

CASE STUDY

# Cheers to Trickling Filters

## INTRODUCTION

Nviro is a full-service wastewater treatment company providing design, construction, and operation to a wide range of markets. Founded by experienced wastewater treatment professionals, Nviro seeks to provide high-quality wastewater treatment systems fully operated by the company. Nviro approached Brentwood about utilizing a trickling filter in a high-strength application in the winery industry.

Winery wastewater contains very high concentrations of biochemical oxygen demand (BOD) due to the processing of organic matter. Additionally, these loadings can fluctuate seasonally because grape processing, known as crush season, occurs over a finite period each year. This particular application also called for a relatively high degree of treatment due to its location and the needs of the end user.

## THE SYSTEM

The system was designed with influent screening, equalization, a modified trickling filter, a conventional activated sludge tank, and final clarification. The trickling filter was chosen as the first part of the secondary treatment as it provides an energy efficient means of reducing BOD. In addition, trickling filters are extremely simple to operate and provide high shock loading resistance.

## THE TRICKLING FILTER

The trickling filter is 13 ft in diameter with a 13 ft media depth, contained within a stainless steel tank. A fixed nozzle distribution system was designed to provide effective distribution and flushing. While many trickling filters utilize rotary distribution arms, a well-designed fixed nozzle distribution system can provide a high degree of treatment and reduce the necessity for more rigorous supports that accompany a rotary distribution arm. In addition, rotary distribution arms are not economical when applied to trickling filters with smaller diameters. This fixed distribution system utilizes nineteen nozzle heads that disperse water in a spray pattern, providing even distribution across the trickling filter media. Isolation valves within the spray nozzle manifold create multiple distribution zones that provide intermittent scouring and control biomass growth.

The media within the filter is Brentwood's VF5000 vertical flow media. This media features an open flute design that is ideal for high loading applications like wineries. The larger flute openings allow for easier sloughing of biomass and avoids clogging, as large



Figure 2. Trickling filter rendering

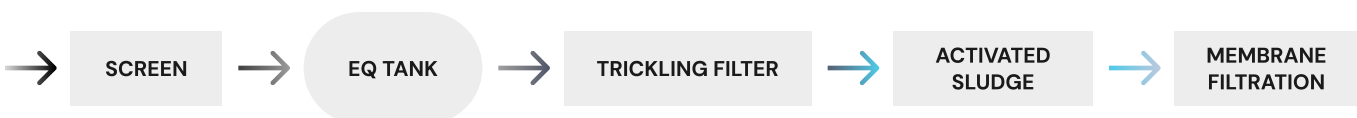


Figure 1: Plant flow scheme

amounts of biomass growth are common when loading is high. The media is supported by stainless steel supports and FRP support grating.

As the volumetric organic loading is high, Nviro opted for a novel approach to trickling filter design. A reservoir below the media contains an aeration manifold that provides supplemental aeration to the effluent.

The entire system was built with performance and longevity in mind, with many of the ancillary components also being stainless steel.

## PERFORMANCE

In operation since 2022, the trickling filter receives variable loadings due to the nature of the winery's processing. These concentrations can range from 46 mg/L to 10,830 mg/L. On average, the filter's volumetric organic loading is approximately 127 lbs/1000 ft<sup>3</sup> and removes 65% BOD<sub>5</sub> on average. This performance is remarkable at such a high organic loading, given the highly variable influent with significant BOD spikes. This loading falls within a roughing filter range and 50–70% BOD removal is expected for typical municipal waste. It should be noted that industrial waste removal rates are not well established for many biological treatment technologies, given the inherent difficulties of characterizing each industrial user's specific wastewater stream.

The typical wetting rate is 1.1 gpm/ft<sup>2</sup> and is doubled once per week in order to flush the media. Isolation valves within the spray nozzle manifold are also used when



Figure 3: Nozzle distribution system



Figure 4. Operators spraying down the nozzles

needed to flush media. This wetting rate is typical for roughing filters and is proven to be effective for this trickling filter.

Maintenance requirements are minimal, as the distribution system routinely flushes the media. Operators spray the nozzles once per week and occasionally spray the media during periods of high loading. Otherwise, the trickling filter operates with limited intervention.

## CONCLUSION

Nviro's novel approach shows the potential of trickling filters in industrial wastewater when focusing on trickling filter fundamentals. Nviro designed the fixed nozzle system to optimize distribution and flushing through the use of splash plates and isolation valves, respectively. This enabled strong performance even under high loading conditions.

As a technology, the limited maintenance needs and low energy consumption of trickling filters make them ideal for industrial sites. Given the biodegradable nature of winery wastewater, a trickling filter is an ideal candidate for biological treatment either as the sole means of treatment or as part of a longer treatment train. Companies with design and operation responsibilities, like Nviro, that choose to utilize trickling filters demonstrate the utility of this technology as part of a holistic approach to wastewater treatment.

Cheers, salud, or kanpai. However you say it, we should continue to raise our glass to this time-tested technology.



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