ACTIVE TRADE EFFLUENT CONTROL

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1. INTRODUCTION

This User Note describes a methodology that involves the ideal of monitoring and pro-actively controlling those key elements of a sewer system which significantly affect both the network and the downstream Wastewater Treatment Works (WwTW).

The vision of Active Trade Effluent Control is the ability to control automatically the diurnal release of significant trade effluent (see WaPUG User Note No 33) at source in order to minimise its impact on the wastewater system, particularly the WwTW. This application makes use of a trader's on-site storage facilities to balance effluent before discharging it to sewer in a controlled manner according to pre-determined rules. In essence, this is an exercise in peak lopping and trough filling both the diurnal flow and load profiles normally received at the WwTW inlet.

2. OVERVIEW OF METHODOLOGY

The aim of the Active Trade Effluent Control methodology is to optimise the performance of wastewater assets through the determination and delivery of the required diurnal flow and load profiles to the WwTW inlet. It is most appropriate for those catchments where a single, co-operative trader contributes a significant percentage of the total load received at the WwTW.

The first step in the methodology consist of making use of existing drainage area information, in conjunction with site inspection data, to gain an understanding of the physical properties of the sewerage system, determine appropriate monitoring points and provide necessary computer modelling data. The next stage is a temporary monitoring stage, which is used to record the flow and quality of the wastewater at strategic points within the catchment.

This is followed by the modelling step in which the flows and loads within the sewerage system are simulated to enable an understanding of how the system performs under different flow regimes. The trader discharge regime which results in the minimum peak influent loadings at the WwTW may then be identified.

These control rules can then be temporarily implemented by the trader, while a second period of monitoring takes place to quantify the effects of the new discharge regime. If benefits are detected as a result, the final step would be the incorporation of these limits into the company's Trade Effluent Discharge Consent.

3. WATER QUALITY MODELLING

The basis of the Active Trade Effluent Control methodology is the modelling process. This is separated into 3 distinct areas:

(i) The build and verification of a PC-based hydraulic model of the chosen catchment – this is to facilitate accurate hydraulic analysis of the system in wet and dry conditions.

(ii) The build and verification of a quality model to allow extensive water quality analysis of the catchment.

(iii) The evaluation of various test scenarios based around trader discharge criteria.

The initial requirement for carrying out water quality analysis is a fully verified hydraulic model – it is essential that the flow regimes and responses within the system can be simulated accurately before any pollutant predicts may take place. All discrepancies within the data should be checked to ensure the model is as accurate as possible, as even minor hydraulic instabilities can have a drastic effect upon results gain from the water quality analysis.

It is possible to carry out the water quality verification using default values relating to sediment and pollutants that are inherent within the program structure. After an initial simulation, these will give an indication as to the reaction of the catchment to dry weather and storm conditions. Although the results are likely to be incorrect, they will identify any sensitive areas within the model. After this initial simulation, it is important to calibrate the model against observed data.

These are certain important factors to consider when building the water quality model:

- Area data
- Sediment characteristics
- Water quality (including trade effluent) data.

It is essential to separate each sub-catchment into a particular land use type. These range from low, medium, and high residential through to commercial and industrial areas; each area being having separate or combined sewerage. Each land type has an associated level of average pollutants which are defined within the modelling program.

The sediment characteristics within the catchment, and the way in which they are modelled, are of major importance when considering both the dry weather and storm verification. The analysis of the sediment may be separated into 3 key areas, these being: build-up, wash-off and deposition/erosion. All of these conditions may be determined within the modelling package by adjusting a number of pre-defined factors.

Water quality data needs to be collected over (as a minimum) 3 dry days at strategic locations within the sewerage system. The trade discharge can be included in the model as a point source with the sampled data being converted to flow and pollutant inputs.

4. TRADE EFFLUENT TEST SCENARIOS

To carry out the modelling analysis, it is necessary to examine the response of the system to a variety of theoretical trade discharges; these enable peak flow and load values to be calculated at the WwTW for discharges occurring at any time during a 24 hour period.

There are a number of determining factors upon which the test scenarios can be based:

- Volume of discharge (m^3)
- Rate of discharge (l/s)
- Pollutant concentration (mg/l); this should be defined (as a minimum) for Chemical Oxygen Demand and Suspended Solids
- Pollutant load of discharge (kg)

Scenarios that represent a specific type of discharge can be selected, and should be chosen to reflect a different combination of pollutant concentration and flow. This will take account of any divergence from the norm which might occur once a new discharge regime has been implemented.

Each scenario can be modelled as a series of user defined input files, with each file containing the data relating to either the flow rate or one of the pollutant concentrations. These input files contain a time record which allows the time of entry of the discharge to the system to be set for any period throughout the 24 hour cycle.

The governing factor in the analysis of each scenario is the resultant level of pollutant loading at the WwTW; the results give a clear indication of the transportation process undertaken by the pollutant input and this aids the development of an optimum discharge regime that the trader can subsequently implement.

5. BENEFITS AND CONCLUSIONS

Field studies have indicated that the benefits resulting from the implementation of Active Trade Effluent Control include:

- Reduction of risk of failure at the WwTW (through the production of a more consistent quality of final effluent) deferring capital expenditure.
- More effective use of the sewerage system with the likelihood of CSOs operating in dry weather being minimised.
- Maximisation of trade effluent revenue (the need to impose a more restrictive trader load limit to protect the WwTW being decreased).

Rural and semi-rural catchments containing significant traders (with on-site storage facilities) that discharge readily treatable effluent are ideal candidates for this form of control.

Increased ratios of biodegradable trade effluent to sewage do not have any adverse effects on the wastewater treatment processes; however, without care, storing such effluent for long periods may give rise to septicity problems.

The methodology described should only be used as a framework in any Active Trade Effluent Control study; for example, in the simplest of cases, it may be possible to simplify the modelling requirement.

In the development of an Active Trade Effluent Control strategy, consideration will need to be given to initiatives such as Urban Pollution Management, Real Time Control and Waste Minimisation to ensure a fully integrated and holistic approach to wastewater management.

AMENDMENTS

Ver	Description	Date
1.	First Published	June 1996
2.	Editorial Amendments	March 2009