Effectiveness of Hydro Ejectors

Southern Water
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Introduction

During periods of heavy rainfall, Eastney Sewage Pumping Station diverts flow to the Fort Cumberland Storm Tank. The flow contains a substantial solids load, which must be removed from the tank once the storm has ceased. This involved the use of hydro ejectors, which would suspend settled solids prior to tank drain down. Hydro ejectors discharge fluid from an ejector, therefore generating a jet. If, however, there aren't a sufficient number of hydro ejectors operating, or the ejectors aren't placed appropriately, solids will settle in certain regions of the tank. The geometry of a section of the storm tank with two hydro ejectors is presented in Figure 1.

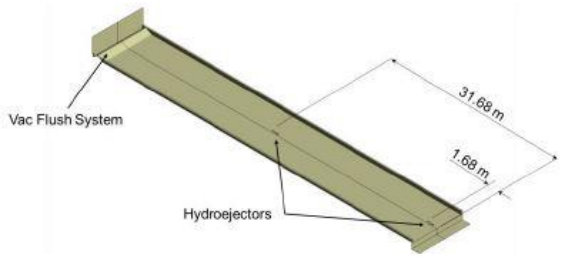

Figure 1: The geometry of a section of the tank showing the location of the hydro-ejectors

Modelling the Flow

The model included the representation of 5 size classes, representing grit particles, and 4 representing tissue. Initially, it was assumed that all solids had settled and the ability of the hydro ejectors to suspend this solids load was assessed. Dimensionless groups were used to assess the likely mode of particle transport based on the operation of the hydro ejectors, which provided additional insight in to their likely performance.

Results

The analysis demonstrated how the solids load was transported along the floor of the tank and generally highlighted that there was stratification of the solids. It was mainly the smallest size classes of grit particulates that were entrained, which suggested that the hydro ejectors were not the optimum solution for suspending solids. Figure 2 presents the mass suspended with time.

Please click on the 'play' icon to view an animation that illustrates the transport of the solids during the operation of the hydro ejectors.

Value Added

The use of Computational Fluid Dynamics (CFD) enabled the hydro ejectors to be assessed at a much lower cost (compared to the commissioning of physical models).