REPORT OF RAINFALL AND HYDROLOGY WORKSHOP

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This workshop considered the various model components in WASSP, noting where problems existed and suggesting ways these might be solved in future versions of the Procedure. The discussion was structured around the following table:

Topic	Now	Problems	Future
Design Storm	FSR[1] Depth-Duration-Frequency	None?	?
Design Storm Profile	FSR 50%-Summer	Smoothness, Long storms	Use radar data
Areal Reduction	FSR Functions	Moving storms, Averaging data	Use radar data
Runoff Volume	Initial Loss PR equation UCWI	Feedback to PR Event based, Uncertain, Pervious areas, Winter runoff ESMD obsolete	Water Balance Model, with: -drying out -surface condition -explicit pervious area model
Runoff rate	Non-Linear Reservoir	Inflexible	Slow Varying Linear Res'r
Sewered Subareas	Equivalent Pipe	No surcharging	New model

[1] FSR = Flood Studies Report, Nat. Envir. Res. Council (1975)

<u>FSR Design Storm Depth</u> was not thought to be a major problem, but the FSR relationships were derived predominately from longer duration rainfall than used in sewer analysis. Also, recent work has suggested greater regional variability in return period ratios.

The <u>Design Storm Profiles</u> and constant <u>UCWI</u> were not thought appropriate to tank design. These had been chosen to predict flow rate, whereas tank design was concerned with flow volumes. None of the catchments used to develop WASSP had tanks (or overflows). In spite of this, tanks designed using WASSP did not seem to have given any problems. Often tank size was governed by the land available rather than rainfall. Moreover, Prof O'Connell's graph presented in the morning session showed the use of time series rainfall had not indicated hugely different volumes (within 20%). Design storms were still relevant (and simpler) for initial studies and for catchments without (or limited) tanks and overflows.

The WASSP <u>Areal Reduction Factors</u> were not thought relevant to the sort of events used in sewer studies. Generally rainfall was thought more variable and storms usually moved. Weather radar might help define these variabilities, but the current radar grid (at 2 Km) was rather large in relation to typical catchment size. Was there a small, portable radar suitable for use in sewer surveys (radar should be seen as an aid to interpolating between a smaller number of raingauges rather than as a total replacement for raingauges). How better data on rainfall variability should be used was not clear.

The discussion widened to consider use of rainfall data in verification. How should data from several gauges be used when SPASIM was not available to many authorities. Upstream areas could be modelled using the nearest raingauge, but how should raingauges be combined for downstream areas. There were no hard and fast rules, but perhaps total depths should be averaged, and used to scale the single most representative profile.

Discussion of the Runoff Volume model was muted. Initial Loss (Depression Storage) was not discussed, though it was known to be poorly accounted for in WASSP (all or nothing, then omitted from the PR equation). There was concern that, in replacing PR with a new water balance model, the 'baby should not be thrown out with the bath water'. Recognising the huge variability of percentage runoff observed in practice, the existing method gave acceptable results in 80-85% of cases. Some way of varying PR during long storms was necessary, and the upper limit of 300 on UCWI was too low. A new version of UCWI, using MORECS in place of ESMD, would be beneficial.

There followed discussion on what impermeability should be assumed for large pervious areas (hillslopes) at the top of drainage systems. Runoff from such areas is better considered separetely using FSR techniques (but adjusting the FSR equation for PR - see WaPUG User Note 10) and then input to WASSP as un upstream input. Treating it as an equivalent paved area could lead to too fast a response.

Runoff Rate response of WASSP was sometimes too fast, rising and falling too quickly. While this might be caused by the surface runoff model, it might also be due to the pipe flow model, or even to oversimplification of the sewer network. A future surface runoff model might optionally include some accounting for pipe flow, giving better results for simplified systems, and extending its applicability to Sewered Subareas. A slowly varying linear reservoir model was being considered. Why had this model not been used originally? All modelling is a balance between flexibility and fidelity. The original non-linear reservoir gives perhaps more accurate simulations of runoff response, but is less flexible. The need to model larger subareas and longer duration storms suggests a more flexible model is required.

The discussion concluded with the thoughts (i) that in view of the variable accuracy of data collected in the field, perhaps we were trying to be too scientifically exact in our modelling, and (ii) that inventive users had developed suitable fudges to the input data to make WASSP work in new circumstances, when (really) relatively simple changes to the control program (rather than the algorithms) were required.