INSTALLATION OF A STEP-SCREEN & VORTEX GRIT REMOVAL SYSTEM AT THE GRIFFITH SEWAGE TREATMENT PLANT

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INTRODUCTION

Griffith Sewage Treatment Plant is a trickling filter System with a 75,000 EP capacity. It consists of an inlet-balance tank, sedimentation tanks, anaerobic digesters, super high rate trickling filters, humus tanks and, before the modifications outlined in this paper, a 15mm raked bar-screen on the inlet - balance tank.

Griffith's sewage comes from a population of 23,000 and trade waste, which is a key part consisting of food and fruit juice processors and wineries.

The challenge identified was the digesters continually getting blocked with grit. The major component of the accumulated grit was snails, which were coming from the trickling filters and then being recirculated to the inlet works via the humus tank sludge return.

This resulted in significant operational problems with wear on pump bowls and impellors, digester blockages and reduced process performance. Council was spending approx $50,000 every 2 years to clean the digesters,

Sedimentation tank pump blockages accounted for a significant amount of the operator's daily duties and also overtime, particularly in the vintage season when winery production is at its peak.

The installation of the step-screen and vortex grit removal required that the balance tank be isolated, necessitating the construction of a by-pass and a second flow divider. Remedial work was also undertaken on the balance tank and other structures whilst the step-screen and grit removal system were being constructed.

1.0 CONSTRUCTION OF RECEIVAL PIT

The tender for construction of the by-pass, step-screen and grit removal system was awarded to KOMPLANT Pty Ltd and work commenced with Griffith City Council relocating services for power, water, etc. The by-pass was required to divert incoming sewage under our major electrical ducts from the control room, as relocation was not feasible.

Due to the nature of the incoming effluent and required flexibility of use, the by-pass main was constructed of HDPE pipe, with some pieces pre-fabricated and others constructed on-site. During exploratory work under the major electrical ducts, seepage was found to be such a significant problem that the contractors were required to modify their plans and go over, instead of under, the ducting.

The flexibility of the HDPE pipe allowed for this modification to be done without delaying the project noticeably.

The by-pass consisted of a receival pit with a 20mm manually raked bar-screen; the effluent travelled through a 450mm HDPE pipe to a flow divider, and then passed to another receival pit constructed around the existing inlet pipe to the sedimentation tanks.

After the receival pit was constructed the tank level was lowered so that the contractors could safely cut and plug the existing pipe; a shut-down was then needed to install the by-pass weir. Railings were bolted into place and a steel door inserted, then a second wooden temporary weir was constructed, which could be corked to prevent minor leakage.

2.0 GRIT CHAMBER

Work began with the removal of the existing bar-screen and conveyor and its associated equipment. The contractor then started on the foundations of the grit removal system. The majority of the formwork was pre-fabricated steel, which reduced the time needed for construction.

From a central cone the floor slopes up toward the internal tank wall, which is needed to allow a space for the grit to accumulate and then be removed from the system using a water jet and an air blower.

An excavator using a jackhammer attachment was used to knock out the walls of the balance tank after they had first been pre-cut using a concrete saw.

A wall constructed downstream of the step-screen was built to divert the flow through the grit removal and then return to the balance tank.

The channels leading to and from the grit removal tank were then constructed using normal ply and wood formwork.

After the tank was finished it was coated with epoxy resin to protect the structure from the aggressive nature of the incoming sewage.

A SERECO DPR-35 Rotating Blades Sand Remover was installed along with an air blower and a SERECO ES-200 Grit Classifier.

The sand remover can work in both continuous and intermittent operation. In our case, it is connected into the PLC and its operation is governed by the flow sensors so that, when inflow falls below 20 L/s, the sand remover shuts down and is automatically restarted when the flow rises again.

The grit is removed by first introducing a water jet to remove most of the lighter organics. The washing cycle lasts 3 minutes and the airlift is then operated, which transports the accumulated grit into the classifier.

The ES-200 Grit Classifier was constructed of stainless steel with PVC piping for supply and discharge.

Essentially, the water and grit enter the classifier and the grit settles to the bottom, where it is picked up by the screw conveyor, which then lifts it from the water, draining it and then depositing the result into one of two purpose-built hoppers.

The water is gravity fed back into the balance tank prior to the grit removal system, which allows for any grit escaping the classifier to be caught again and reprocessed.

Operating as outlined, the unit now typically removes between 60 & 100 L of grit/day, consisting of snails, sand, road base (basalt), and heavy organics – peas and corn are removed with ease, snails make up the majority and the heavy organics are the smallest component.
The washed grit is relatively inoffensive and well drained.

3.0 INSTALLATION OF STEP SCREEN

The installation of the Hollung Screenmat ZA-1135-6 step-screen was relatively easy as very little construction was required for it to be installed into the existing channel. This was one reason we chose this particular piece of equipment. Also, the materials used in the step-screen itself, being totally stainless steel and neoprene, would handle the aggressive effluent better than competing units.

The channel benching prior to the step-screen was flared to encourage the flow to spread out and interact with the step-screen evenly.

A pedestal mounted hydraulic power pack was located adjacent to the unit to run the disc pack, and a USF Contra-Shear SP 200 Screw Press was located behind the step-screen to collect and de-water screenings, which then dropped into a purpose built hopper.

The screenmat consists of a solid and a flexible disc pack built up with shafts and spacers, in our case to 10mm. It also has a rubber edged stainless steel skirt, or guard, which seals against the channel wall and directs flow to the screenmat.

A screening mat of waste builds up continuously on the disc pack, and it is this mat that does the work of screening the waste: as the mat gets thicker, finer waste is removed. The disc pack gradually removes the mat from the water in such a way that the mat remains intact, contributing to an even cleaning effect.

As one section of the mat is lifted, another forms on the accumulating screenings flowing in behind it.

A float switch located in front of the screen mat determines the level of the water as determined by the density of the screenmat. Once the float switch has been activated the disc pack lifts the mat a predetermined number of steps and then stops; if, after a programmed time period, the water level does not drop, the disc pack is activated again.

The mat is then lifted until it drops into the screw conveyor, which feeds the screw press. The excess water is drained away through the perforated drainage section and then the pressed solids are discharged from the barrel, into a purpose built hopper.

With the new step-screen there has been an increase in the capture rate of screenings.
Pump blockages and downtime have been drastically reduced, and the OH&S status has improved as the operators are no longer required to enter a Confined Space.

Overtime has been reduced by 40 % due to pumps not blocking and overall process performance has been improved.

SCADA controls and safety features were programmed by Automation House, Melbourne. With innovative programming, we now have a completely failsafe system, which is operator-friendly, easy to use and able to provide useful data for fault finding (there haven't been any faults, yet). It has also been integrated into our maintenance schedule so that it shows when maintenance is due and run times etc for the individual pieces of equipment.

4.0 CONCLUSION

It took about 12 weeks to build and construct the by-pass with a new flow divider box and two connecting wells at a cost of $ 285,000, roughly 20 weeks to build and install the grit removal system and stepscreen at a cost of $ 336,000.