (PIPERS technology)

The internal inspection of the DN1000 pipeline revealed no actual leaks or air pockets, but identified fouled sections (at the beginning and end of the pipe) as well as a few isolated magnetic anomalies (indicating potential wall-thickness loss). The overall condition of the pipeline is considered reassuring.

6. Conclusions

6.1 Positive findings

- The inspected network is in good overall condition, with no leaks detected.
- The cathodic protection system is effective
- Network operation is efficiently monitored thanks to the implemented sectorisation and remote-management system.

6.2 Points requiring attention

- Ageing of certain pipeline sections
- Widespread fouling, although the hydraulic impact remains limited at this stage
- Frequent transient phenomena on the West branch, requiring corrective actions

6.3 Main recommandations

- Continue investigations on the other pipelines not yet inspected (leak detection, structural diagnostics, etc.…)
- Implement anti-ram devices and audit subscribers generating significant speed variations and initiate corrective actions
- Adapt valve closure protocols (motorization, closing bearings, etc.)
- Prepare pilot cleaning operations on the sections identified as the most dirty
- Strengthen the monitoring of transitory phenomena, particularly when new subscribers are connected
- Perform spot analyses on detected magnetic anomalies
- Adapting investment planning to anticipate the renewal of the oldest and most critical sections

7. Perspectives

The report highlights the need for proactive management and continuous adaptation of the industrial water network in the face of changing industrial needs and environmental constraints. The recommendations resulting from the diagnostics aim to guarantee the sustainability, safety and performance of the industrial water network in the medium and long term.

The diagnoses carried out make it possible to confirm the quality of the industrial water distribution network and to consider future actions to ensure its sustainability. This will benefit water resources and the decarbonisation of the Dunkirk region.

RÉSUMÉ

The Dunkirk Water Syndicate (SED) operates a 60-km industrial water network supplying 16 major industrial users in the Dunkirk area. Commissioned in the 1970s, this network shows a high performance level (97% in 2023) but must now contend with ageing infrastructure and increasing demand.

The study assessed the structural and functional condition of the network in order to anticipate the actions required to ensure its long-term sustainability. It is based on an analysis of the condition of the pipelines (corrosion, fouling) and of the hydraulic behaviour of the system (pressure, transient phenomena, leaks).

The results show widespread fouling, reducing pipe diameter by 15 to 20%, with a limited hydraulic impact. Water-hammer events are, however, frequent—particularly on the West branch—linked to flow-rate variations from industrial users. Internal inspections revealed neither leaks nor air pockets, and the overall condition of the network remains satisfactory thanks to effective cathodic protection and robust monitoring.

The recommendations focus on monitoring ageing sections, controlling transient phenomena, carrying out targeted cleaning operations, and strengthening surveillance to ensure the durability and performance of the network.

Overall, the study highlights the importance of anticipatory management and continuous adaptation of the network, essential to guarantee the safety, performance, and long-term reliability of industrial water supply, while contributing to water-resource preservation and the decarbonisation of the Dunkirk industrial territory.

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