Rapid Design

The location and long profile of the proposed rapid and internal surface boulder arrangement for the rapid feature is shown in Figure 1. This surface consists of keystone boulders up to 500 mm diameter arranged to stabilise the structure against flood shear forces and to act as anchor points for smaller boulders down to 100 mm diameter. These boulder sizes were informed by the initial hydraulic modelling of the feature linked to the shear stress values simulated for the 100 year return period flow. This was sense checked against field evidence of stable boulders seen across rapid areas elsewhere on the river. The placement is designed to create narrow short chute sub-channels where the energy from the overall hydraulic head across the structure is dissipated. These flow paths converge into pool areas created in the backwater of the larger boulder configurations providing low velocity resting areas for fish (Figures 2 and 3).

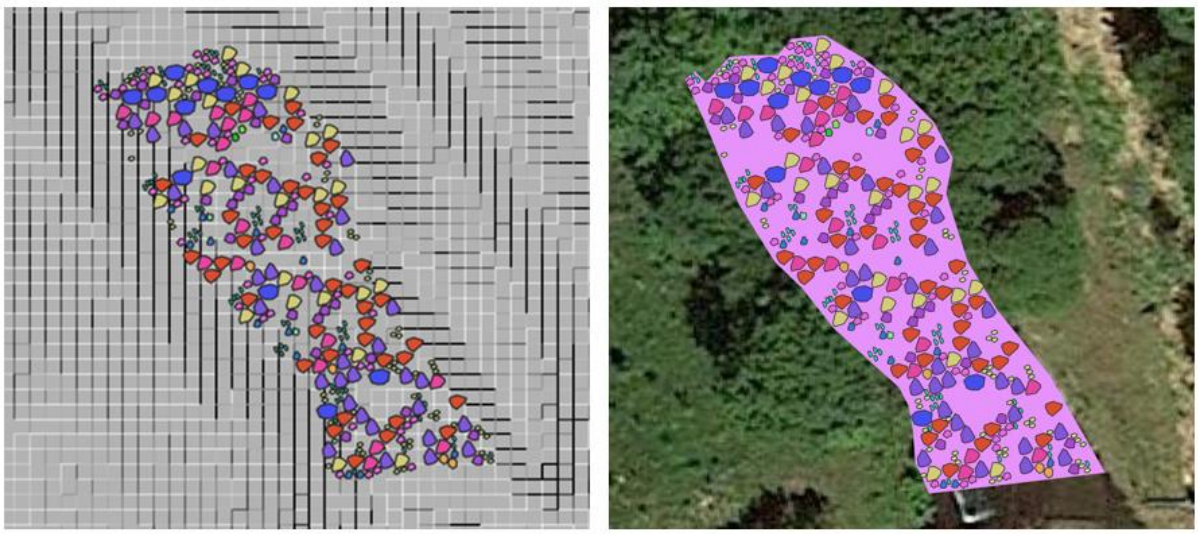

Figure 1. Generic rapid location and boulder arrangement.

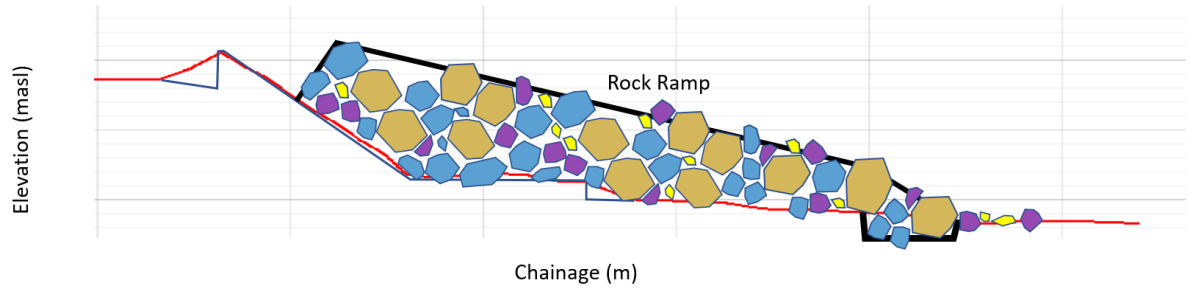

Figure 2. Example generic rapid long section.

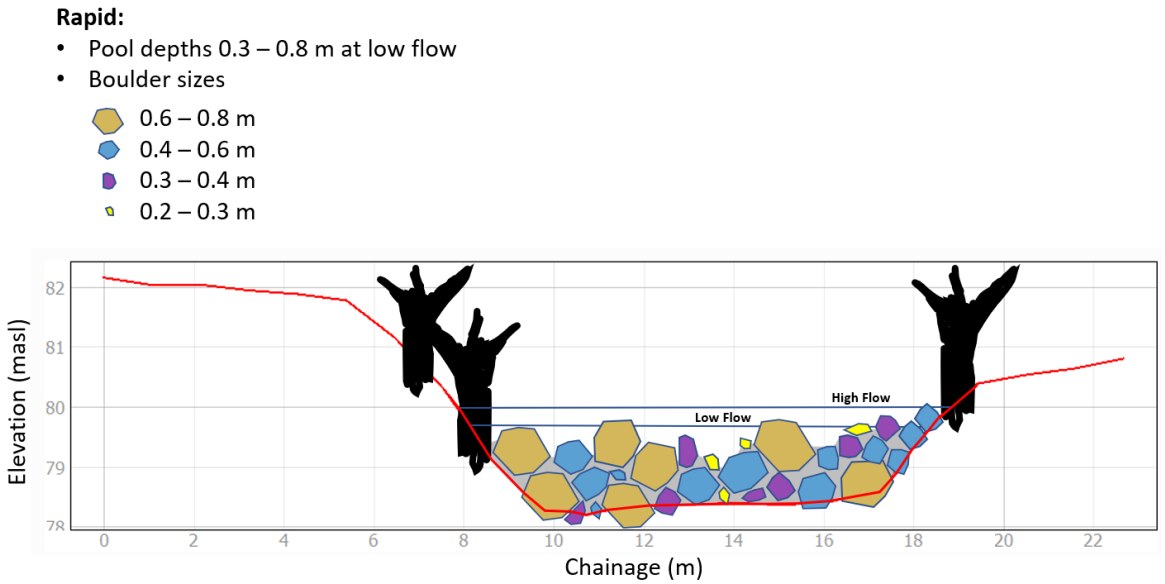

Figure 3. Example generic rapid cross-section

Rapid Build

The 1 m resolution LiDAR DTM was used as the baseline model surface in HecRas 2D. The footprint of the proposed rapid was introduced as shapefile and these two surfaces were used in Ras Mapper to alter the bed of the watercourse in the model to reflect the overall desired slope of the rapid. The area of the proposed rapid was densified 0.1 m to facilitate accurate representation of the bed. Individual boulders of varying sizes were introduced across the sloping surface to create the desired multiple pool-chute sub-feature morphology. Individual boulders were represented as angular polygons and the height variation was achieved through ramping each boulder surface to the desired height linked to their diameter using concentric internal polygon shapefiles.

As well as the physical form roughness created by the diverse boulder surface the rapid area roughness was increased to a Mannings ‘n’ of 0.065.