Investigation of the relationship between humic substances (HS) and total phosphorus (TP) and the processes of release from catchment soils to loch waters

This study outlines proposals to clarify the importance of water colour (in terms of dissolved organic matter - DOM - compositional quality, e.g. HS content) for predicting TP concentrations in Scottish Lochs to help meet regulatory criteria under the WFD. This study highlights the importance of validating models across geographical systems that are in contrast to its original input parameters. Improved model fitting will facilitate more accurate classifications of water body status and allow better informed environmental management decisions.

Improvement and understanding of the HS-TP water model system utilising spectrophotometric analyses is a valid focussed proposal. This study should inform predictor variables and increase the predictive strength of models currently used to establish the TP reference condition for lochs. Whether it will "elucidate transport and release processes that convey TP from catchment soils to lochs" is uncertain within the outline of this project proposal as there is no consideration of riverine or terrestrial inputs of P via particulate transport, especially from eroded areas, nor of processes that recycle P within the loch environment. These can be major inputs of P into surface waters.

It is not completely clear if the proposal aims to only utilise existing data (Spectrophotometric, TP, DOC etc) or obtain novel data across different Scottish loch environments to help discriminate and understand the relationship between DOM quality, total DOC concentration and TP. Furthermore, it is not clear as to the method of spectrophotometric analysis (Hazen units, UV spectrophotometry, at which wavelength?) is being contemplated and that SEPA have historical data for? The variability surrounding spectrophotometric analysis of DOM and its relationship with TP itself could be a PhD project in itself, e.g. similar UV-absorbance values can be obtained from sample of very different DOM composition. Furthermore, even within the same loch, seasonal factors are a large influence on the quality of DOM obtained in surface waters. Interference by nitrate, Fe and pH are also major factors when considering the spectrophotometric properties of DOM. All have an influence on the spectrophotometric properties of DOM and thus relationship with TP.

However, this work on DOM in Scottish Lochs has a strong association with current RESAS work that is undertaking compositional characterisation (using a variety of different spectroscopic analyses, UV-Vis, spectrofluorimetry, FT-IR) of organic matter in river waters across Scotland (collaboration between JHI and SEPA). Moreover, terrestrial factors controlling transport of TP to receiving waters is currently part of ongoing RESAS research on mitigation of diffuse pollutants. In terms of SEPA's strategy, outputs from this study could provide a means of improved monitoring and assessment of Scottish Lochs as part of their commitment to meeting WFD via the constraining of the HS-TP model currently being utilised.

In conclusion, this proposal has scientific merit and is useful research for SEPA to pursue to improve their HS-TP model fitting. However, underlying assumptions of the complicated nature of the relationship between spectrophotometry, DOM quality and TP need to be addressed as part of this research proposal.