CASE STUDY

Assessing the contribution of the Lid Brook to sediment and nutrient pollution on the By Brook – a tributary of the Bristol Avon near Bath

Bristol Avon Rivers Trust and Wavelength Environmental undertook intensive monitoring during two storm events to establish baseline conditions prior to the implementation of remedial works along the watercourse.

Figure 1: Examples of habitat destruction identified during catchment walkovers

Aims and scope

Water quality monitoring was carried out on the Lid Brook and on the By Brook, downstream of the confluence with the Lid Brook during two 24 hour wet-weather events in December 2013 and January 2014. The Lid Brook was chosen for this work as it has been identified as one of the most heavily impacted watercourses in the catchment, in terms of riparian damage from livestock poaching (Figure 1) and so was a primary focus for fencing and remedial works during phase 1 of the By Brook project. The intention is that these data will form part of a simple bio-geo-chemical baseline understanding of the state of the Lid Brook, ahead of implementation of remedial works, (fencing, provision of drinking troughs and gateway repositioning) against which, future improvements can be measured.

Experimental design and field monitoring

The primary focus of the field monitoring was to assess pollution due to suspended sediment and nutrients – especially phosphorous. As sensors for in-situ determination of phosphate and suspended sediments are beyond the budget allocated for this project it was decided to use automatic water samplers to take regular samples during storm events and to have those samples analysed at an accredited laboratory. Flow measurement was carried out using an area velocity flow sensor which measures flow velocity and water level and computes discharge, given the channel cross-sectional area. Estimations of total pollutant load can be made by coupling concentration data from the water samples (i.e. ‘x’ mg/l suspended sediments multiplied by a flow rate of ‘y’ liters/sec will yield a total load of ‘z’ kg sediment (Figure 2). To enable an estimation of flow volumes at multiple sites with only one area velocity flow sensor, lower cost level sensors were installed at other

suitable sites. Once the area velocity sensor had been deployed at one site over a range of flow conditions a level/flow relationship specific to that site, could be defined. The flow sensor could then be moved to another location (where level alone had already been measured) to compute the equivalent level/flow relationship for that site. In this way it was possible to calculate flow volumes (and therefore pollutant loads) for multiple sites during multiple events with access to only one flow sensor.

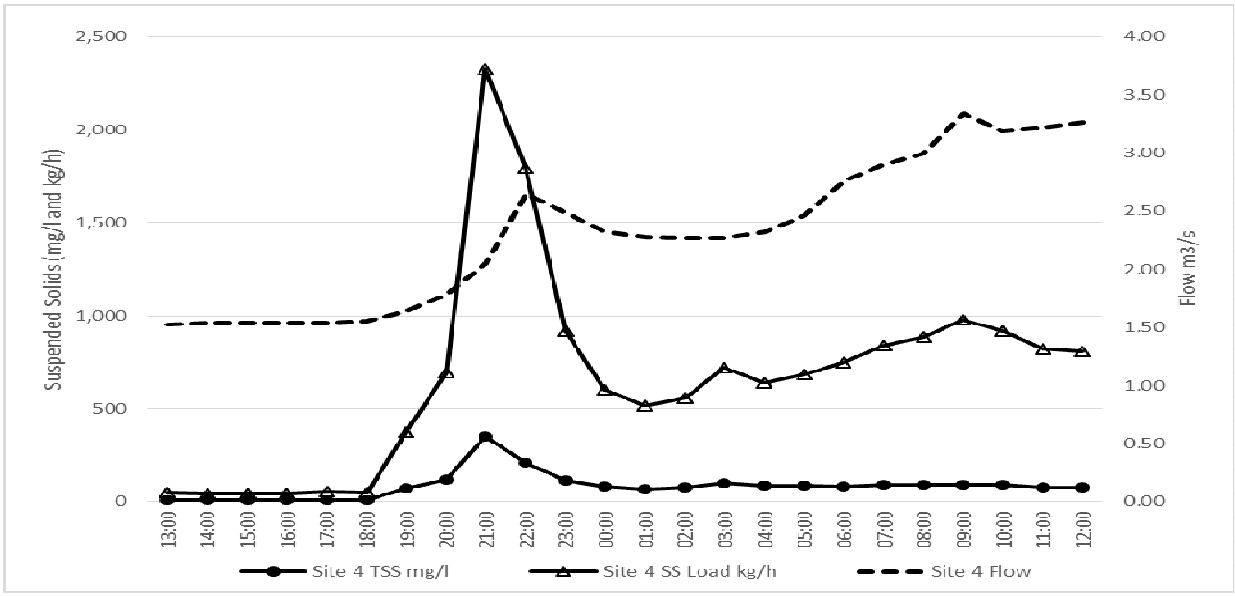

Figure 2: Example graph showing suspended solids concentration (mg/l) and load (kg/h) with flow (m^3/h) in the main By Brook during wet weather event 1

Results

This study showed that, during the 48 hours over which samples were taken, approximately 6 tonnes of soil were lost from the Lid Brook catchment, almost two thirds of which was lost from the lower section of less than 1 km in length. During the same period, approximately 46 tonnes of soil were recorded as suspended sediment in the By Brook. Associated with this sediment was approximately 85 kg of phosphorus. Given that monitoring was carried out over just two of a series of rainfall events over the winter period, soil loss from the catchment over the winter period was likely to have been in the region of several hundreds of tonnes at the very least. While a proportion of this would have been expected as part of the natural process of soil movement, it is clear that a significant amount was the direct result of poor land management practices, as evidenced in the Lid Brook.

Monitoring instrumentation used in this study.

This study used a variety of monitoring technologies in order to carry out a detailed assessment of a small sub-catchment for specific storm events at a high temporal resolution. Automatic samplers were used to take 24 hourly samples across the two separate storm events. In this instance the samplers were programmed and triggered by staff and volunteers from Bristol Avon Rivers Trust. Technologies are available for automated, remote triggering of samplers where the study area is more remote. The combination of area velocity flow sensors with low cost level sensors is particularly useful for the headwaters of catchments where multiple sites need to be measured and budgetary or practical constraints prohibit the installation of primary flow measurement devices (weirs, flumes etc.).