TWO STAGE VERIFICATION - IS IT NECESSARY?

Summary of Presentation

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1. Background

The majority of hydraulic models prepared to date have been required for one of two principal reasons :-

a) As part of Drainage Area Study.

b) To identify and resolve specific hydraulic problems.

The accuracy of models is dependent on system data derived from existing sewer records and an assessment of contributing areas. Most models are then verified using data from short term flow surveys. None of the data used in preparing the model has been subject to rigorous quality assurance procedures.

All of the models prepared under b) and some under a) have been used to test options for specific system improvements, which have then resulted in a recommended solution being adopted as a Capital Works scheme.

2. Problem

There are now a number of instances where errors in the original model data have either been detected during detailed design of the scheme, or more seriously, after implementation. It is difficult to envisage how such errors could have been prevented, because most relate to lack of reliability in basic system data on which the modeller has to depend. Simplified case histories are used to provide the following examples :-

Example 1

A verified model of a surface water system indicated that a serious flooding problem was due to lack of capacity on a 100 metre length of 750 mm. diameter sewer laid at a slack gradient. A scheme to duplicate this deficient length was approved at a cost of £50,000.

During detailed design, the sewer levels were checked and found to be incorrect, there being no slack gradient. These checks also revealed that the 400 metre length of downstream sewer had been incorrectly stated on the sewer records at 750mm. diameter, when it measured only 675mm. diameter. The true deficiency is now confirmed within the 400 metre section of sewer and an upgrading of this length would cost £175,000, although a cheaper storage option is available.

Example 2

A sewage treatment works was to be abandoned and replaced by a pumping station rated at 160 l/s. The flow was to be transferred to an adjacent catchment for which a model had previously been prepared as part of a Drainage Area Study. The optimum point of discharge was determined by testing of the model, the capacity of the receiving sewer being 190 l/s.

The scheme to construct a pumping station and rising main was commissioned after testing of pump outputs. Within days of operation, reports of flooding adjacent to the discharge point were received. An inspection and CCTV survey of the receiving sewer was carried out, which revealed an obstruction and build up of grease and debris causing a serious reduction in its capacity. After a minor sewer improvement, followed by cleaning, the system functioned as designed.

Example 3

A model with some verification problems was used to establish that the only viable solution to frequent foul sewer flooding in a village centre was to construct a relief sewer to the local sewage works. All flows arriving at the works are pumped to treatment and it was the intention to maintain the existing pumping rate by storing all excess flows in an on-line tank, which effectively extended the wet well capacity. Storage was designed for a 50 year storm event.

Within six months of implementation a severe storm, estimated to be of 5 year return frequency, caused flooding to properties adjacent to the sewage works, although the village centre experienced no problems. An investigation established that the output of the works pumps was less than that assumed, because operational changes had invalidated the data supplied for modelling purposes. Hence, the designed storage was inadequate. The problem was resolved by installing an additional pump.

These examples illustrate a diverse range of errors within models, resulting from a lack of detailed knowledge of our sewer systems. Fortunately, these instances have not resulted in wasted capital investment, but there is a serious risk that this will occur in future, unless additional checking procedures are introduced.

3. Purpose of Paper

The paper is intended to promote discussion of the subject and to attempt to establish if there is a need to undertake a second stage verification or 'double checking procedure' for models which are used to design system improvements. This procedure could be limited to that part of the model which is critical to the proposed solution, but would have to encompass a range of checks including sewer sizes and levels, condition surveys, checks or tests on model ancillaries and possibly supplementary flow measurement. Inevitably, there would be associated cost and time implications, but these may be considered acceptable in order to achieve better quality assurance on investment decisions.