

# FROM DRIPS TO DECISIONS: AN EVIDENCE-TRIAL-UPSTREAM FIX METHOD FOR MANAGING WATER INGRESS AT A SUB-SURFACE UNDERGROUND STATION

**ABSTRACT** Ageing rail assets, intensifying rainfall and constrained renewal budgets create a clear challenge: reduce safety and service risk without resource-interventions. This paper presents a transferable methodology for resolving rainfall-driven water ingress at a heavily trafficked, sub-surface underground station operating under brownfield and access constraints. The approach—Evidence → Trial → Upstream Fix—targets root causes, validates mitigations under controlled conditions and selects the preferred solution through multi-criteria whole-life assessment.

Incident–rainfall correlation and a catchment appraisal defined contributing areas and inflow routes, informing, targeted inspections and CCTV/dye checks mapped symptoms to sources at two hotspots, indicating life-expired waterproofing and capacity/condition deficits within the existing drainage serving the study areas, insufficient to satisfy return-period performance under applicable standards. To de-risk novelty before scale-up, the study executed a risk-controlled soffit “tapping” trial under a Safe System of Work (SSoW). Two 20 mm taps were installed in a back-of-house equipment room; monitored results confirmed trapped water and clarified where the technique is appropriate.

The approach used multi-criteria evaluation with whole-life cost and payback to eliminate symptomatic works and target interventions that remove root causes. Upstream remediation renews life-expired waterproofing and provides independent surface-water drainage with foul renewal where condition warrants it, rather than replacing like-for-like. Attenuation at source (blue-roof) and inlet control right-size the downstream network, reducing material use, fittings and maintenance, and aligning the solution with BS EN 12056 and the organisation’s drainage standard.

The approach delivers an application case, targeted innovation and a standards-aligned route from diagnosis to resilient concept. It is now informing portfolio renewals, with infrastructure managers initiating wider roll-out across comparable stations to cut abortive works, shorten payback and reduce maintenance burden. This provided a tool box for implementing low-carbon solutions for budget constrained infrastructure managers, to manage the combined effects of aging assets and climate change.