WASTEWATER QUALITY SURVEYS - IMPROVING C.S.O. MONITORING

A. R. DRINKWATER

WRc Swindon, Frankland Road, Blagrove Swindon, SN5 8YF

1. SYNOPSIS

This paper examines the data collection requirements when carrying out an urban pollution management (UPM) study. Inevitably, a large proportion of the data are associated with combined sewer overflows (CSO's) but a wide range of other data are often necessary. The practicalities of data collection are examined using experience gained from a number of pilot studies carried out over the past four years. A comparison is made with sewer flow surveys, an area of data collection that can be most easily identified with. Finally, future developments are identified.

2. BACKGROUND

The measurement of effluent quality in a sewer system, including the effect of CSO's, has traditionally been reserved for exceptionally serious problems. However, the emphasis on environmental issues over the past few years has resulted in a greater need to measure pollution from CSO's into watercourses. The National Rivers Authority have evolved a policy for CSO consent and have recently issued guidelines[1] on how to achieve the required effluent quality. This has paved the way for the industry commencing a programme of effluent quality measurement where justified by environmental quality objectives.

Sewer flow measurement was introduced into the industry over ten years ago. It has now become a standard part of drainage area planning and can be used for a variety of other purposes such as the investigation of infiltration problems. Effluent quality measurements would, on the face of it, appear to be an adaptation of sewer to flow surveys. There are, however, a number of issues that make the measurement of effluent quality somewhat more complex, so a new approach will be required.

WRc has been involved with a number of pilot studies and similar data collection projects, including contracts in Bulgaria and Italy, over the past few years. This has allowed practical and more cost effective effluent quality measurement procedures to be developed for the purposes of building, calibrating and verifying sewer, river and sewage treatment works models such as MOSQITO, MIKE 11 and STOAT. Thus sufficient experience has been gained to give the water industry confidence to embark on such projects. Doubtless, there will be many refinements during the next few years that will eventually make effluent monitoring economically viable on less complex and smaller schemes.

3. DATA COLLECTION EXPERIENCE GAINED WITH THE PILOT STUDIES

The early pilot studies took the approach that effluent sampling was an extension of flow monitoring. It soon became apparent that the management of such surveys was considerably more complex than had been anticipated, this was especially so during storms when an immediate response was vital. In particular, however, there were a number of additional requirements such as river monitoring, knowing more about the overflows before a survey commences, and more stringent dry weather flow requirements. The problems seemed to centre around the fact that, unlike flow surveys, the project would not run itself without a "Site Engineer" being in residence. One person had to be in charge of all the data collection aspects and the job must be the most

important being undertaken by that individual. That person must have a good understanding of the reasons for data collection (i.e. the modelling requirements) and have some experience in meteorology.

Later studies adopted the "Site Engineer" approach. This proved to be more successful, sampling was carried out in much closer liaison with the flow monitoring and mobilisation for potential storms was more effective. Nevertheless, problems with the question of when to storm sample remained. Storm prediction had never been a problem with traditional flow surveys because the monitors would record data automatically and only require weekly visits. Samplers, on the other hand, cannot be left and expected to operate at the appropriate time during a storm. Automatic sampling triggered by a rise in level/flow is possible in theory, but experience has shown that it is not always practical to leave the equipment at a remote site because sampler hoses, if left in a sewer, often blocked or became ragged. Furthermore, someone would have to be on hand to remove the samples and transport to a laboratory. Thus, triggering was sometimes found to be useful provided that it was done in conjunction with a "Site Engineer" being on hand. It became vital that forecasting of rainfall was relatively accurate so that the samplers were only deployed by the "Site Engineer" just before the storm.

Improved liaison with the relevant section of the Meteorological Office was essential to enable adequate storm warning to be given. Experience with a whole series of sub-issues such as how to "read" weather radar was also gained and found to be very useful. The above measures enabled a much better storm warning system to be operated by the time the final pilot study was carried out. Adopting the method meant that far less time was wasted with abortive starts and more suitable storms were sampled.

A number of other issues had been a problem in the early studies: The labelling of and paperwork systems associated with sample handling had proved time consuming and in order to improve this, more efficient labelling techniques were introduced. Also, the measurement of small dry weather flows had proved very difficult so it became imperative that more practical/suitable dry weather flow sites were chosen.

4. THE DIFFERENCE FROM FLOW SURVEYS

The pilot studies and associated research and development has shown that there are many differences between flow surveys and effluent quality sampling. The most important are discussed below:

° **Data collection must be appropriate.** There is a temptation to collect too much data. This will make data collection more difficult and almost certainly add considerable unnecessary cost to the contract. Sample analysis is expensive.

  Thus, data collection requirements must be decided by modellers and agreed with the "Site Engineer" well in advance of the survey commencing.

  Flow surveys need less forward planning and the consequences of too much data are less serious.

° **Data (dry weather and storm) must be complete.** Accurate data and a very high return rate must be obtained. This is because the nature of pollution and modelling techniques are complex.

  The high data return rate is not always necessary for flow only measurements where, subject to there being no backwater, individual areas can be considered in isolation.

° **Data collection encompasses the river environment** and, if a STOAT model is included, sewage treatment works. This requires a number of additional skills not previously associated with sewer surveys.

° **Data collection covers many areas and is carried out for many purposes.** Although flow

measurement and effluent sampling are the main purpose, other activities such as sediment sampling, the measurement of weirs, culverts and bridges in rivers, significant trade effluent discharges, river cross-sections and river time of travel surveys are also necessary.

- **The studies have to be manned** (or available on a standby basis) on a 24 hour/7 day week basis.

- **Accurate advanced weather information must be available.** Efficient storm sampling is virtually impossible without this.

- **A detailed knowledge of the most important overflows'** physical characteristics, flow conditions and spill modes must be available prior to effluent sampling. Without this, sampling at the appropriate time, the setting of sampler triggers etc. will be almost impossible.

- **Every overflow is unique** so a standard instrument installation (as in flow surveys) will not apply. Some overflows will require multiple flow measurements/samplers whilst others will be much simpler. Sampler triggering and, in future, multiple channel data loggers linking samplers and a flow monitor, may also be appropriate.

- **Handling of samples** can be a logistic problem. Samples must be labelled and transported to laboratories in appropriate conditions promptly. Laboratories must be aware of the samples anticipated arrival.

- **Dry weather flow measurement requirements are more stringent.** Dry weather flow monitoring must be accurate for the calibration of pollution models

- **The seasons must be considered.** The levels of organic/pollution load will vary with the season.

Wastewater effluent quality surveys must, therefore, be treated as somewhat more complex than traditional flow surveys. Experience has shown that such surveys are practical but a considerable degree of thought must be given to the data collection requirements prior to the field work commencing. The larger amount of pre-survey activity can be cost effective. Conversely, a lack of adequate pre-survey planning will almost certainly result in inappropriate data collection and wasted resources.

5. THE FUTURE

Although enough field work has been carried out to enable a practical data collection service to be proposed, there are the following areas that can be refined to enable a more cost effective and reliable service.

- Less verification/calibration data will be required. The models include default values for such parameters as sediments but, until confidence is gained and an adequate database built up, actual site measurements/samples will still be necessary.

- The instrumentation of overflows will improve with the use of multi-channel loggers. Research has shown this to be possible.

- In the long term water quality probes may replace the need for samplers and laboratory analysis.

6. CONCLUSIONS

The following conclusions can be drawn:

° The pilot studies and associated work have shown that it is possible to carry out wastewater quality surveys to produce meaningful data for use in urban pollution management schemes. This was despite some aspects of data collection being more difficult than what was initially anticipated.

° Management of all aspects of data collection by the "Site Engineer" approach was found to be essential.

° A reliable storm prediction system is a vital prerequisite to efficient storm effluent sampling.

° Close liaison between the modeller and "Site Engineer" was found to be essential.

° Although the various data requirements had to be met, it was found that they could often be streamlined thereby saving expensive resources. A number of initial requests were found to be impractical and a compromise had to be reached.

° Sufficient experience was gained in the pilot studies to enable a practical approach to be formulated. The present approach will be revised over the next few years as more experience is gained, especially in the requirements of models such as MOSQITO, STOAT and MIKE 11, but is adequate enough to use in a series of "first generation" studies.

7. REFERENCE

1. NRA. AMP(2)/Effluent Quality: NRA Guidance Note for Preparation Work for AMP(2).

Improving CSO Monitoring-Practical Quality Sampling
Andy Drinkwater WRc Plc

Question David Balmforth Sheffield Hallam University

Location of samplers all the photos were of samplers above ground, is that the best place? Can be looked at without using a full safety team.
I am preparing a detailed guideline on how to do quality sampling, will this be useful?
What about gross solids sampling?

Answer

Photos are above ground because they are easier pictures to take. Security is important, also need to make sure the manholes are big enough to house the samplers. Some covers had to be replaced, if mounted near the top do not need full safety team as do not need to enter the manhole.
Yes it would be useful to have a guide.

Comment Bob Crabtree WRc

MOSQITO does not model gross solids, there are techniques being developed to measure them.

Question John Maziliauskas Howard Humphreys and Partners

If you did the sampling on a weekly basis how did you know when you are sampling a storm? How can you tell the sampler was not triggered by a blockage rather than a storm event? What are the logistics of getting all the samplers going as the event arrives?

Answer

You put the tubes in but not the samplers. The samplers are only installed when it looks like there is going
to be a storm, usually based on met office prediction. Yes they need keeping to a sensible number 10 to 20 is a lot to get in in time.

Question Andy Sharpe Binnie and Partners

Is there an effect from winter road gritting?

Answer

Yes it does have an effect.

Question Phil Deakin Entech Consultancy

I agree with the need for a good model first, we have recently completed a job with good results. We were able to establish the relative importance of overflows. It was important to have rules on when to test samples. The samplers were triggered by depth and that was successful.

Answer

If some samples are lost due to blocked tubes don't proceed. Depth samplers are OK if you have a low DWF profile and good storm response.