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Improved Functions For Runoff Coefficients And Smart Design Of Ditches & Biofilters For Effective Flow detention

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Abstract : An international literature study has been carried out for comparison of commonly used methods for the dimensioning of transport systems and stormwater facilities for flow detention. The focus of the literature study regarding the calculation of design flow and detention has been the widely used Rational method and its underlying parameters. The impact of chosen design parameters such as return time, rain intensity, runoff coefficient, and climate factor have been studied. The parameters used in the calculations have been analyzed regarding how they can be calculated and within what limits they can be used. Data used within different countries have been specified, e.g., recommended rainfall return times, estimated runoff times, and climate factors used for different cases and time periods. The literature study concluded that the determination of runoff coefficients is the most uncertain parameter that also affects the calculated flow and required detention volume the most. Proposals have been developed for new runoff coefficients, including a new proposed method with equations for calculating runoff coefficients as a function of return time (years) and rain intensity (l/s/ha), respectively. Suggestions have been made that it is recommended not to limit the use of the Rational Method to a specific catchment size, contrary to what many design manuals recommend, with references to this. The proposed relationships between return time or rain intensity and runoff coefficients need further investigation and to include the quantification of uncertainties. Examples of parameters that have not been considered are the influence on the runoff coefficients of different dimensioning rain durations and the degree of water saturation of green areas, which will be investigated further. The influence of climate effects and design rain on the dimensioning of the stormwater facilities grassed ditches and biofilters (bio retention systems) has been studied, focusing on flow detention capacity. We have investigated how the calculated runoff coefficients regarding climate effect and the influence of changed (increased) return time affect the inflow to and dimensioning of the stormwater facilities. We have developed a smart design of ditches and biofilters that results in both high treatment and flow detention effects and compared these with the effect from dry and wet ponds. Studies of biofilters have generally before focused on treatment of pollutants, but their effect on flow volume and how its flow detention capability can improve is only rarely studied. For both the new type of stormwater ditches and biofilters, it is required to be able to simulate their performance in a model under larger design rains and future climate, as these conditions cannot be tested in the field. The stormwater model StormTac Web has been used on case studies. The results showed that the new smart design of ditches and biofilters had similar flow detention capacity as dry and wet ponds for the same facility area.

Keywords : runoff coefficients, flow detention, smart design, biofilter, ditch
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