River infrastructure such as weirs and hydropower stations commonly present migrating fish with multiple potential passage routes. Knowledge of the cues fish use to navigate such environments is required to protect migrants from hazardous areas and guide them towards safe passage; however, this is currently lacking for many species. Employing high-resolution positioning telemetry, this study examined movements of downstream migrating adult European eel, Anguilla anguilla, as they encountered a complex of water control structures in one location on the River Stour, southern England. The distribution of eels across five potential routes of passage differed from that predicted based on proportion of discharge alone. Certain routes were consistently avoided, even when the majority of flow passed through them. Passage distribution was partially explained by avoidance in the vicinity of a floating debris boom. Movement paths were nonrandomly distributed across the forebay and eels moved predominantly within a zone 2–4 m from the channel walls. Understanding of avoidance and structure oriented movement exhibited by eels will help advance effective guidance and downstream passage solutions for adults.