BENEFIT/COST APPRAISAL OF WASSP SOLUTIONS

MIKE LEAFE SENIOR ENGINEER (SEWAGE)
ANGLIAN WATER
AMBURY ROAD
HUNTINGDON PE18 6NZ
0480 - 56181 Ext. 2248

1. INTRODUCTION

All Regional Water Authorities have a statutory duty to provide an efficient service to the consumer. In accordance with this duty Water Authorities have developed procedures for project appraisal which result in the most cost effective solution to a known problem. The Ministry of Agriculture, Fisheries· and Foods (MAFF) has produced guidelines for the evaluation of Land Drainage projects.. Their approach is based upon the work of Penning-Rowsell and Chatterton of the Middlesex Polytechnic Flood Hazard Research Project and enables engineers to assess the relative performance of alternative scheme options to different storm return periods. Through the use of WASSP, sewerage engineers are similarly able to assess the relative performance of their scheme proposals and a technique, similar to the Land Drainage Benefit assessment, can be used to identify the most cost ·effective solution.

2. BENEFIT/COST ANALYSIS

The basis of the Land Drainage approach is the application of a Damage Cost vs Event Probability curve for the existing drainage system and scheme option (see fig 1.). The area beneath the curve is the likely flood damage/annum, with the difference in areas giving the relative benefits of flood alleviation betweeen the options.

However, it is generally accepted that Penning-Rowsell's data for flood damage is not particularly relevant to sewerage flooding. The intangible social costs to sewage flooding are thought to be far larger than the tangible and quantifiable costs and Benefit/Cost analysis has therefore been considered as unsuitable for sewerage schemes. Accepting that, at the moment, it is not possible to accurately measure the cost of sewerage flooding it is proposed that flood volume can be used as a measure of flood damage for a particular catchment.

Curves of flood volume vs event probability can therefore be used to calculate the relative benefits of sewerage scheme options and thereby select the most cost effective solution by Benefit/Cost Analysis. Fundamental to this proposal is the assumption that flood damage is proportional to flood volume, which is sufficiently accurate for assessing the relative performance of options for a particular scheme. This approach should not be used to consider the relative merits of different schemes. The flood volume measure can be easily abstracted from WASSP results and the Sewerage Rehabilitation Manual recommends that scheme proposals are simulated for a range of storms. If this advice is followed then the information required for the Benefit/Cost Analysis is available without any extra work.

and operated at the design discharge once water levels rose up to one third of the throat height. Since the sewer water levels were not expected to rise much above this level, a revised long weir equation was used and found to give a satisfactory representation.

6.   The hydraulic performance of the existing sewers was assessed using the performance criteria outlined in the SRM and incorporating criteria set out in the NWW Interim Performance Criteria for Sewerage Systems, January 1985. At each locality where the model predicted significant volumes of flood water an assessment was made of its likely impact on the community. Enquiries were then made amongst the occupants of premises in the vicinity of those areas predicted to be the subject of flooding. In general, field evidence confirmed model predictions both in terms of flooding and stream pollution, the latter due to inadequate dilution.

7.   From consideration of the problems and priorities of the area detention tanks were generally adopted as the most appropriate means of hydraulically upgrading the sewerage system.

8.   Six integrated solutions were developed and costed. Each solution relied on identical sewer renovation, replacement and flood relief or flow attentuation measures. The differences between the options lay in the number of storm overflow outfall sites and the length of associated reinforcement sewer.

9.   The critical storm duration and the appropriate volume of the detention tanks are interrelated. Reassessment of the preferred solution using longer duration storms was carried out. Flow regulation from the tank was based upon the use of Hydro-Brakes. The pre-release version 7.0 of WASSP-SIM was unable to model the performance of the flow regulation device directly. The best approach found was to model the Hydro-Brake as a pipe with fixed roughness and gradient and vary the size depending upon the maximum carry-on flow required.

10.   The use of the WASSP-SIM in the development of the Drainage Area Plan was found particularly valuable in assessing the impact of alternative rehabilitation strategies. The ability to model the effects of surcharging, not only in the existing system but in the proposed rehabilitated network following the introduction of flow attentuation devices, enabled economic solutions to be developed which both eliminated flooding and took account of the water quality objectives of the area.