TRADE EFFLUENT – THE FORGOTTEN ELEMENT.

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1 INTRODUCTION

Studies of the impact of discharges on receiving waters have changed over the years in the elements they have encapsulated. Initially, major continuous discharges from WWTW were the prime focus of attention. As these more significant problems were resolved, so attention also focussed on intermittent discharges. This was paralleled by the development of the Urban Pollution Management (UPM) process and associated advances in computing, which both allowed appropriate standards to be set, and the associated computational modelling to be carried out. Within all these studies however, the need to consider trade effluent discharges has been a secondary consideration.

During AMP3, the need to carry out UPM studies in major industrialised urban areas has meant that the representation of trade effluent discharges has needed to be at a more detailed level. This paper seeks to highlight the increasing importance of trade effluent discharges in intermittent discharge studies, and will consider practical problems and issues in obtaining and representing information on trade flows and loads in sewer systems. The Bradford UPM study, which is in the process of being carried out for Yorkshire Water by Montgomery Watson Harza, will be used as an example to explore these issues further. Finally, the paper will look to the future, where increasing regulatory pressures, including the implementation of the Water Framework Directive will further emphasise the need to consider the impact of trade effluent discharges in their fullest sense.

2 WHY TRADE EFFLUENT DISCHARGES ARE IMPORTANT

In this paper, the importance of trade effluent discharges will be considered initially in relation to their sanitary load, i.e., the concentration of BOD/COD and ammonia within the trade discharge.

To emphasise the importance of trade discharges for industrialised catchments, in the Bradford UPM catchment for example, whilst the population of the downstream sewage works is marginally in excess of 300,000, loading from traders nearly doubles the population equivalent of the works. A similar picture can also be determined at key CSOs in the catchment. One important point to emerge is the differentiation between flows and loads. Whilst traders have historically been considered in terms of flows in relation to sewer capacity, in UPM studies it is the load associated with the trade discharges which is key.

Determinand	Domestic load contribution (%)	Trade load contribution (%)
Thornton Valley		
BOD	12%	88%
Total Ammonia	100%	negligible
East Bradford		
BOD	32%	68%
Total Ammonia	100%	negligible

During the AMP2 period and even into the start of the AMP3, trade effluent flows were typically expressed solely in terms of the BOD equivalent population of the catchment. Experience with such industrialised catchments as Bradford however has shown that such simplifications have serious shortfalls, and that more rigorous methods are needed.

3 TRADE EFFLUENT DISCHARGE INFORMATION

Discharges of trade effluent to sewer are controlled by consents or agreements issued under the provision of the Water Industry Act 1991. These documents can contain the following controls on flows or loads discharged:

- Total daily volume
- Maximum instantaneous flow
- Total daily load
- Maximum instantaneous concentration.

The amount and quality of effluent actually discharged within a day can vary greatly, depending on the type of processes and plant operated by the trader, and additionally may be significantly lower than those within the consent.

Consents require discharges to be monitored. The extent and frequency of monitoring is determined by the relative size of the trader and the implication a breach in consent would have. The monitoring can vary from rigorous weekly sampling of both flow and loads from a major trade effluent discharge such as a chemical works, to a yearly check on a small trader to ensure they are still operating. As a further complication, in a small number of instances traders have been found bypassing sample points, or other methods of creating incorrect sample readings. Whilst such activities result in enforcement against the traders concerned, this does not address historic data availability.

Each of the above questions creates significant issues in representing trade discharges within a model. In the example below, how these questions were addressed will be examined further.

4 THE BRADFORD UPM STUDY

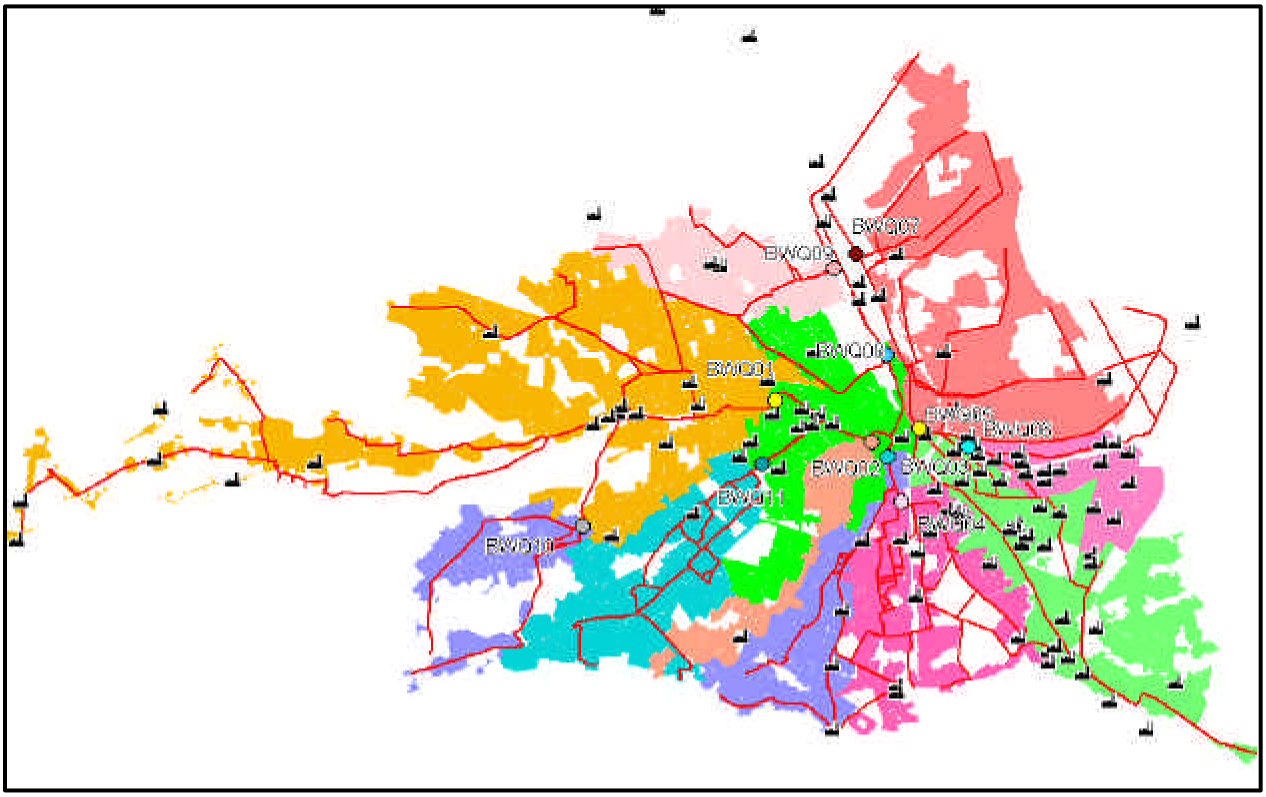

Fig.1 The Bradford UPM Study Area

4.1 Initial approach – default values

The Bradford UPM study area covers all the urban areas that contribute to the Bradford Beck catchment. The study incorporates 11 drainage area zones with a total area of approximately 76 km^2 and a population of 259 000 (YWS year 2005 estimate). There are 67 CSOs within the catchment discharging to Bradford Beck or its tributaries.

From the initial 128 traders identified as operating within the catchment only 22 were identified as significant enough to be discretely modelled. On deciding which traders to include, details of consent figures are required and these are analysed based on their significance within the catchment. Generally flows above 0.5 l/s are included but these must be looked at in the context of the total catchment flow. Any unmodelled traders then need to be checked in terms of total loads to ensure even small quantity discharges with high concentrations are not omitted.

Originally only consented trade effluent figures were supplied. After further enquiries actual average flow and load figures were obtained which greatly assisted in the calibration phase of the model. Unfortunately very little data was available on operating times and these were assessed based on trade type and the consent figures. Operating times in themselves do not necessarily establish a diurnal profile and also require a reasonable amount of sample data (usually three days are collected) to establish an average diurnal profile.

For discharge quality, a default COD to BOD ratio of 2:1 was initially used for all traders. After discussions with YWS trade effluent section traders were identified that did not fall within this assumption and further data was supplied on actual COD:BOD ratios.

As a result of these issues, what became increasingly apparent when attempting to match observed and modelled information, were the repeated disparities between the two sets of information. Whilst some of these mismatches were readily addressed, in other areas data anomalies remained unresolved for some time. In these areas, concerted effort was required from a UPM team that now directly included a member of the trade effluent team. As a result, on a number of occasions, previously accepted thinking relating to traders had to be revised.

4.2 Revised approaches

Targeted monitoring

To enable the inputs from significant traders to be characterised, targeted sampling was carried out at key sites on the network. These key sites need to establish the quality profile upstream so the identification of significant traders, populations and key areas are essential in the planning phase. The sites also needed good flow conditions, to facilitate good data return. Scoping studies assist in this planning phase and greatly assist in identifying significant areas of the study. Figure 1 shows a skeletal network with monitor sites and traders indicated.

Relatively few sites were chosen considering the size of the network. By choosing only significant sites however that determine large areas of low significance or smaller areas of greater importance then costs can be kept to an economic level.

Working day profiles

Trade flows can generally be represented within a sewer network model by specifying the daily flow and loads and applying a typical 'working day' profile. As part of their trade effluent control activities, Water Companies have amounts of trader monitoring data available. For the larger traders there is usually sufficient data to generate an average flow and load and a typical operating profile (8,12 or 24 hr) can be assumed dependant on business type. However, smaller traders are not individually modelled but allowed for in the domestic profile since the loads are usually insignificant. This may not be the case in smaller catchments where all traders may need modelling due to the low level of loads within the catchment.

Figure 2 below shows a typical domestic profile, which confirmed that no significant traders were present, upstream. The observed profile and simulated profile show a good match based on values recommended in CIRI R177 'Modelling DWF'. These default domestic parameters have been used successfully in various UPM studies across the country. The ammonia profile has been especially consistent and has been known to be more reliable than flow monitors in predicting upstream populations for sites with poor flow monitoring characteristics.

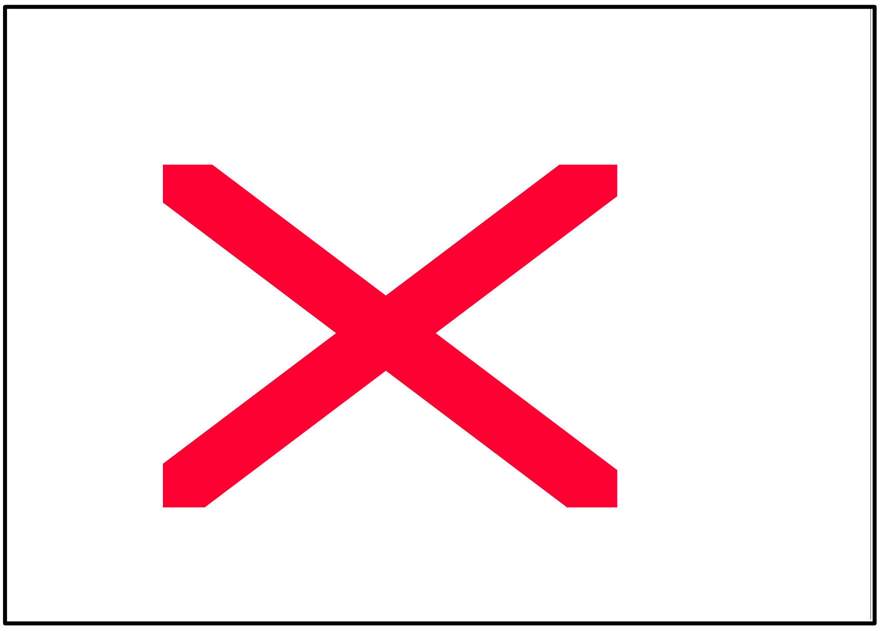

Figure 2. Diurnal profile for domestic catchment

Figure 3 below in contrast shows a DWF profile influenced by trade effluent discharges but still shows a good ammonia profile indicating the domestic content is correct. From the suspended solids plot it is clear that these are much larger than would be expected form any domestic load. The trade flow was originally based on a 24hr-operating regime. This highlighted a poor fit and attempts to calibrate the data were very unsatisfactory. After further investigations the trader was eventually contacted and revealed the works had been on a shorter 8hr cycle during the survey period.

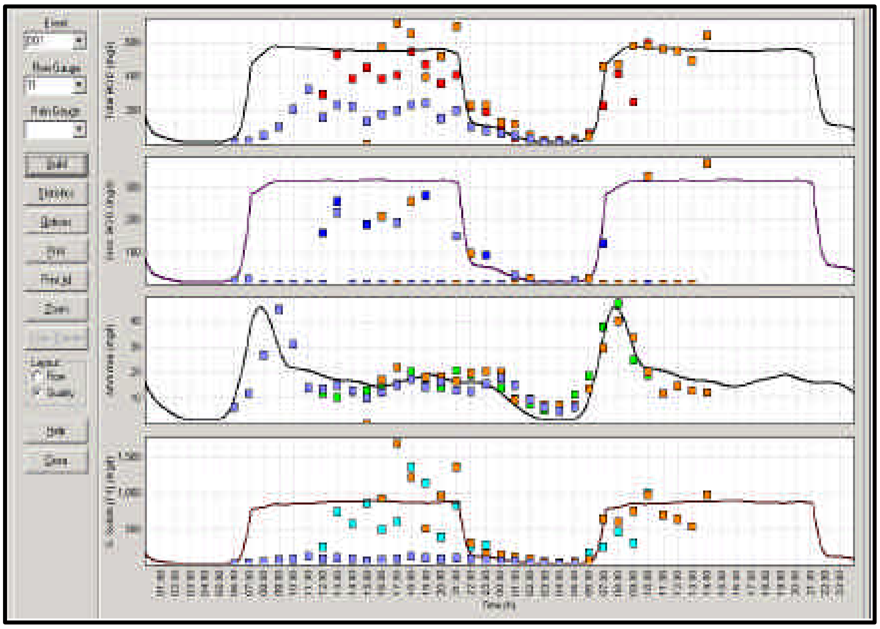

Figure 3. Diurnal Profile for catchment with trader

This particular issue, of difficulties in characterising the trade discharge, arose a number of times throughout the study, and required close liaison developing between the UPM team and the Yorkshire Water trade effluent control team. A number of unexplained discharges required further investigation on the ground by the trade effluent team, including the instance highlighted above where the trader was being monitored at the incorrect manhole. For future studies in such catchments, the need to establish efficient communication with trade effluent colleagues at an early stage is now better understood. In addition, it is important to also make use of the subjective information which these teams can provide, for whilst some information may be subjective, it still allows better quantitative characterisation of trade discharges to be made.

5 SOLUTION DEVELOPMENT

Where CSO impacts are found to relate to trade effluent discharges to the sewer system, then there are several solutions options that may exist, in addition to a 'traditional' storage solution. These include:

- Changing the trade effluent regime to reduce impact, such as by the use of balancing storage at the trader site.
- Reduction of flows and or loads in agreement with the trader, particularly where actual values are significantly less than consented values.
- Control of when and or how the trade effluent discharge is released into the sewerage system.

This approach gives far more scope to solution development, as options are no longer centred solely on providing storage in a catchment. Better utilisation of available assets can be made, reducing solution development costs. In particular, the use of active trade effluent control could offer the most cost effective solution for a number of the catchments being investigated in AMP3. To be able to carry out such innovative solutions will require the appropriate software modelling tools to be available, not only to determine solutions, but also to demonstrate that they are fit for purpose to the regulator.

6 THE FUTURE

In considering the impact of trade effluent discharges to sewer systems we need to look to the future and try to predict the direction regulation may drive investment. Current quality investment relating to intermittent discharges is targeted to ensure the sanitary and aesthetic load discharged is matched to the needs of the receiving environment. Control over micro pollutants is provided at the point of discharge to sewer by Water Companies and at the final effluent discharge to the receiving watercourse by the Environment Agency. Currently Dangerous Substance consenting only sets standards at these two points – the question is, will future legislation require control of these substances at intermittent discharge points?

Such legislation already potentially exists under the Integrated Pollution Prevention and Control (IPPC) Directive, and gives the Environment Agency the ability to directly regulate significant traders at source, rather than solely via Water Company discharges to the receiving environment.

For the future, the implementation of the Water Framework Directive will result in a need to consider the impact of discharges both in terms of Environmental Quality Standards, and in the biological sense of 'Good Ecological Quality'. Consideration too will be required under the Habitats Directive, if discharges have the potential to impact on Special Protection Areas and Special Areas of Conservation.

All of these growing regulatory pressures are likely to result in a greater focus on holistically considering wastewater systems, and on the trade effluent source of pollutants. Sanitary and micro pollutant loads will both be important, as will be the recovery time of systems, after changing or removing trade inputs.

The industry needs to be aware of these issues and look at the way they may be addressed. The debate is out there. The solutions of the future may look significantly different to those of today.

7 CONCLUSIONS

This paper has set out to show that for complex industrial urban catchments in particular, consideration of trader impacts can be more significant than thought previously. In such situations, representation of traders as population equivalents alone is insufficient, and requires their actual flows and loads to be determined.

Whilst the availability of trader data is variable, by use of targeted monitoring, and by active involvement and consultation with trade effluent colleagues and traders, such quantitative information can be recreated from qualitative sources.

In a number of catchments, realistic affordable solutions are unlikely to be achieved without trade effluent control forming some part of the solution.

There is scope for innovative solutions to the problems in some UPM catchments, by dynamically linking the discharge of trade effluents to when there is available carrying capacity in a sewer system.

With increasing regulatory pressures, including the implementation of the Water Framework Directive in the near future, which encompasses Environmental Quality Standards for a wide range of substances, the need to consider discharges from sink to river will only increase in the future.