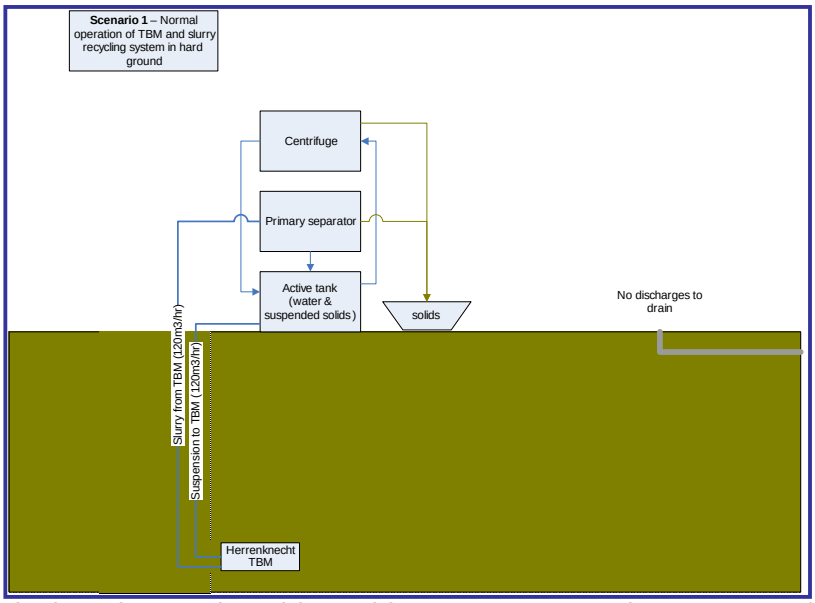
Clean effluent

The challenge

Barhale encountered challenges at a sewerage scheme in Kenilworth when the Herrenknecht tunnel boring machine (TBM) which had been configured to excavate hard rock, encountered mixed ground, including clay. Under typical conditions the TBM operates in conjunction with a closed-loop slurry recycling system, where slurry is injected into the tunneling face to capture arisings and then transporting those arisings to surface for separation. The recycling of slurry has been optimized by Barhale to ensure that slurry returned to the surface is efficiently separated ensuring that the circulated slurry (120m^3/hr) is returned to the TBM in as clean a state as possible.. This process is continuous during the entire duration of a tunnel drive its efficiency allows a fully closed system that does not generate any effluent for disposal (see diagram Scenario 1).



However, due to the presence of clay, a high pressure jetting system had to be introduced to the face of the TBM in order to increase the ability of the machine to deal with the softer than expected ground which has a tendency to block the cutter head if the jetting system is not used. This resulted in an additional 4m^3 /hour of water being added to the slurry system. As the slurry system is designed as a closed loop this water generated an excess of slurry that could not be contained by the fixed volume of the existing system and consequently needed to be disposed of.

The situation was made more testing due to the volumes involved and the high level of solids within the slurry. The limited working area in an urban location, meant that there was insufficient space available for traditional settlement tanks or the use of a lagoon. Consequently discharge to a nearby foul sewer was prohibited by the water company, which ultimately could have stopped the tunnelling operation, at the very least it would have meant the disposal of significant volumes of liquid waste each day to a specialist disposal site the cost of which was estimated to be around £5000 per day.

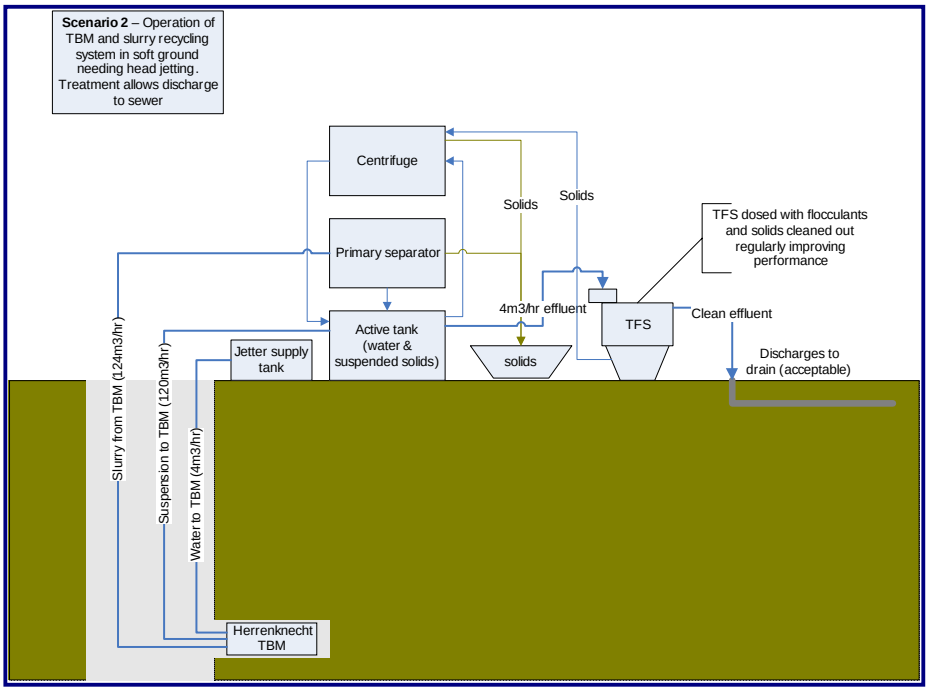
The Solution?

The Tangential Flow Separator!

To help reduce the percentage of suspended solids within this excess effluent the Kenilworth team installed a Tangential Flow Separator (TFS), hired in at a cost of £750 per week.

The TFS utilises the physical properties within an effluent to generate tangential forces which enable the removal of solids. Unlike hydro-cyclones where

Photograph 1. Slurry fed into TFS header tank



the fluid velocity is high, water and solids rotate slowly in the tangential system, energising the small suspended particles, which are encouraged to drop leaving cleaned water to flow from the top of the unit.

Initially, the quality of effluent discharged from the TFS into the local foul sewer was unacceptable to the client due to the heavy loading of suspended solids and they required an improvement before allowing further discharges. Photograph 1 above demonstrates the quality of slurry being fed into the TFS.

Although the initial installation of the TFS had made a marked improvement to the quality of the discharged effluent, to compound problems, the solids that had been generated by the TFS were very wet and needed specialist disposal by tanker at a further cost of £750 per week.

Improvements

However, following a review, improvements in the set-up of the TFS were identified, as illustrated in the diagram Scenario 2. Flocculants were added to the header tank to which help to bind very small solid particles together increasing their weight thereby aiding their separation. In addition the solids taken out of suspension by the TFS were regularly removed and passed through the centrifuges to remove excess fluid, thereby avoiding slurry being generated

In the end a clean effluent was generated which was acceptable for disposal to the available foul sewer (see picture 2).

The cost of specialist equipment to remove suspended solids along with disposal costs may have been prohibitive in the past, this case study clearly demonstrates that in this instance significant costs were avoided.

Photograph 2. Clean effluent

Contact

For more information contact Iain Casson on 07717 780119