Is that possible?

Clean the pressure line economically during operation

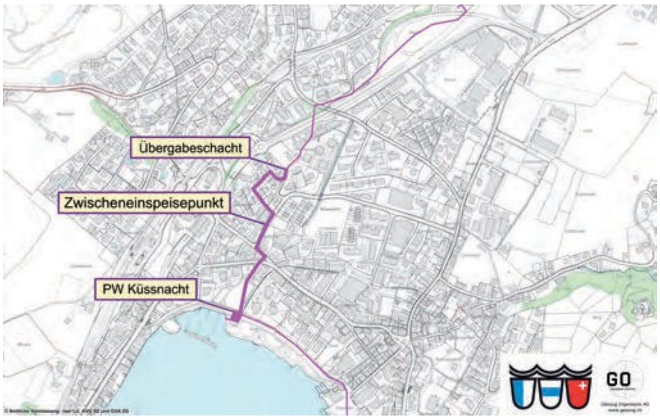

Fig. 1: Overview plan of the GVRZ wastewater pressure pipeline in Küssnacht

In order to operate a wastewater network safely, periodic cleaning and maintenance work is unavoidable. Particularly in the case of wastewater pressure pipes that cannot be temporarily taken out of service, cleaning work was previously only possible with great effort or even technically impossible.

1 Situation at the GVRZ

The Water Protection Association of the Zugersee - Küssnachtersee - Ägerisee region (GVRZ) operates two sewage pressure pipes made of fiber cement (dry and rainwater pipes) in Küssnacht am Rigi (Switzerland) with a length of almost 500 m and diameters of 300 to 800 mm. Due to the existing route with countless bends, the pipeline cannot be flushed using conventional methods or inspected using sewer television (Figure 1).

This was made even more difficult by the importance of pressure control within the sewer network. We knew that up to three-quarters of the pipes were filled with sandy-gravel deposits. The main aim of the cleaning work was therefore to remove the deposits and the seal skin in order to reduce the pressure loss and restore performance. Of course, the aim was also to increase energy efficiency.

2 How the cleaning process works

We therefore pinned our hopes on the cleaning process from Hammann (Anmweiler am Trifels, Germany), which was described to us as a very simple flushing process. In this process, water first flows in a defined cleaning section in a slow, laminar flow before it emerges again at the discharge point.

The so-called Comprex flushing process (Figures 2 and 3) makes use of the existing waste water (partial filling of the pressure line) and introduces filtered compressed air in pulses via the feed point. This creates packets of air and water blocks that flow through the pipe section at high velocities of 10 to 20 m/s. These highly accelerated packets generate enormous turbulence with strong shear and drag forces at the interfaces between air and water, allowing the mobilizable deposits to be reliably removed. The wastewater required for this can be temporarily dammed upstream of the pumping station.

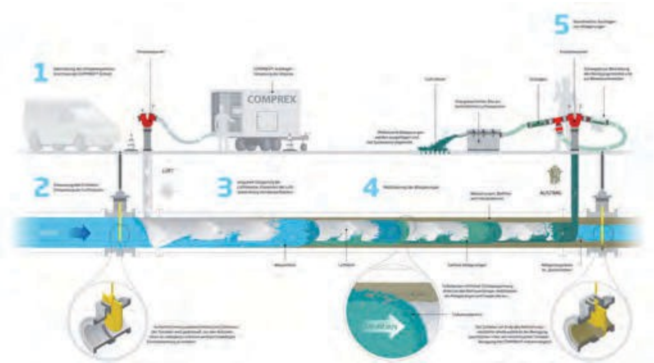

Fig. 2: Diagram of Comprex cleaning on wastewater pressure pipes

Fig. 3: Comprex cleaning can also be carried out in confined spaces.

3 Implementation

The flushing of the dry weather pipe (TWL) was carried out as a test due to the presumably less heavy deposits. In addition, the TWL only has one feed point for compressed air at the pumping station, meaning that the flushing from the feed point to the transfer shaft in the sewer had to be carried out in one stage. The constant feed The flow rate of the pump was regulated with a throttled valve. A pressure test was then carried out by TWL for quality assurance purposes.

Due to the heavy deposits and the larger diameter, the rainwater pipe (RWL) was flushed in two stages. The first flushing stage was carried out from the intermediate feed point (flange on G-Storz and ball valve, Figure 4) to the transfer shaft in the sewer. In the second stage, flushing was carried out from the pumping station (Figure 5) to the transfer shaft. This allowed mobilizable deposits to be flushed out of the pipe in stages without the risk of blockage. Table 1 provides an overview of the cleaning data.

Fig. 4: Compressed air connection at the intermediate feed point

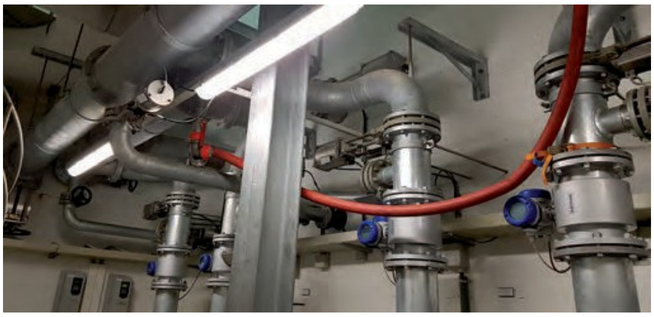

Fig. 5: Compressed air feed in the Küssnacht pumping station

The detached debris was flushed into the adjoining sewer section and was to be held back by means of a temporary retention barrier. This was only possible with moderate success due to the high velocity of the impinging packets of air and water blocks. The amount of debris mobilized by the flushing is likely to be much larger than the material extracted. After each stage, the sewer section intended for deposition was cleaned before the retention barrier using a vacuum truck. In total, almost 3 tons of deposits were vacuumed and disposed of

	Dry weather pipe	Rainwater pipe
Cable diameter	300	400/700
Duration [h]	7,5	13
Pulse interval [s]	4-15	4-15/19
Pulse pressure [bar]	5 bar	6-8/6 bar
Number of pulses	190	132/137
Flow rate during flushing in the pressure line [l/s]	30	50
Deposits, mobilizable [^{m3}]	approx. 0.1	approx. 2
Procedure	from the pumping station to the Transfer shaft	in stages in the direction of flow, from the transfer shaft to the pumping station

Table 1: Cleaning data

4 Cleaning result

In order to be able to estimate the success of the cleaning, the flow rate was also measured in addition to the current consumption of the pump in the lift. The effectiveness of the cleaning could be quantified based on the flow rate and current consumption.

The prerequisites were the same conditions before and after cleaning at the pump and with regard to the filling level upstream of the pump, i.e. delivery by the same pump, the same switch-on point and automatic operation (Table 2).

	before	after
Delivery rate [$^{m3/h}$]	380	410
Power requirement [kW/h]	8,0	7,5

Table 2: Result of cleaning the rainwater pressure pipe

5 Conclusion

The patented Comprex cleaning process (impulse flushing process) from Hammann has proven to be an efficient and simple flushing process. It was possible to clean our pressure lines without any problems during operation.

With an annual wastewater volume of around 1.2 million cubic meters, the savings in electricity costs are so great that the costs for cleaning are amortized after a few years.

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