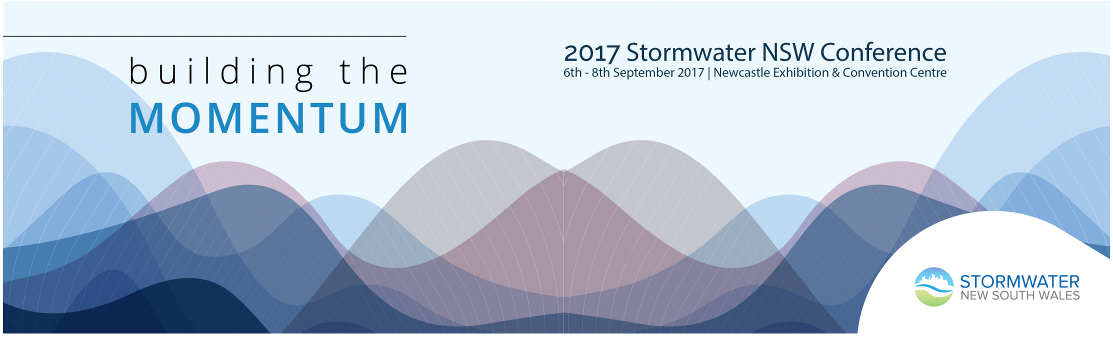

Understanding Complex Stormwater Systems Through Physical Modelling.

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Accurately predicting the behaviour of flows throughout stormwater systems is often difficult due to the complex interaction of stormwater channel junctions and separations. This complexity often leads to the tendency of hydraulic engineers to greatly simplify stormwater systems into one dimensional elements in numerical models with a single-head loss factor. For complex pipe junctions, head-loss factors are rarely static and vary significantly with water depth due to changes in flow regime from free surface flow and pressurised flow. The adoption of a single head loss factor relating head loss to approach velocity is not appropriate for such systems due to their changing response to flows regimes and the development of vortices and fluctuations in velocities. At a minimum, the stormwater designer should consider which flow regime is most likely to occur and which has the potential for adverse impacts. In highly complex stormwater systems construction of a scaled hydraulic physical model may be the only reliable tool available to gain an understanding of the system. . It is often difficult to establish numerical models that accurately capture the complex three dimensional flow behaviour in stormwater systems and thus predict their potential for adverse impacts. In these situations, construction of a scaled physical model is a well established engineering approach providing accurate predictions on how hydraulic structures will operate and their resilience to change.

This paper will showcase learnings from analysis of multiple hydraulic physical models from the Sydney area undertaken at the UNSW Australia Water Research Laboratory. Example systems include a complex stormwater junction chamber, a gross pollutant trap and a large 10 m diameter circular junction caisson, In particular the presented models demonstrate that open channel systems with mild grades are particularly sensitive to changes in downstream tailwater conditions. Furthermore, these models demonstrate that that the choice of a single k- factor is not an appropriate assumption as is common practice in stormwater design.