An assessment of WFD compliance in Yorkshire's river catchments

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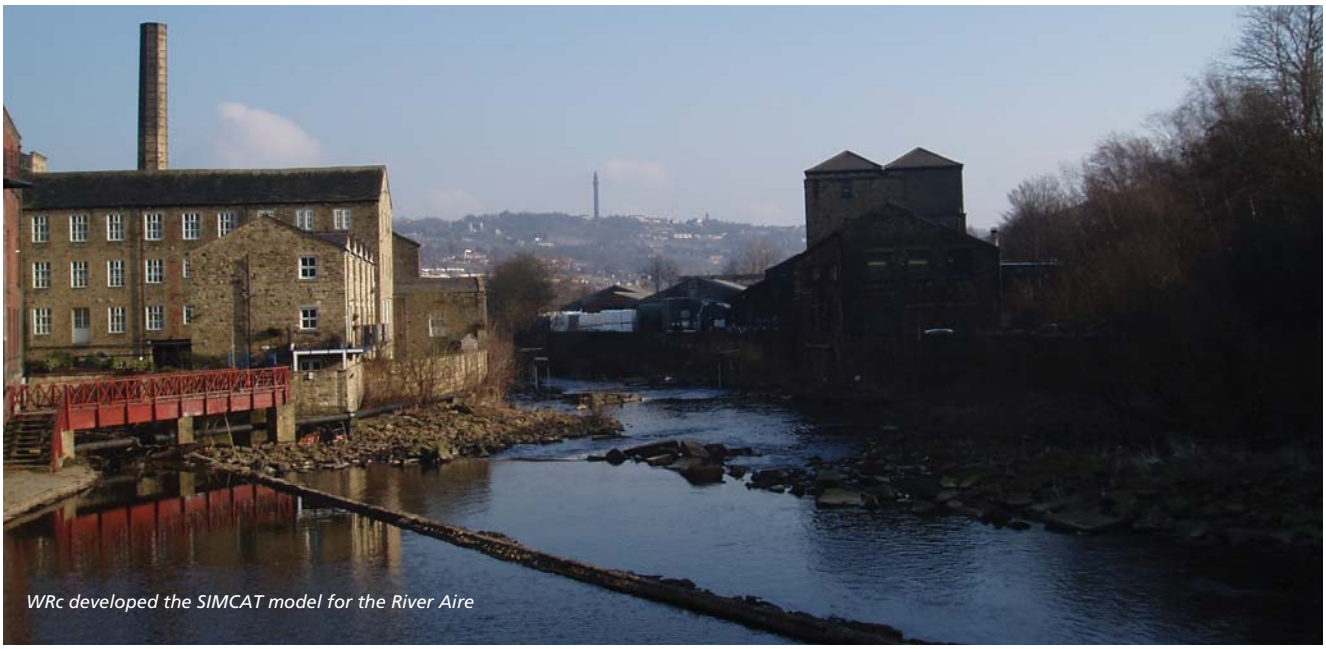
Complying with the EC Water Framework Directive[1] – 'the WFD' – water quality standards for 'good ecological status' in England and Wales potentially require a range of Programmes of Measures (PoMs) to control point and diffuse sources of pollution. The WFD will drive improvements in water bodies over the next 20 years. Therefore, it is vital to understand the implications of the WFD for long-term environmental planning, including the degree to which the requirements of the WFD can be met; and, the options for improvements to assets across a range of business sectors.

Computer-based water quality modelling can be used to understand the sources of pollution impacting on water quality and to identify how the greatest benefit can be achieved through point source and diffuse pollution reduction. This information is essential to target cost-effective investment by environmental regulators, water companies, industry and those with responsibilities for diffuse pollution from agriculture, urban runoff and other sources. In the UK, river water quality modelling with the Environment Agency's SIMCAT model[2] is regarded as the best current approach to support decision making for river water quality planning.

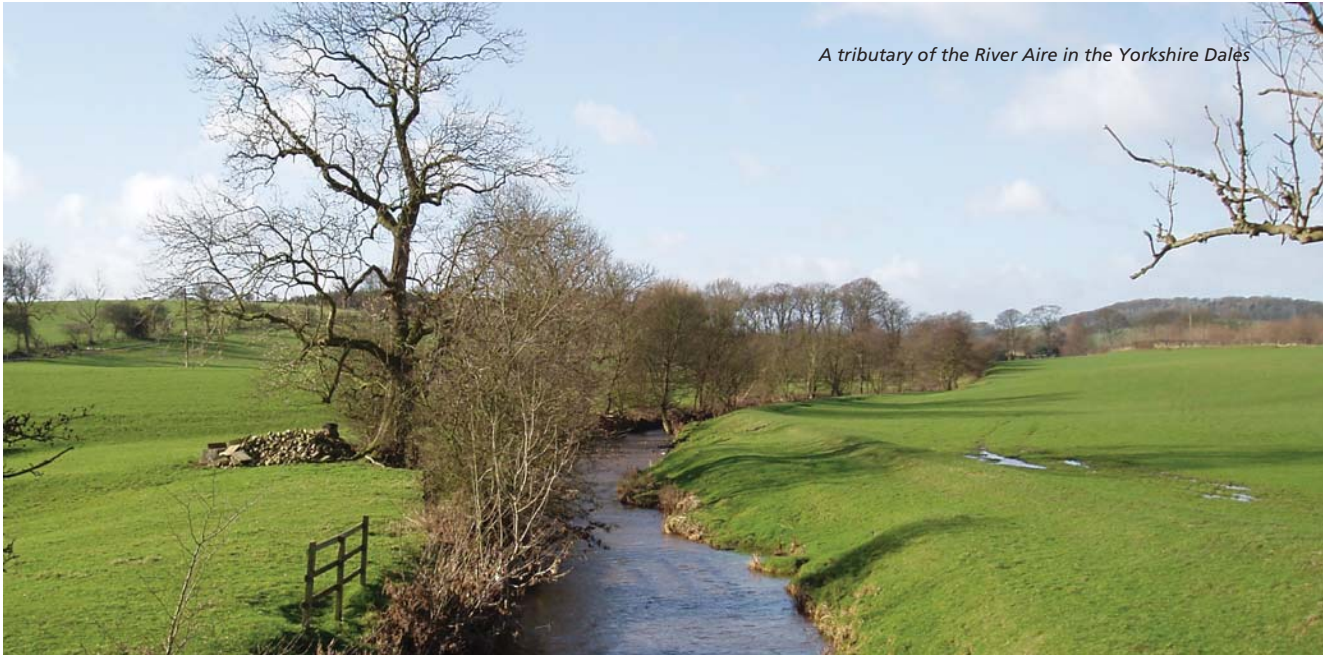
Under the WFD, surface waters are categorised by water body into different typologies according to their physical and chemical characteristics. The typologies indicate, in very general terms, the sorts of plants and animals likely to be present in undisturbed conditions[3]. Phosphate standards do not contribute to 'good chemical status' but phosphate is one of the Annex VIII substances for 'good ecological status' and, therefore, in-river concentration standard must be set for each water body.

A recent WFD SIMCAT pilot catchment study, applied to the Ribble catchment in North West England[4], indicated that the WFD water quality standards[3] for phosphate pose a major technical and financial challenge to achieving compliance by measures to control both point source and urban and non urban diffuse pollution. Also, currently proposed measures, focused on point source reduction, may not deliver cost-effective ecological benefits as an outcome.

There are 488 river water bodies in the Yorkshire region in the North East of England. Typically, the WFD phosphate standards for these water bodies range from 0.02 to 0.12 mg/l as an annual average orthophosphate (PO_4-P) concentration. The more stringent standards tend to be applied to the higher quality rivers in North Yorkshire, such as the Ouse and Derwent, compared to the rivers in the



WRc developed the SIMCAT model for the River Aire



A tributary of the River Aire in the Yorkshire Dales

more industrial south of the county; for example, the Calder and the Rother catchments.

SIMCAT models for the main river catchments of the Yorkshire Region – the Hull, Aire, Don, Ouse, Derwent and Esk – were developed by WRc with joint funding from the Environment Agency and Yorkshire Water between 2003 and 2008. These models are based on the Environment Agency's routine river and effluent monitoring data for the five year period of 1998-2003. The models are being used as water quality planning tools for both individual catchments and regional modelling studies.

In part, these studies are considering the relative impacts of point source and diffuse pollution across each catchment and, therefore, the potential benefits and costs of measures to reduce both pollution sources to achieve WFD water quality standards in the most cost-effective manner. An initial focus for a regional study was to identify the water quality benefits and improved compliance with WFD standards that could, potentially, be produced by point source, sewage treatment works (STW) discharge controls alone. The scenarios focused on phosphate, but also included BOD, ammonia and nitrate, and assessed a number of scenarios:

- current actual STW effluent performance;
- current STW effluent discharge limits;
- future STW effluent discharge limits; and
- current technology limits for phosphate removal at STWs as specified by the Environment Agency. The discharge limits applied were: annual average 1mg/l for STW population equivalent (PE) > 1000; annual average 2mg/l for STW with PE <1000; and no limit applied to STW with PE <250.

Currently, 45% of the Environment Agency's river quality monitoring sites comply with its WFD phosphate standards. The majority of failures occur in South Yorkshire. Compliance varies between individual catchments, ranging from 75% for the Esk catchment to 36% for the Don catchment. However, there is little evidence to indicate that river biology is being adversely impacted by eutrophication, except at a small number of locations.

The results from the modelling scenarios demonstrated that effluent discharges are the largest source of phosphate in the more urbanised Aire, Don and Hull catchments. However, diffuse pollution is the largest source in the more rural Ouse, Derwent and Esk catchments. At a regional scale, diffuse pollution is the largest source of phosphate at 54% of the average input of approximately 10 tonnes per day. Diffuse pollution is also the largest source of BOD, ammonia and nitrate.

The results produced for a range of potential, future discharge control scenarios indicate that phosphate removal at current technology limits applied to all 256 STWs with PE> 250 would produce a reduction of 67% of the current STW input and 32% of the total river load. However, this would only result in an additional 7% of river monitoring sites meeting their WFD phosphate standards.

The SIMCAT results show that achieving WFD compliance across the region will be a major challenge. Phosphate (and other) standards cannot be met by STW discharge control alone. Achieving full compliance, if appropriate, will require targeted investment in future measures to reduce both point source and diffuse pollution across all catchments by both economically and environmentally sustainable measures.

References

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