Letcombe Brook volunteer sediment and phosphate survey, Spring 2013.

Summary of data and suggestions for further work by Sian Davies, 29/10/2013

The remit of the work was to take water samples for phosphate analysis during dry weather and wet weather and, during dry weather identify potential sources of sediment to the brook and sediment lying within the brook, during wet weather to identify sources of sediment to the brook.

Water samples were analysed for phosphate using field test kits. These kits enable appropriate phosphorus analysis reagents to be added to the sample and provide colour charts allowing the sampler to estimate the phosphate content of the sample; the intensity of blue colouration in the prepared sample is directly proportional to the concentration of phosphate in the sample. The kits are known to perform poorly at low phosphorus concentrations but are ideal for identifying high-concentrations in water samples.

Volunteer surveyors were provided with maps indicating the stretch of river they should survey and on which to record the phosphorus concentrations they found and the sediment sources they noted. These were returned, with more or less additional information by each surveyor. The accompanying powerpoint file provides maps of the brook and a summary of the data returned. They also include two time series plots of Environment Agency phosphate data from sample locations down the brook.

Letcombe Brook Phosphate data

The results were a little variable, which is to be expected given the nature of the test kits. However, concentrations were clearly higher (~300ug/L) down stream of Wantage sewage treatment works, than they were up stream (ranging from 0 to 200ug/L). It is worth noting that the phosphate test kits are increasingly unreliable the lower the actual phosphate concentration. However, individual surveyors may be able to indentify relative differences between samples. In Grove, the samples collected during the wet weather period had higher concentrations than those collected in dry weather, whereas in the Upper Letcombe Brook section the samples had lower phosphate concentrations during wet weather than dry.

Elevated phosphate concentrations during wet weather could be associated with urban diffuse run-off from pavements and drains within built up areas, especially if the rain is the first following a prolonged dry period. Conversely, lower concentrations during wet weather can be caused by dilution of a constant source of phosphate, such as sewage works effluent or septic tank drainage, by rain water.

The Environment Agency phosphate data for the Letcombe Brook is shown in the accompanying powerpoint file. The graphs show a time series of data from January 2000 to the present. The impact of the sewage effluent from Wantage STW is clearly shown, as phosphate concentrations in the river below the works (sample point POCR0006) are much higher than at any of the sample points upstream of the STW.

The phosphate concentrations in the river down stream of Wantage STW show a number of patterns. The concentrations in the summer tend to be a lot higher than those in the winter. This is because the works discharges a reasonably constant volume of effluent at a constant concentration which is diluted more or less by river water. Dilution is high in the winter when

river levels are high, so the concentrations are lower than in the summer when river flows are low and therefore dilution is low. From mid 2005 onwards, the concentrations in the river downstream of the STW are significantly lower than prior to this date. This coincides with the installation of phosphorus stripping on the final effluent, which results in an effluent phosphorus concentration rarely exceeding 1mg/L, many times lower than the effluent concentration without P removal.

Sample points upstream of Wantage STW show a different picture. Phosphate concentrations are much lower, around 0.05 mg/L (that is 50ug/L) and tend to be higher in the winter than the summer. There are no values shown below 0.02mg/L because that is the limit of the method. In reality, some of those concentrations would have been <0.02mg/L. The overall low concentrations of phosphate are because there are no town or village STWs discharging to the river and the phosphate there is is derived from a mixture of rural and urban land-use and phosphate discharged from private, (usually) single-dwelling sewage treatment works and septic tanks via soak-a-ways.

Higher phosphate concentrations in the winter than the summer are generally associated with P washed in from the catchment during wet weather, either from urban or rural catchments, and may also be associated with release of P from the in-stream sediments, especially when they are resuspended. This pattern of phosphate variation through the year tends to indicate that there are no significant, continuous sources of P to the river, such as STWs, but could also be associated with other polluting but non-consented activities.

The phosphate concentrations measured by the volunteers in the spring of 2013 using the field test-kits are broadly in line with the data from the Environment Agency, especially down stream of Wantage STW, but probably tend to over-estimate the concentrations which are likely to occur upstream of the sewage treatment works.

Letcombe Brook sediment information

Information collected on sediment in the brook is less quantitative and more difficult to record than for phosphate. Probably for this reason less information was gathered, and crucially, less information was obtained during wet weather. However, from the information collected, it appears there were few clear sources of sediment to the river in the low-lying areas, with the exception of a few specific locations where poaching by livestock is a problem in the farmed lower reaches of the river. In the steeper headwaters, clear evidence was provided of some sources of sediment. Most of these were recorded as being from erosion of road verges rather than run-off from agricultural land or built up areas. It appears that not all of the steep roads generate sediment which ends up in the river, as effective “grips” on some of the roads are able to divert sediment onto nearby land rather than the river.

The stretch of river between Letcombe Regis and Wantage do not appear to have been assessed during this monitoring programme.

Some information provided alludes to the accumulation of sediment in the river channels at certain points in the river. This is likely to be a specific problem where ever the flow is slow. This can occur behind weirs and structures, where the water “ponds” behind the structure, and anywhere where the river is widen and/or over-deepened. Widening and overdeepening has the effect of allowing the channel to hold more water during high flows, but during normal flows provides too much space for the river water which consequently slows in flow

and the sediment being transported by the water drops out, settling in the river bed. Water held behind structures, even quite small ones, also allows the suspended sediment to drop out of the water column and accumulate on the river bed.

Interaction between P and sediment and impacts on riverine ecology.

Sediment can be a source, a carrier or a sink for phosphorus. Sediment, regardless of it's phosphorus content can also have environmental impacts, including smothering of fish spawning gravels, clogging the gills of fish and invertebrates and making river beds unsuitable for growth of most macrophytes. Fine sediments are the biggest problem in terms of physical impact on aquatic ecology and also have the highest capacity to carry phosphorus.

Sediment washed in to the river by rain from agricultural activities (e.g. ploughing, poaching by livestock, movement of farm vehicles into and out of fields, compaction of soils and trackways) can often contain high concentrations of phosphorus, especially from highly fertilized land or livestock. Other sources of sediment from the catchment, such as erosion of road side verges might contain less phosphorus. Sediment sources from urban areas will be very variable in terms of their phosphorus content.

Once settled onto a river bed sediment can release phosphate into the overlying water, either when the sediment is resuspended (e.g. during high flows) or if the sediment becomes anoxic. This can happen when the organic matter content is high and bacterial activity uses up all the oxygen. Sediment can also "bind" additional phosphate, especially when the water column has high phosphate concentrations as you might expect to find down stream of a sewage treatment works. However, if the phosphate in the overlying water is reduced, as will occur when P-removal is installed at an STW, then the sediment can become a source of P for some time following the change. Fine sediment is more able to bind phosphorus than course sediment, partly because of the type of chemical interactions involved and partly because fine sediments have a relatively higher surface area than course sediments.

A combination of too much fine sediment on river beds, the elevated phosphorus concentrations they often contain and elevated river phosphorus concentrations can have major impacts on the aquatic ecology. In the upper stretches of the Letcombe Brook, where phosphorus concentrations are quite low, speeding up the flows to clean gravels and push sediment through the entire river system, alongside implementation of measures to reduce the sediment sources, would help to improve river ecology.

Suggestions for further work

The information provided by the volunteer monitoring project from spring 2013 has indicated that phosphate concentrations are broadly in line with data already held by the Environment Agency. Furthermore, the phosphate test kits are of limited value where phosphorus concentrations are low, as is the case in the Letcombe Brook. Consequently there would appear to be little value to be gained in furthering the phosphate monitoring aspect of the work.

However, the assessment of sediment, in-stream and catchment sources, could be carried out in more detail. Some additional catchment surveys, carried out in wet weather in other seasons, would help to pinpoint the sediment sources within the catchment. Autumn/Winter

surveys, when fields are ploughed would help to identify if there are particular hotspots of sediment coming from agricultural land. This would be valuable work to establish whether the majority of sediment sources are purely from eroding road verges or if in fact there are agricultural sources too. The control measures which could reduce the different sources of sediment would be quite different.

The river section between Letcombe Regis and Wantage, including the Manor Road Farm tributary should also be surveyed for sediment sources.

If sediment sources can be clearly pinpointed at different locations and times of year, it is likely that staff from the EA and Letcombe Brook Project would be able to provide help and guidance in finding ways to reduce these sources, possibly in conjunction with the volunteers involved in this project.