FILLBROOK RESERVOIR FLOW MONITORING STATION

DESIGN SCOPE

Located at 53°39'45.2"N 2°35'10.2"W, Fillbrook Reservoir is located north of Rivington Water Treatment Works. Fill brook feeds the reservoir at Anglezaeke. Access is off the highway via unmarked private access and farming land.

DESIGN CHALLENGE/MITIGATION

Due to the wide ranging flows associated with upland Surface Water hydrology, conventional weir structures are compromised. The compound Weir used is a complex two-step process which utilises the exponential component 2.5 for the triangular V at low flow rates and 1.5 for the broad crested weir at the higher flow rates. Utilising the compound weir allows the monitoring station to achieve flows in the range of 0.8–164 l/s.

To improve the coefficient of discharge Cd, the approach channel is short and therefore requires a flow straightener/ baffle. The flow straightener is designed to reduce the energy from the flow by means of a solid central section with the perforated holes geometrically placed at the left and right hand side of the dead zone. The holes have been equally spaced and elongated to prevent surcharge in high flow conditions.

TECHNICAL REQUIREMENT

- Redesign the approach channel flow straightener / baffle plate to accommodate the short approach length and improve normal velocity distribution
- Identify components of error, and qualify their compounded corresponding uncertainties using methods derived from statistical theory into an overall result for the measurement process
- Survey the current Compound V – Notch Weir and produce a software calculator for computing flow
- Survey the weir structure and approach channel and advice on suitability
- Produce a flow calculator to be used by United Utilities for the Compound V – Notch Weir

UNCERTAINTY BUDGET

Combining uncertainties of the notch angle and allowing for a 0.002m tolerance on the broad-crested weir the overall combined uncertainty of the compound weir Uc* (Q) is better than 7%. This is based on Cd Value uncertainties referenced in BS ISO 1438:2008 / 16/30301971 DC

0.8l/s to 164 l/s flow with an uncertainty of 6.7 % at the 95 % level of confidence is achievable

NON-MODULAR FLOW DISCHARGE

Due to downstream obstructions it is possible at times for the weir to become Submerged (drowned). As the modular limit of a full-width thin-plate weir is significantly influenced by the ratio h1/P, clearing of downstream obstructions should be removed prior to final commissioning of the Flow monitoring station. If the weir is to operate in the non-modular condition, there will be a need to survey the downstream hydraulic conditions. The downstream measurement head (h3) will be monitored independently and a drowned flow reduction factor (f) will be applied to the modular discharge equation.

For details of all calculations used for this design scope please contact Detectronic for the design file.

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