

## Executive Summary

The research reviewed catchment response due to urban development on the basis of comparative assessment. This required the identification of similar rainfall in the catchment during different development stages for which gauged flow rates were recorded. The hypothesis which was reviewed here relates to the statement that urban development which creates more impervious areas on the one hand also generated longer times of concentration due to the changes in the length of the flow path as well as more temporal storage capacity which could result in a higher groundwater recharge.

Three different catchments were evaluated:

Catchment 1 (Willowspruit) in the Tshwane Metropolitan Council Area where a flow gauging structure was installed and autographic rainfall stations were placed to obtain a representative distribution and intensity of rainfall. Flow and rainfall was recorded since 1992 when the catchment was fairly undeveloped. During this research the flow gauging was undertaken for the current developed levels in the catchment.

Catchment 2 (Robert's Place) is a highly developed urban security complex. Flow gauging weirs for two defined areas of the catchment as well as an autographic rainfall recorder was installed on this property. The recorded data was compared with the results obtained from a detailed modelling of the catchments.

Catchments 3 (Rietvlei Dam, Daspoort gauging structure and Kameeldrift catchment) were selected to conduct a comparative discharge evaluation for similar rainfall seasons for different levels of catchment development.

Catchment 1 (Willowspruit) was fairly undeveloped for the period for which the discharge was recorded (October 1993 to May 1995) and it was believed when the research stated that autographic rainfall data were also available at three autographic rainfall stations. It was later established that this valuable data set was apparently lost. Rainfall data from two rainfall stations, Irene WO and Pretoria Eendracht, which had hourly recorded rainfall data, was then used to calculate the rainfall intensities. The rainfall intensity was also calculated by reviewing the time periods in which the discharge rate through the gauging station increased. Catchment 2 was a densely developed smaller catchment. An autographic rainfall recorder as well as a flow gauging structure was installed for both zones in Robert's Place. A comparison was conducted between the modelled discharge, from a detailed EPA SWMM that was set up for this catchment, and the recorded gauged discharge.

The assessment of the Willowspruit catchment revealed that the discharge flow rates are less than the calculated values, reflecting the lack in uniform rainfall distribution, storm duration and influence of retaining structures (culverts that are fully or partially blocked). Although "similar storms" were selected for comparisons between the discharges during predevelopment versus post development it was realised that even for small catchments the variation in storm events are significant and it was impossible from the limited data to discard the hypotheses. It was concluded that both the temporal rainfall distribution and the influence of antecedent conditions are important when discharge calculating techniques are applied.

The assessment of Robert's Place reflected the calculated discharge was at times larger and at times smaller than the gauged discharge. Based on the comparison of calculated discharge

(Peak flow rate and volume of discharge) with the recorded data it was impossible to derive any conclusive findings, but to indicate that the modelled results tend to be higher than the recorded runoff data.

In the case of the large catchments, a comparison was set between the cumulative rainfall and the cumulative runoff produced by similar rainfall events for different development levels in the catchment. This analysis compared years of similar volumetric rainfall, antecedent conditions and temporal distributions. There was a general trend indicating an increase in the percentage runoff produced as urban development increased, but certain anomalies were observed.

The hypothesis that the influence of urban catchment development will decrease the peak runoff has neither been proved nor disproved.

Consideration should be given to conduct further research in this field. It is therefore recommended that further investigation be done for both developed and undeveloped catchments to quantify a full understanding of the influence of drainage structures and different types of catchment development on the stormwater response from urban catchments.