Geophysical Research Abstracts
Vol. 18, EGU2016-18238, 2016
EGU General Assembly 2016

Sediment transport mechanisms through the sustainable vegetated flow networks

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Understanding the pollution treatment efficiency of a sustainable urban drainage (SuDS) asset or network requires the influx, transport, detention and discharge of the pollutant within the system. To date event specific monitoring of sediment (primarily total suspended solids) concentrations in the inflow and discharge from SuDS have been monitored. Long term analysis of where the sediment is transported to and the residency time of this pollutant within the SuDS asset or network have not been unraveled due to the difficulty in monitoring specific sediment particulate movement. Using REO tracing methodology, sediment particulate movement has become possible. In tracing sediment movement from an urban surface the internal residency and transportation of this sediment has illustrated SuDS asset differences in multi-event detention. Of key importance is the finding that sediment remains within the SuDS asset for extended periods of time, but that the location sediment detention changes. Thus, over multiple rainfall-runoff events sediment is seen to move through the SuDS assets and network proving the assumption that detained sediment is permanent and stationary to be inaccurate. Furthermore, mass balance analysis of SuDS sediment indicates that there is notable re-suspension and ongoing release of sediment from the SuDS over time and cumulative rainfall-runoff events. Continued monitoring of sediment deposition and concentration in suspension illustrates that sediment detention within SuDS decreases over time/multiple events, without stabilizing within a 12 month period. Repeated experiments show a consistent pattern of detention and release for the three SuDS networks monitored in Scotland. Through consideration of both rainfall and flow factors the drivers of sediment transport within the monitored SuDS have been identified. Within the limitation of this field study the key drivers to SuDS sediment detention efficiency (or transport of sediment through the system) have been identified as flow velocity, wetted surface area, stream power, rainfall occurrence and depth, Fr, Re and Rep.