



Sedimentation Ponds and their Operation in Stormwater Systems

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Abstract

Sedimentation ponds are widely utilised in the treatment of storm water. Although they are heavily relied upon in catchment management there is still a lack of understanding of the functional processes that occur in sedimentation ponds, and how these affect treatment performance. In this research, the efficacy of sedimentation ponds as a means of sediment and heavy metal remediation has been investigated, with particular regard to the physical and chemical conditions that may lead to remobilisation of metals from the sediments.

A series of sediment sampling stations were set up at 5 sites (including two sedimentation ponds) around the Patawalonga and Torrens catchments in Adelaide, South Australia to determine the characteristic behaviour of sediments and heavy metals in the catchments and to evaluate the performance of existing sedimentation ponds. Long-term temperature stratification monitoring and intensive short-term measurements were made of the physical and chemical conditions in sedimentation ponds that are conducive to remobilisation. In addition a model was developed using STELLA™ to simulate stratification behaviour of sedimentation ponds and was validated with data collected in the field.

Heavy metals analysis of sediments trapped at a number of locations in the Patawalonga and Torrens catchments, indicated that heavy metal contamination of the sediment is a problem at all times of year, highlighting the need for treatment facilities. It was found that while sedimentation ponds are generally effective as a means of water quality treatment, their management and design should be individually tailored to local conditions to prevent or minimise inefficiencies in capture and retention of sediments and heavy metals due to persistent pond stratification and remobilising conditions.

The remobilising conditions were common in spring and autumn when pond flow was intermittent. They developed when the weather was warm and relatively calm following a high flow event, which increased the organic loading on the pond. Organic loadings were generally high, and it is recommended that sedimentation ponds be regularly cleaned to remove organic matter and contaminated sediment to circumvent the metal remobilisation problem.

Persistent pond stratification developed in summer and early autumn, when salinity was very high. Simulations with the pond model indicated that sedimentation pond stratification behaviour is highly dependent on local meteorological conditions, pond dimensions and flow regime characteristics such as salinity. It is recommended that stratification modelling be carried out using local data to evaluate the stratification potential of a variety of pond design scenarios as part of the sedimentation pond design process.

Statement of Originality

This work contains no material that has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

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