MODELLING THE LA RIVER: THREATHS AND OPPORTUNITIES FOR THE LOS ANGELES RIVER, USA

In the years between 1938 and 1960 the Los Angeles River is channelized into a concrete channel, due to big devastating floods in the early 1900's. After the channelization, which prevented the city for other big floods, the river became invisible for the inhabitants and the high velocities caused wear and tear of the concrete lowering the protection levels. In this study a 2D-model of the LA River is set up which is used to investigate flood probabilities in the current situation and for three scenarios in which different measures to reduce flood risks along the river are implemented.

With data series of the daily averaged discharge in the river, three extreme value distributions were compared to estimate the return times at the different stream gauging stations along the river. The distributions showed large differences indicating a large uncertainty in determining the return time of a give discharge.

To set up the 2D-model the module Delft3D-FLOW of the suite Delft3D, developed by Deltares, is used. The grid of the model includes the river itself from the Sepulveda Dam to the ocean, as well as the floodplains and some areas in which measures are planned. The bathymetry, obtained from a digital elevation model (DEM) and corrected with the cross sections used in the 1D-model HEC-RAS by the US Army Corps of Engineers (USACE), and the friction coefficients for roughness are coupled to the grid. The upper boundary is set as a variable input and the downstream boundary is set by harmonic constituent. The lateral inflows are set as a factor from the upper boundary condition, derived from data. The model is calibrated and validated and the results are assessed as sufficient to use the model for evaluating the different scenarios.

With the model described above the reference situation (i.e. current geometry and representative discharge wave) is investigated. For the most critical point in the river a discharge with a return time of once in 154 years is determined. This is quite different from the return time for the most critical point in the river given in the Feasibility Study of the USACE, i.e. once in 10 years. This is mainly due to the use of daily averaged peak discharges for the extreme value distributions instead of maximum or hourly peak discharges as used in the study of the USACE. Also the uncertainties in the model set up of for example the grid, the bathymetry and the estimation of the boundary conditions for the lateral inflows may explain these differences. However, the design discharges used in the HEC-RAS model of the USACE are quite the same as the hourly peak discharges found in this study. Therefore, the uncertainty lies mainly in the determination of the return times.

For the first scenario a reduction of the lateral inflows is defined, which can be achieved by storing precipitation in the catchment before it flows into the river. This scenario has the biggest positive effects on the flood safety in the city. A reduction of 15% of the total discharge in the river will increase the safety in the city by 50% in terms of return times. For scenario 2 two side channels are implemented near the sharp bend at Griffith Park and in scenario 3 a retention basin is created at the location of the Piggyback Yard. Both measures appear to have only local effects on the water levels and the safety for the city. For scenario 2 it can be concluded that the safety will increase locally by 30 to 50%. For the third scenario it can be concluded that only a retention basin without levees has positive effects on the safety locally by 12 to 16%. The measures could be very effective in solving other problems than safety, but this was not assessed in this study.

Table 1. Return times (once in x years) for the scenarios

	Station B	*Station C*
Reference situation	154	166
Scenario 1, 5% off	180	198
Scenario 1, 10% off	207	231
Scenario 1, 15% off	228	268
Scenario 2, first side channel	224	232
Scenario 2, second side channel	213	222
Scenario 3, with current levee		166
Scenario 3, with lower levee		167
Scenario 3, without levee		193

Figure 1: Part of the LA River near Griffith Park

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