Optimising Flow & Load Distribution

Severn Trent Water
Nottingham

Civil engineering structures are used to distribute the flow and solid loads to multiple settling tanks or ASP lanes at a Sewage Treatment Works (STW). Achieving a good solids distribution requires adequate mixing to homogenise the solids, but this can be detrimental to achieving a good flow distribution, which normally requires quiescent conditions.

At Stoke Bardolph, a new chamber to mix the effluent from the primary flow and Return Activated Sludge (RAS) from the final tanks was investigated by MMI using Computational Fluid Dynamics (CFD). The mixture of RAS and primary flow was to be equally distributed from the chamber to 10 ASP lanes.

The initial concept is shown in Figure 1, where the RAS enters at the centre of the chamber and the primary flow through the side channel. It was found that due to the direction and momentum of the primary flow and lack of mixing between the two fluid streams, that there was a good distribution of flow, but a poor distribution of the solids. The solids distribution is shown in Figure 2.

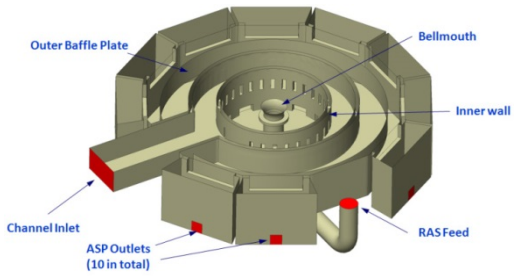

Figure 1: Concept design

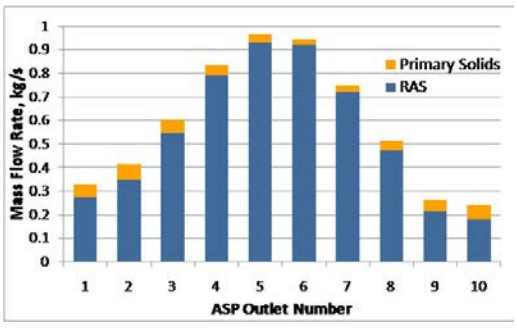

Figure 2: Poor solids distribution with the initial concept

In order to achieve a good solids distribution, adequate mixing of the two fluid streams could only be achieved when the RAS was fed into the channel upstream of the chamber. Figure 3 shows the location of the RAS feed and contours of RAS concentration, which demonstrates good mixing in the upstream channel. The solids distribution to each ASP lane was within ±5% of the ideal distribution. Figure 4 shows the chamber during construction at Stoke Bardolph STW's.

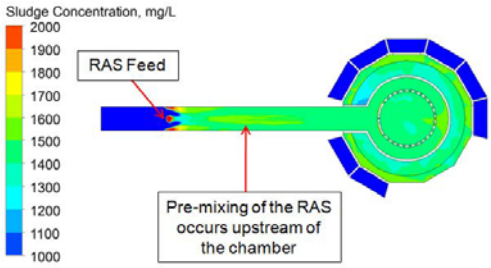

Figure 3: Chamber with RAS feed upstream of the chamber

Figure 4: Chamber during construction
(photograph courtesy of ukwaterprojectsonline.com)

MMI Engineering's experience of flow and solids distribution aided the development of the distribution chamber, leading to a system with a good flow and solids distribution over a range of flow rates.

www.mmiengineering.com
info@mmiengineering.com