Stormwater drainage systems design under variable climatic conditions

F. Ahammed

Civil Engineering Discipline, STEM Academic Unit, University of South Australia
Email: FaisalAhammed.Ahammed@unisa.edu.au

Abstract: Australia Rainfall and Runoff (ARR) revised the rainfall intensity frequency and duration (IFD) relationships known as ARR2016 replacing the previously used ARR1987 design rainfall. The guidelines of ARR were used to understand the climate change effects on rainfall intensities and CSIRO's Climate Future Tool (CFT) was used to predict the future climatic conditions of Australia. Variability of greenhouse gas emission scenarios, rainfall and temperature were considered for South Australian conditions and the modelling outputs of CFT resulted three possible maximum temperature increases of 1^0C, 2.25^0C and 3^0C in 2030, 2060 and 2090 respectively. These predicted increased temperatures may alter the rainfall patterns of South Australia and thus, IFDs could be increased as 5%, 11.6% and 15.8% in 2030, 2060 and 2090 respectively.

The DRAINS model was used to understand the climate change impacts on drainage systems for a South Australian catchment. IFDs from ARR2016 were initially entered into the DRAINS model and an optimum design of drainage system was established for the catchment. Thereafter, the projected IFDs due to climate change impacts were entered into the DRAINS model for minor and major storm events. Finally, the hydraulic and hydrologic comparisons of the designs were performed considering several aspects including flow, pit up welling, free board, overflow routes, hydraulic grade line and pipe size.

The results showed that while surface runoff and subsequently flow rates increased in the drainage system, there was no increased number of pits upwelling, freeboard levels were maintained, overflow routes were safe in the most cases, no notable differences were observed for major storm's hydraulic grade lines (Figure 1) and the drainage system proved adequate. The modelled results demonstrated that the drainage system had sufficient capacity to cater for the increased surface runoff volumes, thus indicating the initial design was conservative. In this instance, the impacts of climate change on stormwater drainage systems design in South Australia were negligible and changes to current design practices and procedures would not be warranted.

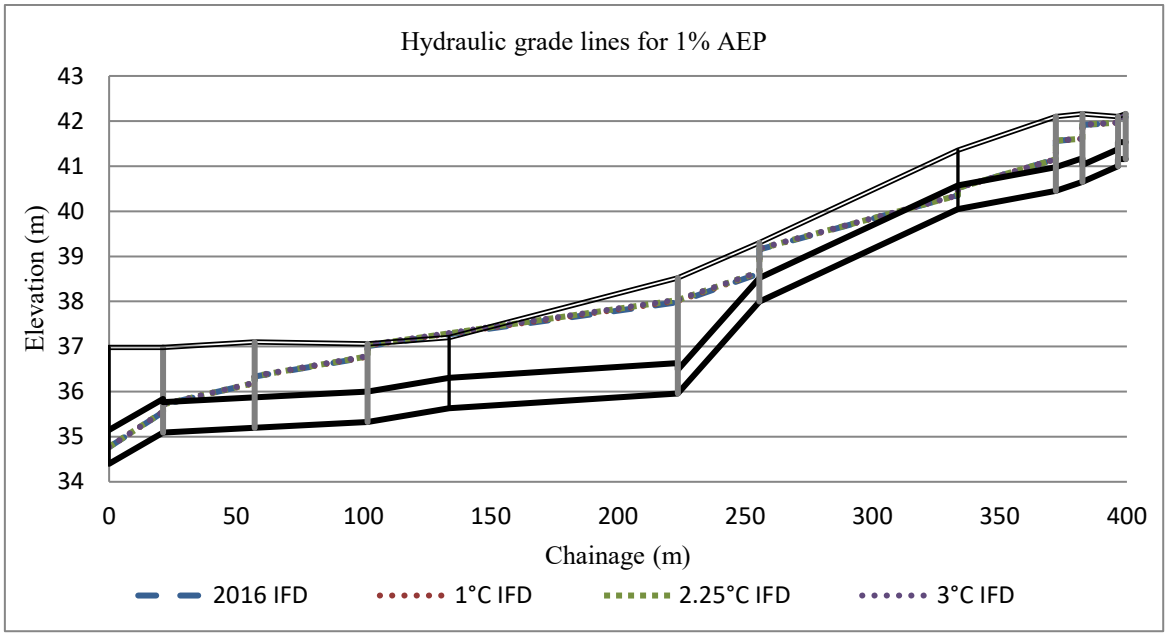

Figure 1. Climate change impacts on stormwater drainage design for 1% AEP

Keywords: *Climate change, drainage systems, DRAINS model*