Capability Statement

Modelling Combined Sewer Overflows with CFD

Introduction

Sewerage systems in the UK are made up of networks of drains, pipes and culverts. In urban areas, the rainwater, domestic sewage and industrial effluent is often combined into a single network. In order to reduce stream flooding during storm events, Combined Sewer Overflows (CSO's) are placed periodically to provide capacitance in the system and to allow for over spill of excess storm water.

Validation Studies

To assess the ability of a CSO design to retain aesthetic pollutants, the hydrodynamic performance of an FR0488 chamber was studied under normal wet weather and storm conditions. The retention efficiency was predicted using a single-phase flow calculation coupled with lagrangian particle tracking and with an Eulerian multiphase calculation.

The WaPUG Design Guide

Further studies were performed for smaller scale screened CSO's based on the WaPUG guidelines. These models were used to prove a new WaPUG design to operators and the Environment Agency.

References

[1] Burt, D.J., Corton, M., Heatherington, D. and Balmforth, D. Multiphase modelling and the prediction of retention efficiency in a side weir CSO. Presented at the ASCE 9th International Conf on Urban Drainage, Portland, Oregon, USA, September 2002

[2] WaPUG guide, The design of CSO chambers to incorporate screens, 2001, www.wapug.org.uk

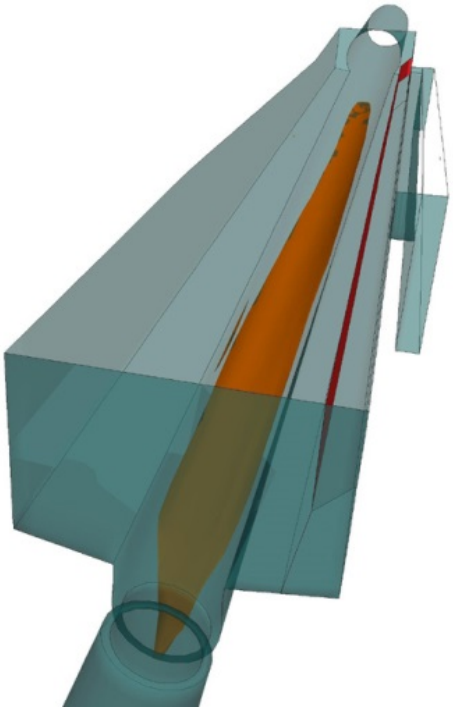

Figure 1: Sediment deposition in the FR0488. Full two phase modelling was used to represent the drag interaction between the storm water and the aesthetics. Predictions of retention efficiency were obtained by computing the solids overflow and the solids hold up in the CSO. The figure shows an isosurface of solids volume fraction > 0.3 for aesthetics with sg = 1.003

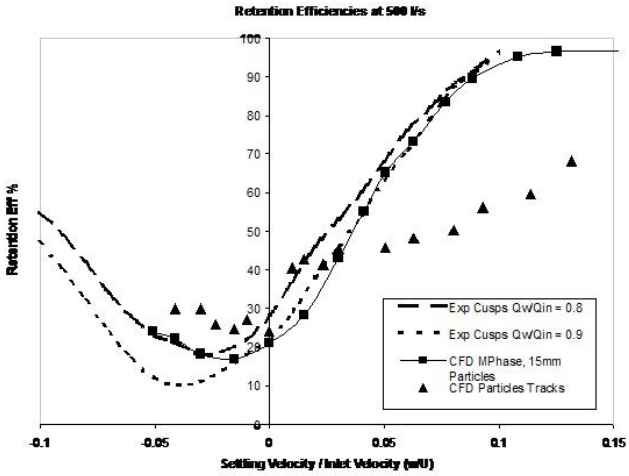

Figure 2: Comparing CFD predictions with experiment. Eulerian multiphase matches the trend but particle tracking does not [1]

Figure 3: Flow in a revised geometry. A screened CSO based on the WaPUG guidelines [2]

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