Norwich Western Link

Environmental Statement

Chapter 12: Road Drainage and the Water Environment

Appendix 12.3: Water Framework Directive Assessment

Sub Appendix B: Geomorphology Dynamics Assessment

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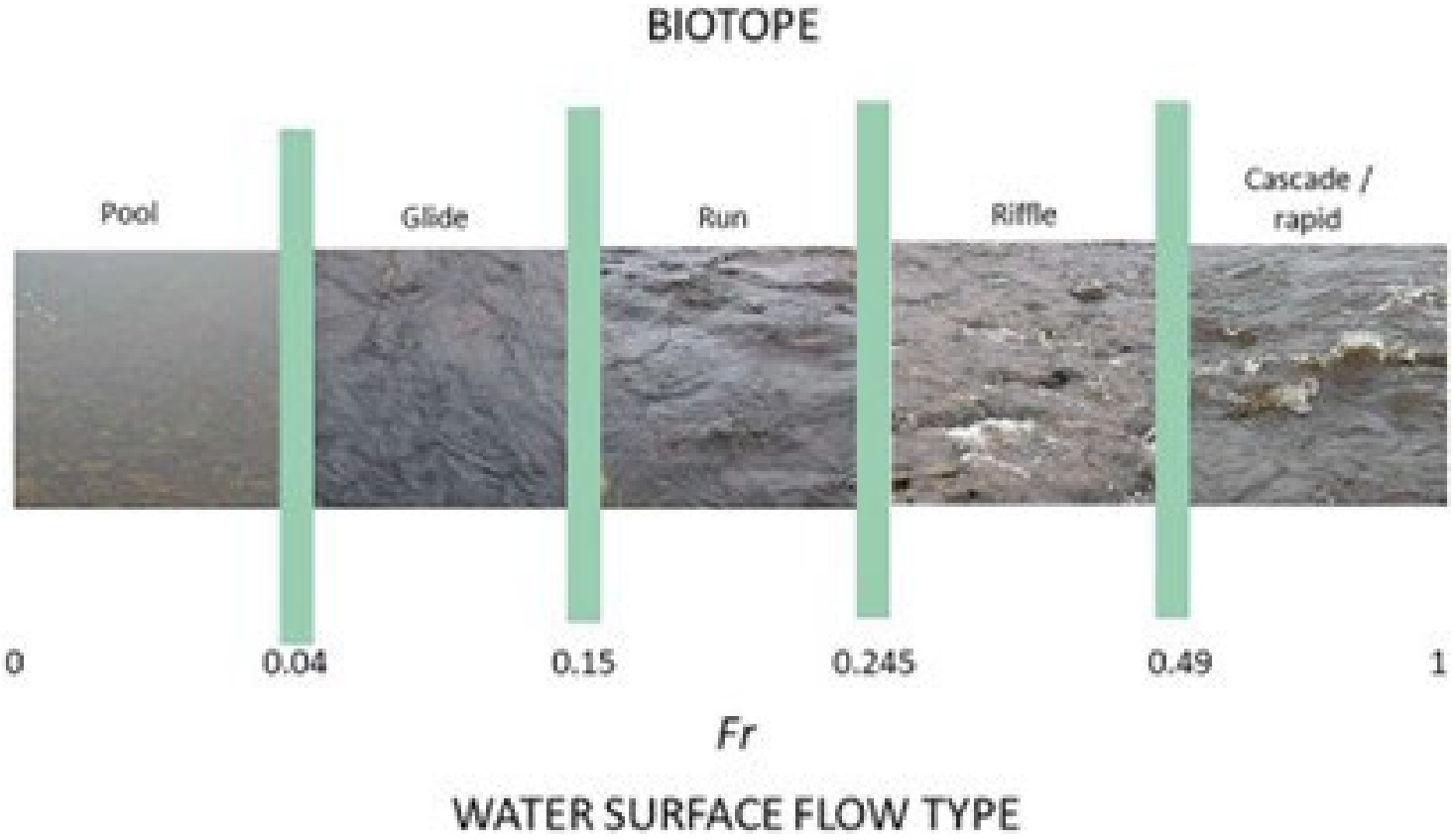
1 Geomorphology Dynamics Assessment

1.1.1 In addition to identifying forces responsible for driving change the assessment of the River Wensum considers the eco-hydraulics of the reach and demonstrates, quantifiably, the variety and variability of flow types (also referred to as 'hydraulic habitat' and 'biotopes') that exist across the flow regime. To meet this objective, the Froude number (Fr) was selected as an output variable from the hydraulic models and has been employed here as a surrogate for representing flow types.

1.1.2 The interplay of flow depth, velocity and bed roughness is widely reported as being the determinant process of physical habitat; therefore, Froude is the most commonly utilised variable for characterising flow. At Froude values below 1, flow is dominated by gravitational forces and is subcritical; whereas Froude values greater than one flow is dominated by internal forces and is supercritical (**Ref B.7**). In essence, the greater the Fr value, the more turbulent the flow. Froude number may be analysed in greater detail if Fr values between 0 and 1 are divided into sub-units that each represents a characteristic flow type (see **Ref B.7**) and is demonstrated in **Figure B-1**.

Figure B-1 Biotope characterisation determined by Froude number boundaries (source: Entwhistle et al., 2019 Ref B.7)



1.2 Hydraulic Modelling River Wensum

1.2.1 A fully two-dimensional (2D) hydraulic model was developed for the River Wensum in TUFLOW using a combination of Environment Agency aerial LiDAR (2m resolution) and topographic survey data. The hydraulic model has been produced to assess impacts the Proposed Scheme on maximum velocity (m/s), maximum depth (m), bed shear stress (Nm-2) Froud number (dimensionless), and stream power (W/m) for a range of return period peak flows (2-years, 5-years, 20-years, 100-years, and 100-years +20% climate change).

Figure B-2 2D hydraulic model set up