

APPENDIX D –NAM model

D NAM model for the Kahibah Creek catchment

A NAM model for the Kahibah Creek catchment was developed to determine the critical durations and temporal patterns in the area.

A NAM model is a deterministic, lumped and conceptual rainfall-runoff model embedded in MIKE HYDRO River (DHI, 2021). It simulates overland flow, interflow, and baseflow components as a function of the moisture contents in four storages and the simulated flow can be directly added to the MIKE HYDRO River network for hydraulic routing.

For each of the network branches, a number of catchment areas were delineated and developed in the NAM model based on the DEM. For each of these, the same rainfall and reference evaporation data as the calibrated MIKE SHE model were applied.

For all simulations a $0.1\text{m}^3/\text{s}$ baseflow was assumed for Kahibah Creek while sea levels were set based on gauged data from the 1988 event at Ettalong 212423 station.

An automated optimisation procedure was employed to calibrate 13 key NAM model parameters. This calibration routine is based on a multi-objective optimisation strategy known as the SCE algorithm. Using this procedure in combination with the NAM models allows for the simultaneous optimisation of the 13 parameters to meet up to four distinct calibration objectives. The parameters included in the autocalibration process were:

- Maximum water content in surface storage (U_{\max})
- Maximum water content in root zone storage (L_{\max})
- Overland flow runoff coefficient (CQOF)
- Time constant for interflow (CKIF)
- Time constant 1 for routing overland flow (CK1)
- Time constant 2 for routing overland flow (CK2)
- Root zone threshold value for overland flow (TOF)
- Root zone threshold value for interflow (TIF)
- Root zone threshold value for groundwater recharge (TG)
- Time constant for routing baseflow (CKBF)
- Lower baseflow
- Recharge to lower reservoir (C_{qlow})
- Time constant for routing lower baseflow (C_{klow})

The autocalibration process optimised the above parameters to provide modelled runoff and flow from a number of creeks across the catchment. These data series were then compared against MIKE SHE 2D results from the 1988 event. Parameters were selected with the aim to minimise the RMSE and balance the overall water balance between these two series. MIKE SHE 2D results were used as the target data series as no historical flow monitoring data was available across the catchment.

Water level and creek flow optimisation was conducted across several locations throughout the area of interest. These locations are shown in [Figure D 1](#). Simulated NAM results were also compared to MIKE SHE 2D outputs across a number of locations in [Figure D 2](#) through [Figure D 9](#).

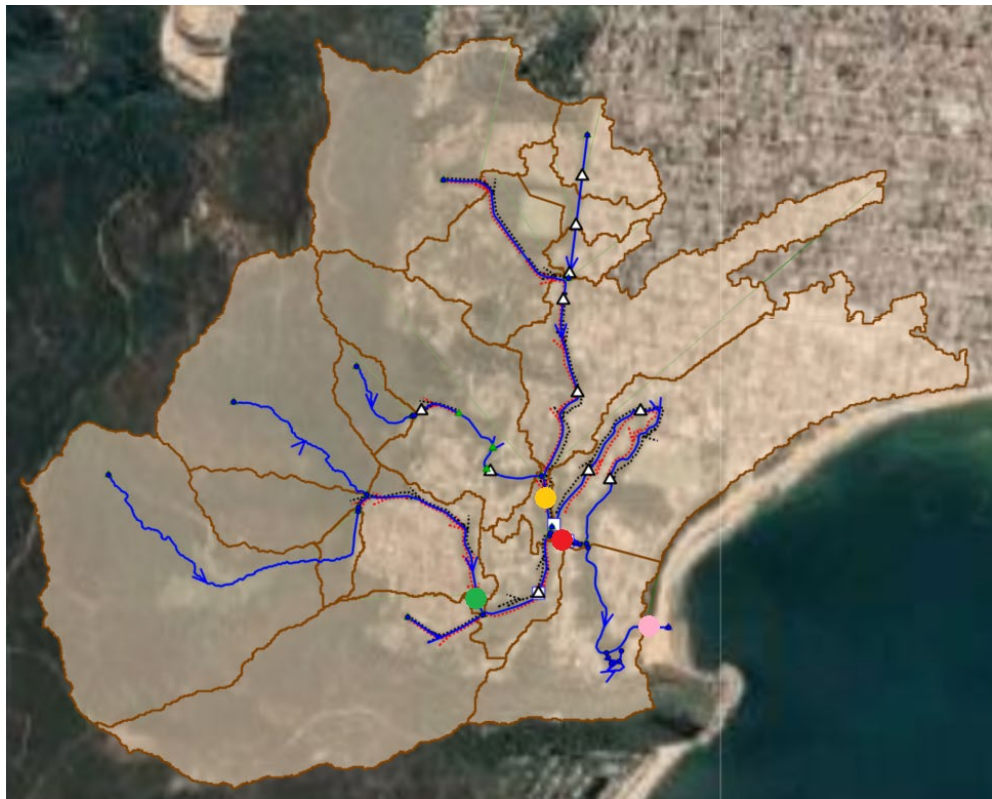


Figure D 1 Calibration site locations. Ettalong Creek-Outlet cross-section 3628.61 (rose), Ettalong Creek cross-section 800 (green), McLaurin Channel cross-section 45 (red) and Kahibah Channel Ceek cross-section 1640 (yellow)

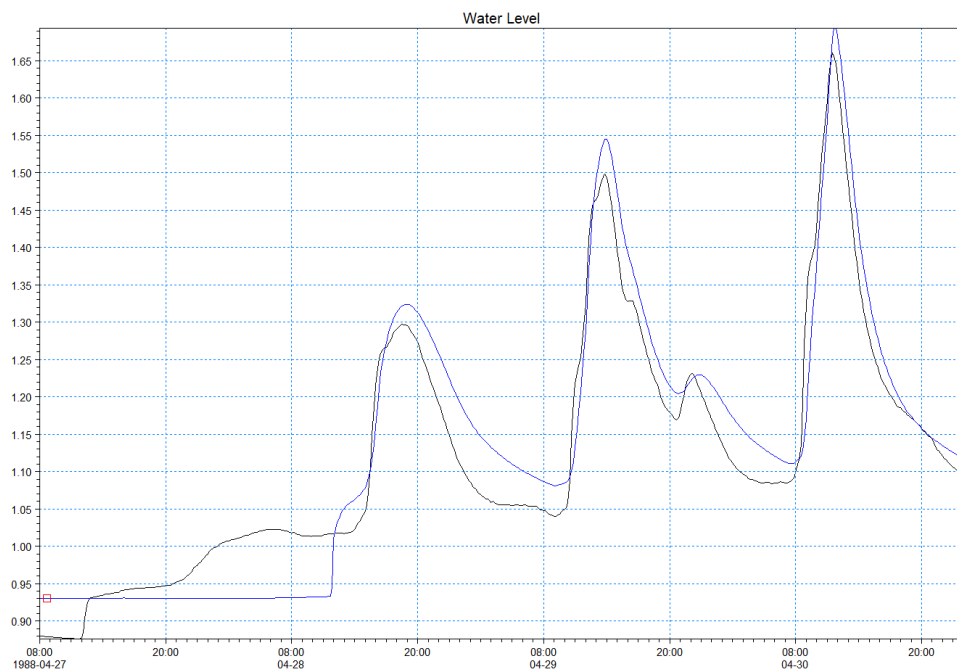


Figure D 2 NAM simulated water levels (blue) compared against the MIKE SHE calibration target (black) at Ettalong Creek Outlet cross-section 3628.61.

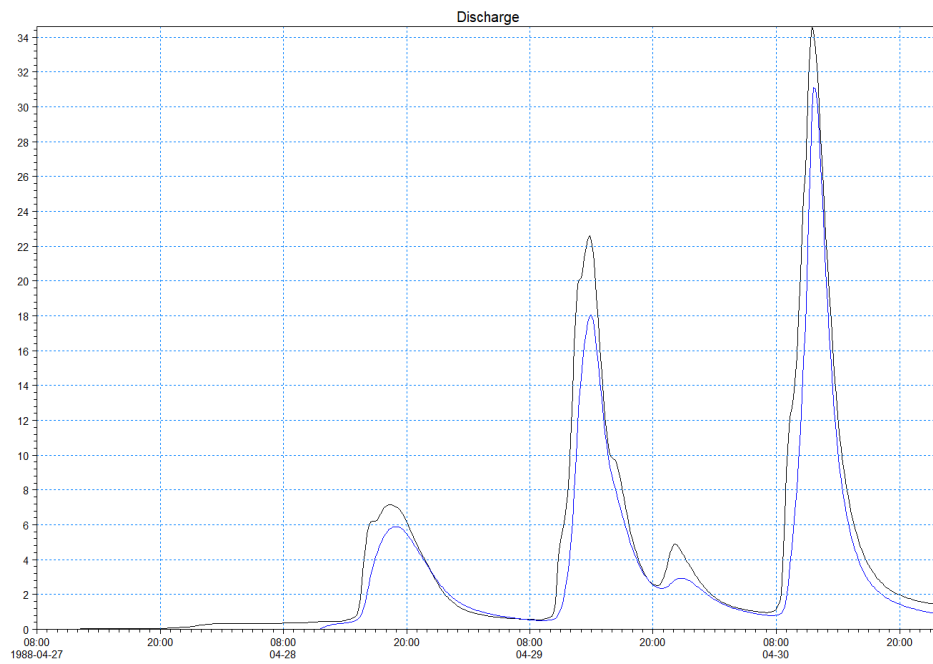


Figure D 3 NAM simulated discharges (blue) compared against the MIKE SHE calibration target (black) at Ettalong Creek Outlet cross-section 3628.61.

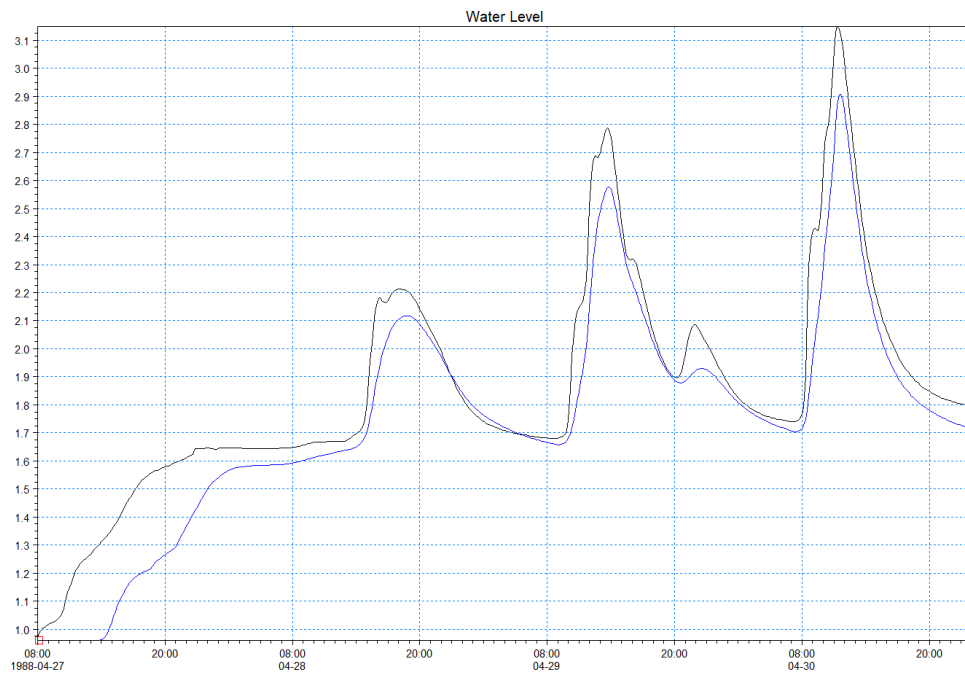


Figure D 4 NAM simulated water levels (blue) compared against the MIKE SHE calibration target (black) at McLaurin Channel cross-section 45.

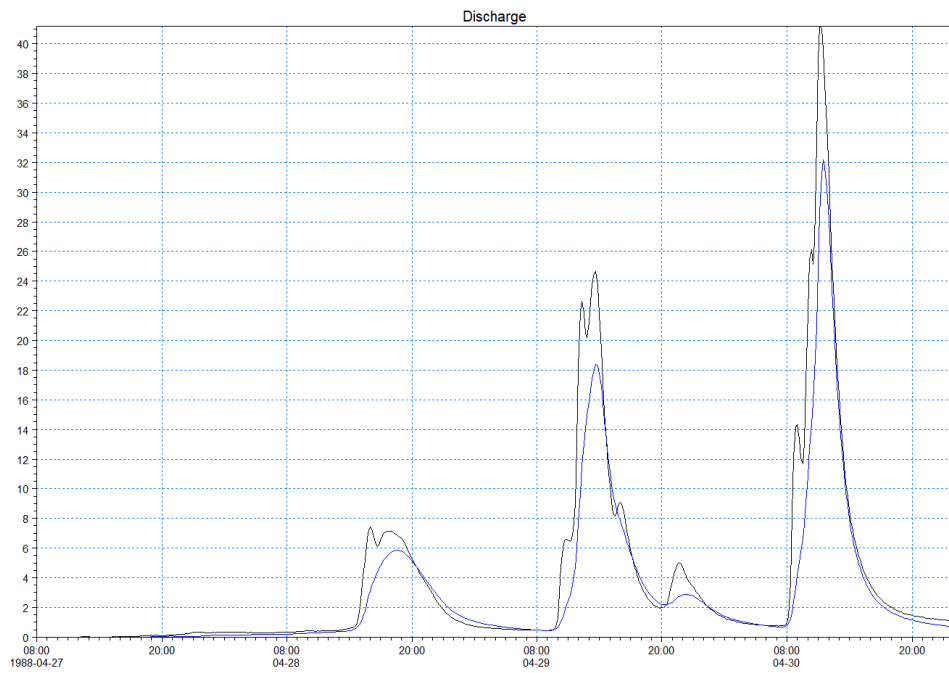


Figure D 5 NAM simulated discharges (blue) compared against the MIKE SHE calibration target (black) at McLaurin Channel cross-section 45.

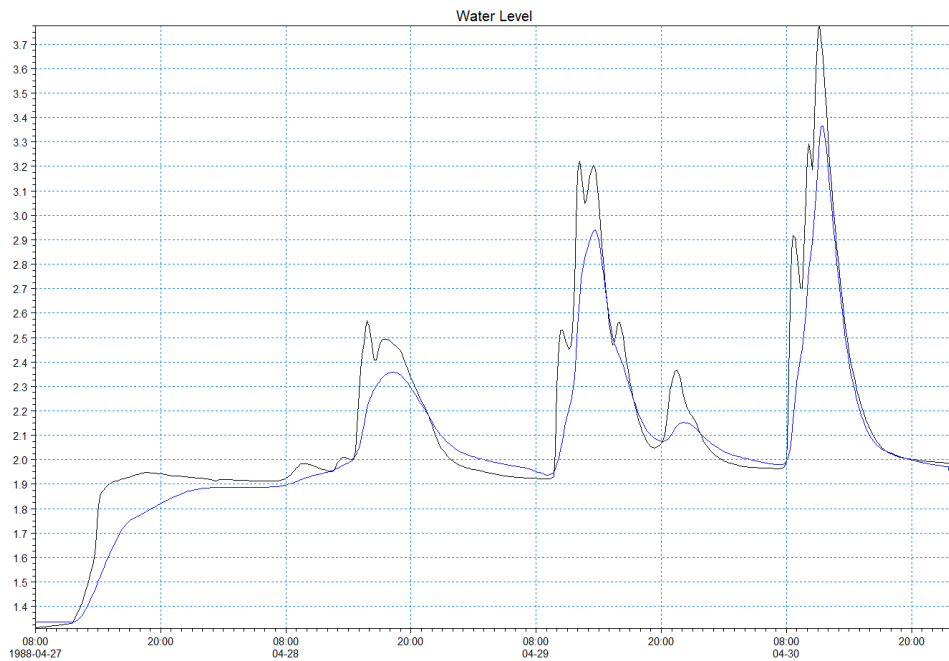


Figure D 6 NAM simulated water levels (blue) compared against the MIKE SHE calibration target (black) at Ettalong Creek cross-section 800.

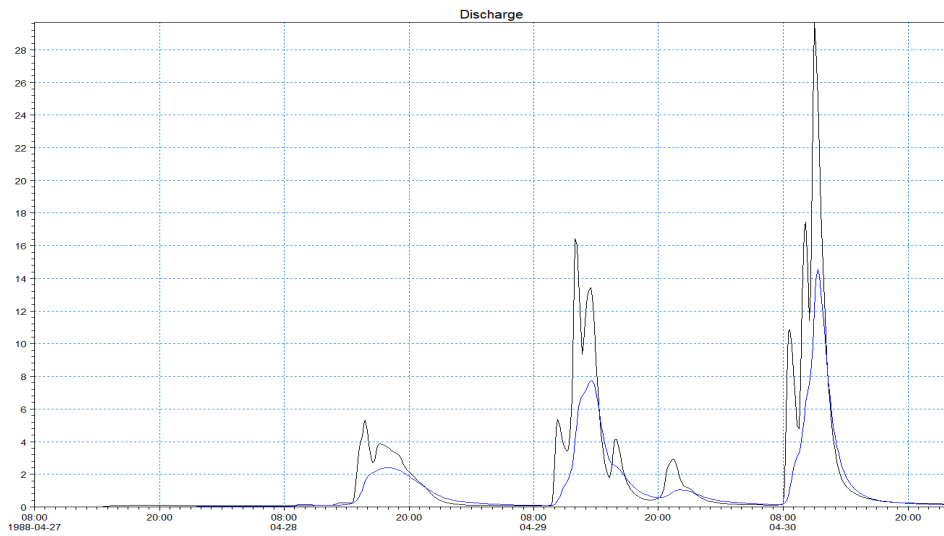


Figure D 7 NAM simulated discharges (blue) compared against the MIKE SHE calibration target (black) at Ettalong Creek cross-section 800.

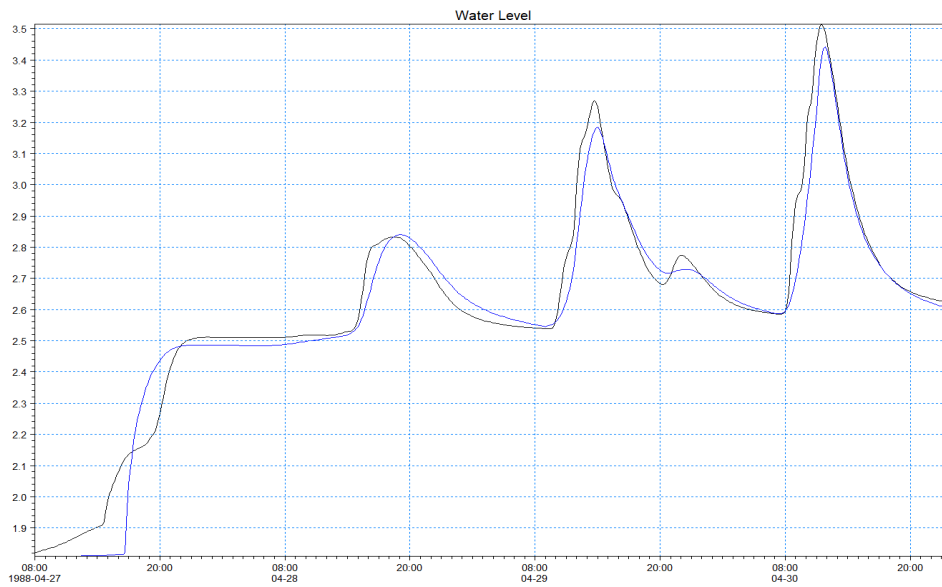


Figure D 8 NAM simulated water levels (blue) compared against the MIKE SHE calibration target (black) at Kahibah Channel Creek cross-section 1640.

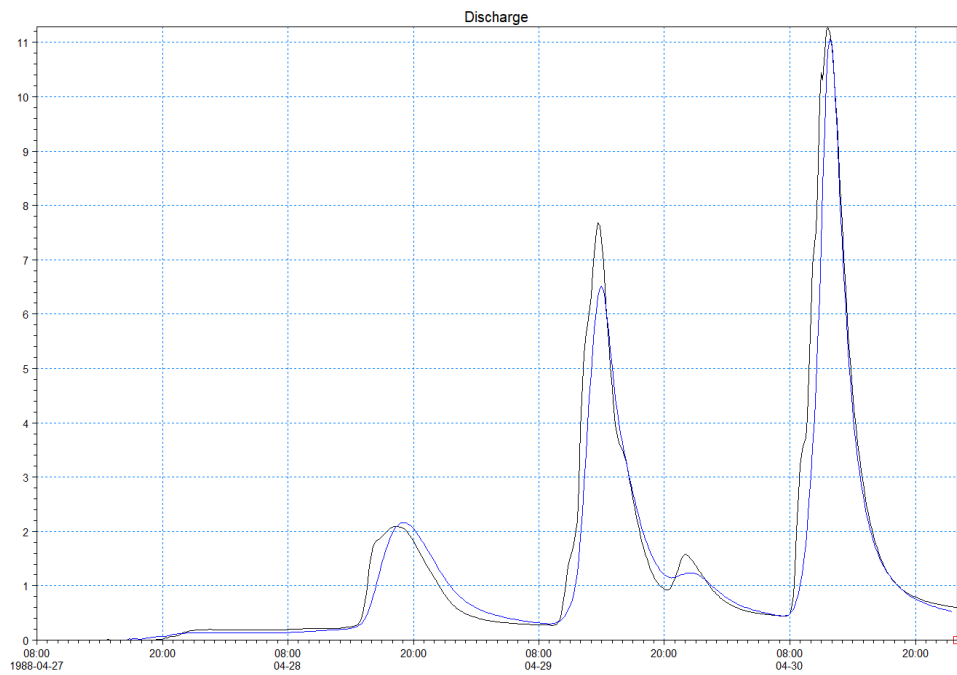


Figure D 9 NAM simulated discharges (blue) compared against the MIKE SHE calibration target (black) at Kahibah Channel Creek cross-section 1640.