

CUSTOMER CASE STUDY

SAM4 HEALTH

Yorkshire Water

Optimizing maintenance planning with remote and real-time clogging detection: How Yorkshire Water is reducing pollution events and pump inspections using advanced analytics from Samotics.



Yorkshire Water's 'blueprint' to optimize maintenance strategy

Yorkshire Water is committed to building robust and resilient clean and wastewater networks for the future in the run up to 2050 and beyond. This is the basis of what it calls its 'Blueprint for Yorkshire' where it aims to supply its services while preserving the environment and keeping bills as low as possible. Its networks currently service the 5.4 million people who live in Yorkshire, the millions of yearly visitors and about 140,000 businesses.

Yorkshire Water is optimizing its maintenance operations through innovation as one way to fulfill its vision. The company invests in various technologies, aiming to enhance all aspects of the services it offers and to develop resilience in the system. To this end, Yorkshire Water selected Samotics' SAM4 Health and Energy asset health monitoring solutions. The aim is to transform the way in which Yorkshire Water monitors the health of its critical equipment, especially with respect to clogging and to optimize the operation of its sewage pumping stations.

Through optimization of Yorkshire Water's sewage pumping stations using SAM4 Health, the need to perform cyclical pump inspections is greatly reduced, improving asset performance, efficiency and reducing pollution events. This in turn cuts operating costs and ensures Yorkshire Water's activities continue to support clean rivers and a healthy environment.

Samotics is a leading provider of real-time actionable insights to optimize performance and energy efficiency of AC motors and rotating equipment. Through AI-powered algorithms and a technique called electrical signature analysis (ESA), Samotics offers Yorkshire Water a robust and high-quality failure detection technology. This is coupled with performance and energy insights to help bring Yorkshire Water's strategy to fruition.



Our journey toward industry 4.0 has led us to collaborate with a wide range of companies to help enable our new operations and maintenance strategies in Yorkshire Water. One of the most interesting and successful collaborations has been around the use of ESA (electrical signature analysis). Not only are we extending the life of our assets, but we are benefiting by enhancing our environmental performance.

Matt Armitage, Dynamic Maintenance Transformation Lead at Yorkshire Water

Advanced analytical solutions to deal with pump clogging

To treat about 1 billion liters of wastewater a day, Yorkshire Water operates over 600 wastewater treatment sites, and has a fleet of submerged pumps at over 2,000 wastewater pumping stations. Using SAM4 Health to monitor this equipment remotely, provides Yorkshire Water with reliable and actionable asset health and performance data, without the need for cyclical site visits. It does this by collecting high-frequency data from sensors located in the pumps' motor control cabinet and employs a suite of techniques to analyze a motor's electrical signature. Yorkshire Water indicated that the greatest challenge it faced with respect to cost and impact was pump clogging. This can lead to deterioration in asset health, asset breakdown, loss of service and pollution events, which have environmental implications. In pump stations and sewage treatment plants, removing the blockages has become part of the daily routine.

To help manage and prevent clogging from occurring, Yorkshire Water maintenance teams undertake around 70,000 visits per year to lift and inspect pumps and find clogging if it has occurred. This incurs significant financial costs in personnel hours, and associated costs and emissions related to transport. When considering that many pumps inspected are in good working order, this is even more significant.

To help tackle this major challenge, Samotics data scientists worked in close cooperation with Yorkshire Water to develop an enhanced clogging detection feature in its SAM4 Health solution. It provides real-time alerts of where clogging is developing and takes into account pump station setup and dynamics to provide an intelligent severity estimate of clogging incidents. These capabilities are enabling Yorkshire Water to detect clogging events in their early stages, optimize its maintenance scheduling and prevent pollution events from occurring.

To determine its effectiveness, SAM4 Health and its clogging detection feature were initially rolled out across a select set of sites for Yorkshire Water. Since the start of this pilot, Yorkshire Water decided to roll the solution out across their entire sewage network covering thousands of assets.

How real-time detection of clogging is reducing pollution events

At the heart of each sewage pumping station in the Yorkshire Water network are two co-located pumps operating in an alternating pattern (one on/one off) to help in the transfer of wastewater to an associated sewage treatment facility. This provides for redundancy in the system should one of the pumps become clogged or trip. However, if both pumps at a station become clogged this does create a serious issue which can lead to a pollution event. Having no concrete insight into the health status of each pump increases the risk of this happening.

Receiving real-time alerts of developing clogging is having a significant impact on Yorkshire Water’s operations. Once initiated across a number of Yorkshire Water pumping stations, it took two weeks before the first clogging incident was detected and the system was able to detect more than ten (partial) clogging events in four months. This is illustrated by the following three SAM4 Health case studies.



Image of clogged material from a sewage pumping station in the Yorkshire Water network, following an alert by SAM4 Health’s clogging detection feature:



CASE STUDY 1

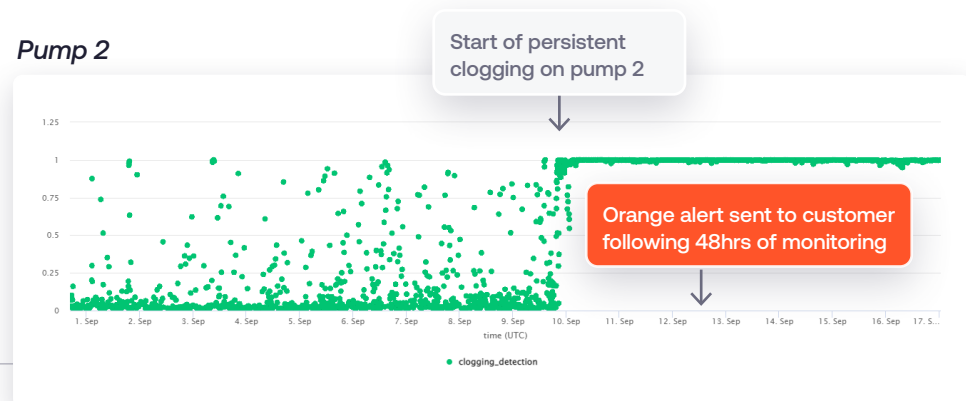
Clogging feature alerts to clogging incident developing across both pumps at a sewage pumping station

At a sewage pumping station in the Yorkshire Water network, two co-located pumps operate in an alternating pattern to meet required demand and provide system redundancy. On one night a pump (pump 2) displayed characteristics of clogging. This could be seen in Figure 1 below where the clogging scores remained continuously high following the start of the incident.

Cross checking these clogging scores against other analyzed data suggested that there might be a (partial) blockage that was persisting while the pump was in operation. With one other working pump at the station this did not create an emergency response situation at the time. It was determined to continue to monitor the situation closely for 48 hours to determine if a site visit was necessary or if the blockage would clear itself in this timeframe.

Figure 1

From the data points generated it was clear to see the start of a clogging incident. Hereafter, the clogging score remained at the highest level of clogging indication (around 1.0) until a maintenance crew cleared a blockage.



10 September

Clogging feature detects signs of clogging on one pump at a sewage pumping station.

10-12 September

Situation monitored for 48 hours to determine appropriate action.

12 September

Orange alert sent to customer as clogging persists. Medium-priority maintenance visit planned in.

Two days later, with no improvement seen, an orange alert was generated and sent to the customer indicating a clogging incident at the pump. The alert stated that same-day action was not required and that the situation could be resolved in the following week without impacting pump station operations.

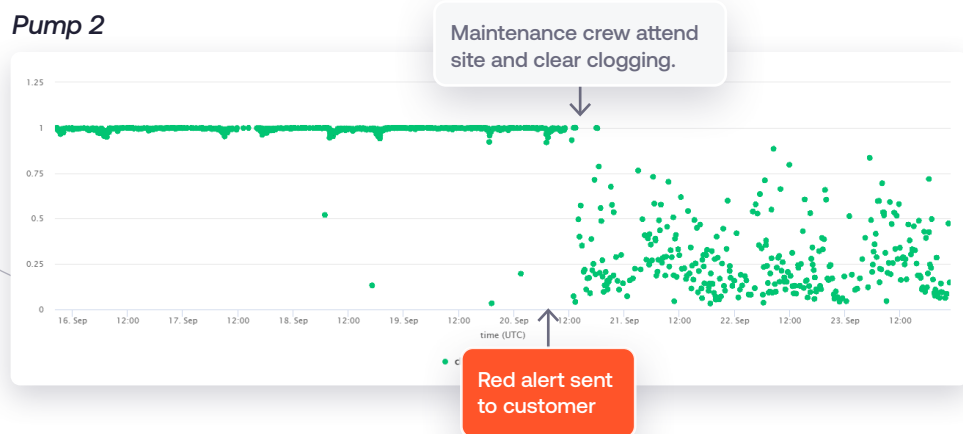
Figure 2

Graphs for pump 1 and pump 2. It is clear to see the evolving development of a clogging incident on pump 1 while clogging continued to persist and remain at the highest level of clogging indication (around 1.0) on pump 2.

Pump 1



Pump 2



12-20 September
Monitoring of the pump station continues in advance of maintenance visit.

20 September
Prior to maintenance visit, signs of developing clogging detected on the second pump.

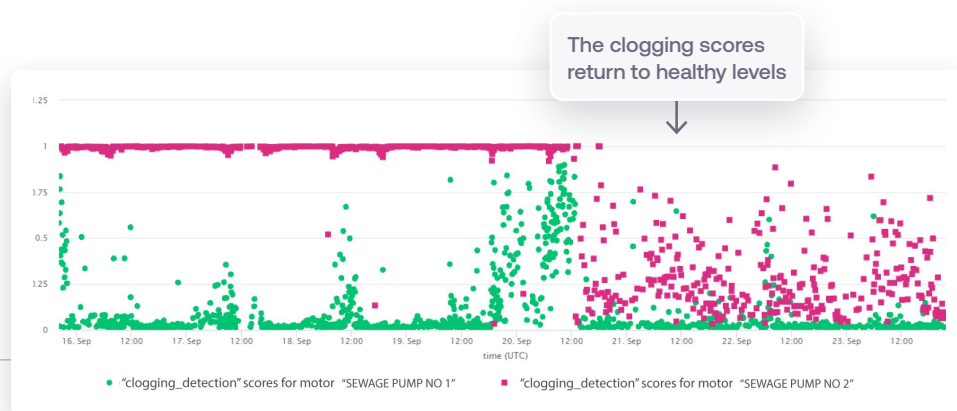
20 September
Red alert sent to Yorkshire Water to inform them of clogging incident across both pumps.

A week or so later however, data also indicated signs of developing clogging on the other pump at the station (pump 1). With incidents of clogging on both pumps this did create an emergency response situation due to an increased risk of a pollution event. As such a red alert notification was sent to the customer (see Figure 2 on the previous page). Yorkshire Water immediately sent a maintenance team and lifted both pumps out of the pumping station. They found that both pumps were indeed partially blocked confirming the detections by SAM4 Health and its clogging detection feature. After the blockages were cleared and the pumps were put back in operation, the clogging scores and other supporting metrics returned to healthy operating levels. This can be seen in Figure 3 below.

The SAM4 Health clogging feature successfully detected the issues. It provided continuous insight into the severity of the situation and alerted to when action needed to be taken. This enabled Yorkshire Water to optimize maintenance planning and prevent a potential pollution event from occurring.

Figure 3

From the graph below, it is clear to see the resolution of both clogging incidents. Once the maintenance crew removed the blockages, the continuously high clogging scores on pump 2 and the signs of developing clogging on pump 1 dissipated reverting to healthy clogging score levels.



20 September

Maintenance team visits the pump station and clears blockages on both pumps.

20 September

Data returns to normal levels once pumps are resealed and returned to operation.

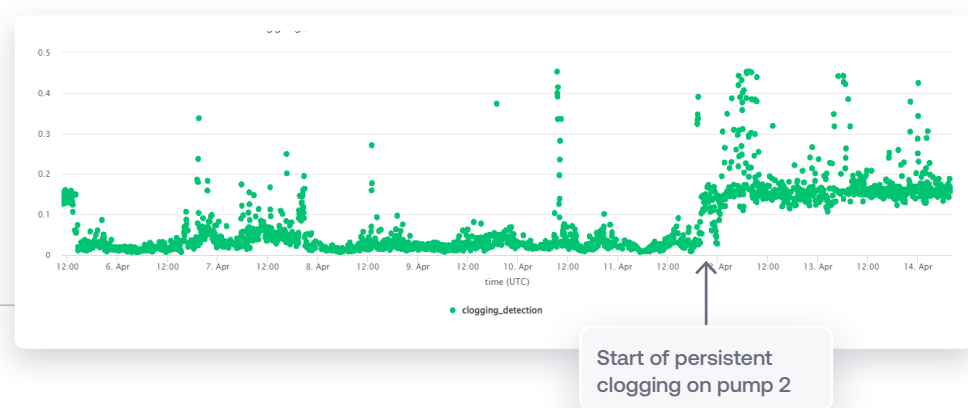
CASE STUDY 2

Clogging detection feature helps to diagnose a blockage outside of a pump

At a sewage pumping station in the Yorkshire Water network, SAM4 Health detected a developing clogging event (see Figure 4). This was due to increased clogging scores coming from the SAM4 Health clogging detection feature related to one of the pumps (pump 2). Following an extended monitoring period in which there was no improvement in the situation, the customer scheduled for the two pumps to be lifted for a full inspection by engineers from the pump manufacturer. This took place two months after the initial clogging indication. Prior to this taking place, SAM4 Health and Samotics experts performed additional diagnostics of the problem. They were able to pinpoint that the blockage was outside of the pump based on SAM4 Health clogging event indicators (slightly lower power active and an elevated spectral energy around the supply) and advised the customer to check the inlet and the discharge side of the pumping station for any obstruction. Being able to specify where the blockage was in the system was of great benefit to the customer.

Figure 4

The clogging detection scores from SAM4 Health became elevated for one of the pumps (pump 2) at the pump station.

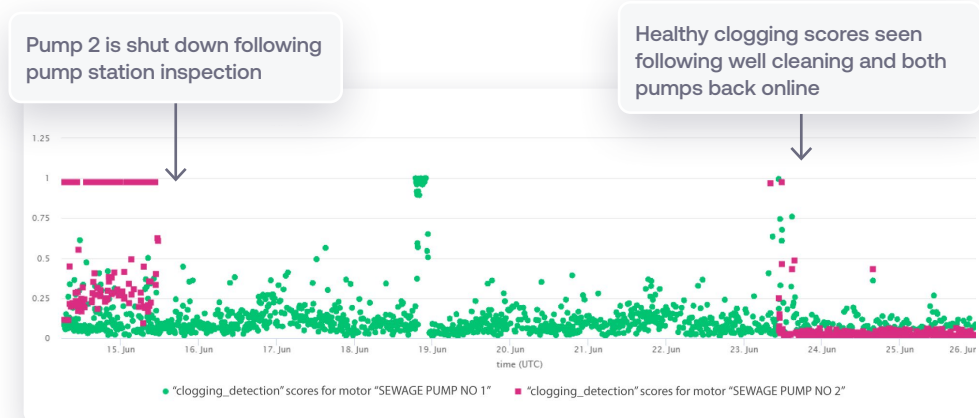


CASE STUDY 2 CONTINUED 

The pump manufacturer confirmed this diagnosis following pump inspection and pump 2 was shut down. After the customer was able to clean the well and the inlet of the pump, the anomalies disappeared and healthy behavior was confirmed by SAM4 Health, once both pumps were back online (see Figure 5).

Figure 5

Plot of pump 1 and 2 showing normal clogging scores resuming following well cleaning.



Several offending items that caused pump blockages at the pumping station



CASE STUDY 3 

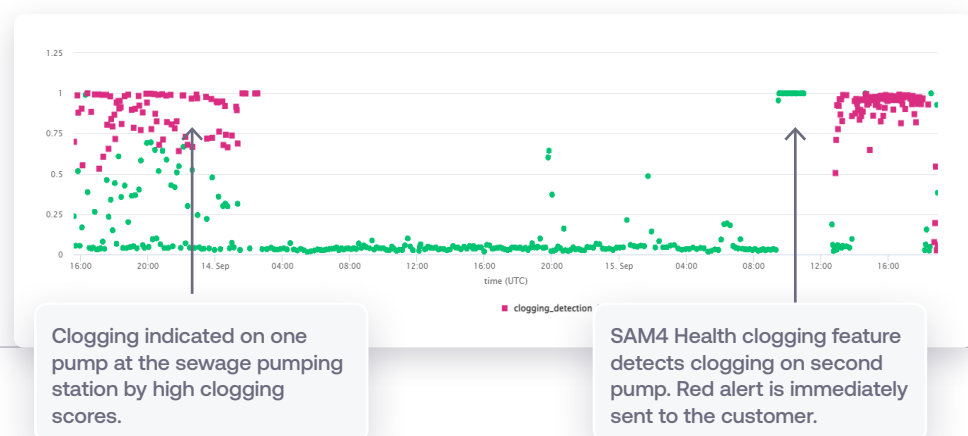
CASE STUDY 3

Clogging detection feature provides only visibility at pump station as telemetry system experiences temporary issues

Two co-located pumps were operating at a Yorkshire Water sewage pumping station. Yorkshire Water were monitoring these with Samotics' SAM4 Health solution and its clogging detection feature together with additional telemetry systems. One of the pumps (pump 2) was showing signs of clogging, i.e. higher than normal clogging scores, and was being monitored closely (see Figure 6). It was eventually shut down. The other pump (pump 1) was exhibiting normal behavior. The following day the telemetry systems indicated that one of the pumps had tripped and the other was still operating normally. This, in itself, didn't constitute an emergency response situation. The other pump at the station could deal with associated demand until a Yorkshire Water maintenance team could be planned in to visit the site and rectify the situation. However, in contrast to the telemetry data, SAM4 Health's clogging feature detected that both pumps had become completely blocked and had tripped which did create an emergency response situation.

Figure 6

Clogging scores for two pumps at a sewage pumping station. Scores range from 0 = no clogging up to 1 = completely clogged. Pump 2 (red points) was shut down and reactivated the following day during an emergency pump visit following a red alert from SAM4 Health.

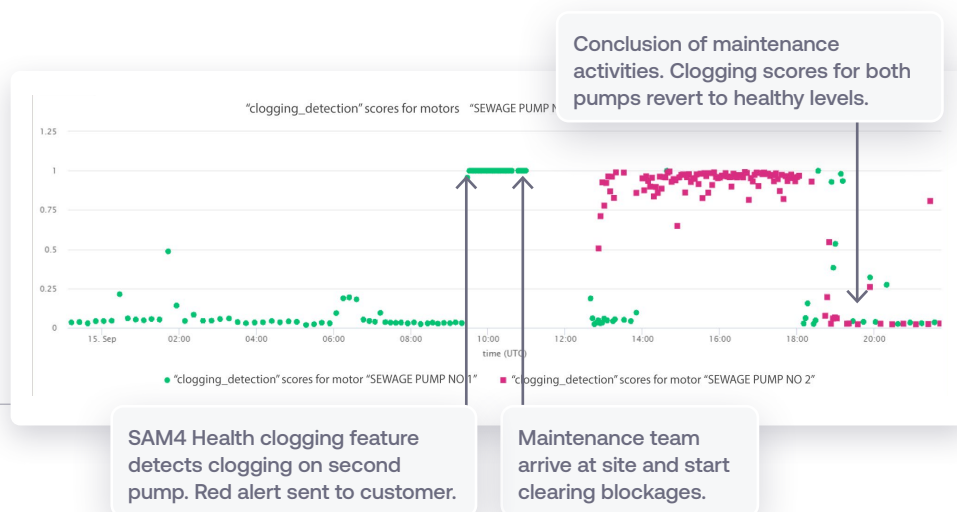


CASE STUDY 3 CONTINUED 

A red alert was sent to Yorkshire Water (see Figure 7) who immediately sent a maintenance crew to the site. They confirmed that both pumps were clogged. It also confirmed that the additional telemetry systems had experienced a transient issue during which time they didn't provide correct data. The situation was cleared and both pumps came back online. This was confirmed by the SAM4 dashboard where associated data indicated a return to normal pump behavior. Had it not been for the detection of the situation by the SAM4 clogging feature, a pollution event would definitely have occurred according to Yorkshire Water. This was due to the fact that telemetry systems were indicating normal behavior on one of the pumps. It was estimated that this would have cost £130k (€150k) in regulatory fines and caused significant reputational damage to the company.

Figure 7

Clogging scores for two pumps at a sewage pumping station. Scores range from 0 = no clogging up to 1 = completely clogged.



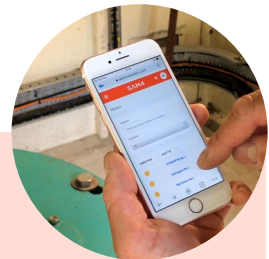
Temporary issues with the site telemetry meant the only visibility we had was via the Samotics unit. Thanks to the alert system we were able to urgently attend the site, investigate and remove blockages that would have led to pollution of the local environment.

Simon Rhodes, Business Transformation Manager at Yorkshire Water

The future landscape at Yorkshire Water

The problem of clogging is large and environmentally relevant, both in terms of potential pollution events as well as the financial costs and emissions associated with inspections. By developing an accurate clogging detection feature in its SAM4 Health solution, Samotics is providing Yorkshire Water with continuous and real-time insight into the severity of clogging incidents across its pumping stations. This allows them to plan maintenance activities optimally to prevent pollution events from occurring. It saves on associated maintenance costs by dealing with issues at an early stage when they are less severe. This helps to avoid emergency repair costs or costs of full equipment replacement. More importantly, continuous remote insight into pump health and performance mitigates the need to perform cyclical pump visits, only visiting pumping stations when an issue is developing.

Moving to a more proactive maintenance strategy with SAM4 Health shows Yorkshire Water's commitment to improving its business operations by making use of the most modern analytical techniques. It is helping Yorkshire Water to improve the efficiency and reliability of its wastewater network and at the same time reducing operating costs in dealing with clogging incidents. As such SAM4 Health is forming a key element of Yorkshire Water's plans as part of its 'Blueprint for Yorkshire' to maintain its services, preserve the environment and keep customer bills as low as possible. To this end, Yorkshire Water is currently in the process of incorporating SAM4 Health and its clogging detection feature across its whole sewage network covering thousands of sewage pumps while also rolling out SAM4 Health across a large set of critical clean and wastewater assets across Yorkshire.



Up to £130k (€150k) savings per pollution event

By identifying early-stage cloggings in real time at its pumping stations, Yorkshire Water avoids associated pollution events which incur up to £130k (€150k) in fines per incident.

Interested?

Would you like to get to know more about how SAM4 Health works and whether it could be of value to your operations? Do not hesitate to reach out.

Contact

Rogier de Groot
Business Development Manager
rogierdegroot@samotics.com
+31 6 533 252 56

www.samotics.com