Visualisation & Modelling for Stakeholder Education in Sustainable Water Treatment

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It is the aim of current European legislation, especially the Water Framework Directive (WFD), to create cleaner rivers and lakes throughout Europe. Under the WFD the UKs rivers must adhere to a number of environmental quality standards (EQS) which limit the levels of specific contaminates in the water. These contaminants come from a wide range of sources such as food additives present in faeces, agricultural runoff, drinking water additives such as iron dosing and other water treatment methods.

The selection of effective treatment or source control methods poses a sustainability problem as there are a number of economic and social aspects which must be balanced with the environmental standards set down by the WFD. Different treatment methods may require a larger capital expenditure or may provide jobs in the local community. Others may require a large carbon cost either in the manufacture of new treatment works or in the transport of waste materials. Source controls methods will require the populations in the area to reduce the intake of specific foods or the reduction of specific detergents. This choice becomes even more complex as all of the stakeholders involved, the companies, the local government, local industry and the general public must be engaged in the decision making process if they are to fully support whatever solution is chosen.

PhiZ, a sustainability assessment and visualisation toolkit, has been designed to allow the assessment and communication of the relative sustainability of Phosphate management scenarios. The PhiZ system takes the approach of combining a number of computational models covering the economic, social and environmental aspects of the scenarios with a unique visualisation based on 3D rendering technology through which the results of the models can be communicated. PhiZ does not take the approach of defining sustainability but provides a method for all the stakeholders to compare the relative sustainability of a number of scenarios.

To determine the scenarios effectiveness at reducing the phosphate levels the current baseline situation and the impact of each scenario on the phosphate level in the river was modelled using the INCA-P modelling system. INCA-P is a dynamic computer model that predicts water quantity and quality in rivers and catchments, its primary aim is to represent the catchment topography and the complex interactions and connections operating at a range of scales. The social, economic and environmental impacts of these scenarios were then determined using either collected or modelled data. This creates an overall dataset of over 1.5 million data points, which would be extremely difficult to comprehend using traditional means even for the expert stakeholders involved.

Using the PhiZ visualisation system this data set was transformed into a much simpler representation of the rivers water quality. A colour scale is used to represent the EQS standard and thus show where the phosphate level exceeds permitted levels. The stakeholders are able to move forward or backward in time to determine if specific river reaches or treatments works have a greater impact during different seasons. But most importantly the stakeholder can easily flip between the different scenarios and get a visual indication of the changing water quality and sustainability of the scenario.