Suggested correlation between storm sewage characteristics and storm overflow performance

G. HEDLEY & M. V. KING

R. D. Goffey, Ward, Ashcroft & Parkman

There has been a considerable amount of discussion in recent years regarding the problem of pollution generally and, more specifically, the provision of storm sewage overflows, culminating in the publication of two Government Reports on the problems.[5, 6] The major problem appears to be the question of the pollution level that can be accepted from the financial and the biological viewpoints; the Authors' solution seems to be both economical and to provide a good degree of quality control.

50. It would be appreciated if the Authors would re-state the values of the total effective impervious area (96 acres in § 1 and 93 acres in Fig. 5) and the time of concentration (30 min in § 1 and 35 min in Fig. 7).

51. As I was, from the values of BOD, SS and DWF given in Table 2, unable to verify the total BOD and SS loads for average DWF, 820 lb and 670 lb respectively quoted in Figs 5 and 6, some clarification as to the derivation of these totals would be appreciated.

52. At an average BOD rate of 0·9 lb/min (i.e. 54 lb/h) for a DWF of 65 cumins, the maximum total excess BOD load measured, in Storm 7, of approximately 580 lb (from Fig. 5) would be equal to 10·74 h DWF and not 12 h as stated in § 9.

53. I would like to express agreement with the decision to use the term 'rate of load' for the measurement of the BOD and SS. When considering the effect of a discharge on a receiving watercourse, this method of measurement is a far better indication and it is to be hoped that it receives greater usage.

54. In qualitative terms, the graphs plotted in Figs 5–8 were somewhat predictable. The Authors, however, are to be congratulated for collecting the data to make these comparisons quantitative.

55. Since the excess pollution load probably comes from the roads etc., I wonder whether the separate system of sewerage, discharging the stormwater run-off direct to a watercourse, is entirely satisfactory. In view of the high polluting content of this stormwater run-off, as demonstrated by the Paper, it is suggested that some means of trapping a proportion of this load be incorporated in separate stormwater systems.

56. Before such works are undertaken, though, further research into the extent and scope of this excess pollution load is, as the Authors state, necessary.

57. The solution proposed by the Authors appears to overcome many of the problems normally associated with storm sewage overflows: premature spillage and poor quality control are but two of the common problems. However, its application, on existing sewerage systems, would seem to be somewhat limited to situations where the sewer gradients are favourable in order to avoid the necessity of 'remote' pumping stations.

58. I note that penstocks are to be provided such that the retention tanks may be flushed out with sewage. I would like to ask whether arrangements are to be made for the tanks to be flushed out immediately after every storm, or at regular intervals, in view of the fact that some sludge will remain after each usage.

59. Once these prototype installations are in operation, it is to be hoped that the Authors will be able to publish the results obtained, in order that they may be compared with results from the more conventional types of storm sewage overflows.

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60. In dismissing the more conventional overflows, the Authors appear to have overlooked the fact that it has been shown by Ackers *et al.*[7] that a 'storage overflow' afforded some considerable degree of quality control, and by Smisson[8] that a 'vortex overflow', incorporating storage, could be effective. These two types of overflow have the advantage that, once a storm has subsided, sludge is not left deposited on the base of the overflow chamber.

61. In my own research I have also found that the 'vortex overflow' could be quite efficient, provided that sufficient care is taken regarding the design of the chamber and the central overflow weir.

M. Lansdell, Torbay County Borough

The Authors' remark regarding the professional rainmakers is particularly apt. Whilst trudging about in torrential rain, the only chance one gets to see sewerage systems working at design conditions, I have noticed a marked change in the colour of storm sewage. After being black at first spill, it changes through dark brown to a reddy brown, the colour of local soil. Have the Authors noticed any such change?

63. The discharge of the bulk of the excess BOD during the rising leg of the hydrograph and the black colour of first spill lead me to suspect septic gully liquid as a major contributor.

64. Perhaps a few words on the urban gully would not be out of place. We must install many thousands of these every year and spend vast sums cleaning out existing gullies without knowing their effectiveness or real purpose. Recent research by the Road Research Laboratory into the hydraulic efficiency of gullies was well intended, but it needs only a handful of leaves or a sheet of paper to cause the whole flow to leap a bar grating. In dry weather each gully pot becomes a miniature septic tank, anaerobic digestion setting in very soon after being charged with the necessary dead leaves etc.

65. Research in the USA has revealed BOD values ranging from 40 to 1000 mg/l depending upon site, temperature and stage of digestion. It was also discovered that the BOD load of street refuse builds up at a rate of about 0·4 lb BOD per kerb mile per day since rainfall.

66. The present gully design is virtually unchanged since the 1820s when the connexion of water closets to the (surface water) sewers made trapping necessary. Modern paving, sewer design concepts and type of construction have changed considerably since those times.

67. There is therefore a case for the review of current sewerage practice with reference to the improvement of gullies and the possible elimination of the pot under each inlet. More centralized and efficient oil and grit separating facilities should be provided at the outfalls of surface water sewers, as is current practice in many American and French municipalities where the separate system is in use.

68. Trapping combined sewer connexions without the use of a water seal is difficult but some plastic flap valve arrangement might be developed for the purpose.

69. The recent report of the Central Advisory Water Committee on the future management of water made little mention of the future of urban hydrology. This is the management and control of storm and combined sewers and the small rivers and streams in urban areas whose flow in storm time consists almost entirely of surface run-off and storm sewage. Would the Authors like to comment, bearing in mind the fact that surface water is not as clean as was at one time thought?

Messrs Hedley and King

Mr Goffey has drawn attention to an unfortunate discrepancy in value for impervious areas in times of concentration. These should be 96 acres and 35 minutes, although 93 acres run-off in 30 minutes, which is how the confusion arose.

71. The daily total for BOD and SS took account of a build-up from zero to the peak values in the morning over a period of about 1 hour, and a reduction at night

over about 1½ hours which appeared to be characteristic for this particular area. This phenomenon was also taken into account in assessing the value of the excess load in Storm 7.

72. Whilst an investigation into the nature of separate storm water discharges has much to commend it, we feel that this is only part of the problem and we would recommend that a full investigation is carried out, to discover the sources of the considerable excess pollution load in storm flows and to determine the proportion of load emanating from each.

73. The conversion to a totally separate system within existing towns has many inherent problems particularly during the transition period. When areas for redevelopment are chosen they are selected and defined on political rather than topographical grounds. Usually the area forms only part of the total drainage area and whilst eventually the sewers may operate as a separate system they must of necessity operate in the manner dictated by the adjoining areas until such time as these too are redeveloped.

74. The provision of storage capacity at individual overflows can however largely overcome these problems. Whilst it is preferable that situations are chosen where the sewer gradients are favourable the other advantages should be carefully examined as these might perhaps justify the adoption of mechanical methods of tank emptying.

75. The performances of the tanks are to be carefully monitored and it is our intention to publish the results at some future date.

76. We did not lightly dismiss conventional overflows upon which much useful work has been done. However, the overwhelming evidence indicated that the polluting matter in storm sewage is held in very fine suspension or even in solution. We therefore consider it improbable that any type of overflow can achieve quality separation and will do little more than retain the solids in the foul water sewer while allowing the major part of the pollution load to escape to the water course.

77. **Mr Lansdell** has mentioned the change in appearance of storm sewage during the early part of the storm. This was noticeable during the investigation especially after long dry spells. It may well be that septic gully liquid is an appreciable contributor to the excess pollution loads, but without an investigation as suggested earlier, its full extent cannot be truly assessed. We share Mr Lansdell's view that it is time to take another and more critical look at the traditional gully.

78. The problems of urban hydrology are not often brought to the fore. The figures issued by the Institution of Municipal Treasurers and Accountants for 1968–1969 indicate that only 36% of sewage works were discharging effluents outside 30:20 conditions and that just under 14% of these were only marginally unsatisfactory. We may, therefore, confidently expect that urban pollution will become more apparent simply because the condition of streams and rivers in dry weather has been vastly improved. We would suggest that all of the recent Government publications have been disappointing and paid insufficient attention to this particular problem. We found the Final Report of the Technical Committee[6] especially disappointing after the publication of the interim report which promised so much.

References

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