

Welcome and Introduction

Lady Wakeman *Patron of the Vitacress Conservation Trust*

Good morning everybody and a very warm welcome. It is marvellous to see so many people here at the 4th annual Vitacress Conservation Trust Chalk Stream Headwaters Forum, to which many have come previously and some, like me, here for the first time. The importance of chalk streams in our landscape history and culture is undeniable, and they are under threat. Today we shall hear from leading experts in chalk stream management and research, with a focus in particular on the role of phosphorus pollution, its causes and remedies, as well as reports from initiatives arising from previous forums.

The main purpose of forum has always been to identify practical solutions making an on the ground difference, using local stakeholders' knowledge to develop detailed and practical management plans for both short and long term improvements.

The Upper Itchen and the Bourne Rivulet are amongst the most beautiful chalk streams in the world. Their issues are similar to other chalk streams around the country. We expect their initiatives to facilitate the rapid implementation of best management practice by similar groups providing a model which could be adopted on a national scale. Lord Selborne set huge store by these and other initiatives and I am sure this year's forum will be equally useful.

Presentations

Did Farmer Giles do it?

Dr Mike Bowes, Centre for Ecology & Hydrology Wallingford

Determining sources of phosphorus input to rivers using load apportionment modelling

The focus of Dr Bowes' presentation was to introduce load apportionment modelling, a new model that can determine the proportions of phosphorus entering our rivers from agricultural sources and from sewage treatment works.

There has been a national effort to reduce phosphorus entering our rivers, by installing phosphate scrubbers at sewage treatment works and controlling the amounts and timings of agricultural fertilisers. Over the past 12 years these initiatives have proved successful with up to a tenfold decrease in phosphorus in some rivers. However, this decrease has not yet translated into a change in river ecology. A further reduction is needed, and so we need to find out where phosphorus is coming from.

Traditionally this has been done by mapping (GIS – geographic information systems) using land use to estimate phosphorus sources taking into account application rates, population density, soil and topography integrated with Environment Agency (EA) water quality monitoring data. Whilst this gives a reasonable annual load of phosphorus entering the river, most methods do not account for the timing of input.

The load apportionment (LA) model has been developed using data from hundreds of rivers monitored for a number years and is based on the relationship between phosphate concentration and flow. The CEH study identified two distinct patterns of flow and phosphate concentrations attributed to effluent from sewage and farm inputs (being independent and dependent on rainfall respectively, termed point and diffuse sources). The LO model applies a line of best fit to a graph of phosphate concentration against flow rate of the two loading types. At times of high flow rate (winter), input from agriculture is the dominant source, whereas during low flow rate (summer months) sewage is the dominant source. The flow rate at which these lines cross is important in river management, suggesting that sewage effluent should be reduced in the summer months to reduce the risk of eutrophication.

The model has been used in conjunction with boron monitoring (high levels of boron are used as an indicator of sewage in rivers) to identify sewage input into a stream without sewage treatment works. Upon investigation, field drains into the river turned out to be carrying domestic waste water from several sources, including a septic tank. The Defra PARIS project investigating rural phosphorus sources identified the importance of septic tank input.

There is a need to focus on sewage inputs, in particular multiple direct inputs from septic tanks, as agricultural inputs may be overestimated by traditional

methods of source appointment. The seasonal availability of soluble phosphate from sewage to vegetation in the summer months is particularly important. Agricultural input tends to be less available, attached to soil and sediment, and occurs in winter, when flow rates are higher. While sewage treatment works improvements results in immediate and significant phosphorus concentration reductions, changes to agricultural land use often have no observable effect on water quality.

Q. Mike Payne *NFU Watercress Association*

If agricultural input enters the river in winter, does it remain in the river bed over winter to be released in summer?

A. This is a component of the model I did not discuss, which is the interaction of phosphorus with river sediment of river. We are not saying that agricultural input is not important, but outweighed by the impact from sewage.

Q. Peter Evans

Where does aquaculture come in?

A. In aquaculture, rain driven input probably follows a different process.

Are chalk streams going down the pan?

Dr Linda May, Centre for Ecology & Hydrology Edinburgh

The role of domestic sewerage systems in diffuse phosphorus pollution

Dr May's presentation focussed on the role of septic tanks in phosphate pollution, and the lack of currently available information on the number of domestic septic tanks nationally.

Septic tanks are essentially underground chambers for the collection of domestic water waste. A well maintained tank should not retain much phosphorus but generate a clear effluent rich in available phosphate. Septic tank maintenance is important. There are many problems associated with tanks which are not built or maintained properly, such as layers of waste mixing in the chambers creating sludgy effluent, or seepage out into the surrounding area creating effluent rich lakes.

It is not certain how many septic tanks there are. On a map Dr May showed that the number of septic tanks that the EA are aware of in the Norfolk Broads numbers only 5% of the total number (of unknown condition) likely to be in use in the area (derived from detailed aerial photographs of houses outside sewered areas).

In Scotland, from April 2006, all tanks must be registered. In England and Wales, it is hoped that all discharges will be registered within 12 months, although it is unlikely that this will include any determined upper limits of discharge for consent.

Several examples of water quality being affected were given, showing marked increases in phosphorus concentration below septic tank inputs (eg the Wyre catchment, Eye Brook, Loweswater). In a recent catchment survey of Hornsea Mere, spot readings of organic phosphates in certain areas measured up to 2000mg/L where a background level of 30mg/L would be expected.

If the potential input from septic tanks based on research evidence for the 'true' number of septic tanks (rather than just the currently registered tanks which are small in number) then the input calculation based on 'best guess' reduces dramatically the proportion of input allocated to farmers. Further research is needed to check these levels on the ground.

Areas for improvement of septic tank discharges were discussed. Sewerage schemes as a replacement for septic tanks may show improvements in streams, but the effluent may simply be being diverted into another waterway. In Scotland, local planners have introduced a 125% rule to new developments so that all new properties / conversions must show how they will reduce phosphorus coming into the catchment overall (such as by helping or advising on phosphorus reduction). Providing the public with better information may encourage improved maintenance of septic tanks.

Q. Dr Steve Rothwell *Trustee – Vitacress Conservation Trust*

What proportion of septic tank phosphate comes from the use of detergents?

A. Around 50%. Introducing phosphate stripping technology can reduce this to 15%.

Why is the Danube blue?

Dr Pete Shaw, University of Southampton

Diffuse phosphorus pollution, the case for further research

Dr Shaw's presentation outlined the role of phosphorus in pollution and the different sources and forms of phosphorus. A case study of phosphorus in the headwaters of the Itchen was discussed along with further research needs.

The analytical chemistry of phosphorus is very important. Some phosphorus, soluble reactive phosphorus (SRP or 'phosphate'), can be measured readily to give an indication of concentration. Soluble unreactive phosphorus (SUP or 'organic phosphate') is more difficult to measure. It is still soluble but only reacts with reagents after treatment with acid in order to be measured. Particulate phosphorus (PP) is insoluble, that is retained during filtration, and must be digested by acid before measurement.

These different properties give an insight into what the different forms of phosphorus might do in the environment. SRP is readily available for plant growth while SUP and PP are not necessarily available in their current form in a river. They are a potential release problem but not immediately available.

Therefore, the composition of phosphorus gives an indication of the potential for harm, with SRP as the primary pollutant, and also the most useful form as fertiliser. SUP and PP are secondary sources of pollution as they must be modified to take effect.

The Holdgate model of environmental pollution (1979) describes how the transport of pollutants from source to target is not direct. Phosphorus is modified on the way, such as through sequestration by sediments, wash out or the conversion of SUP and PP to active forms (eg by reaction with secondary pollutants).

Although conventional descriptions of points and diffuse sources of phosphorus come from treated sewage / wastewaters and agriculture respectively, both types of discharge can arise from a variety of sources.

It is important to recognise that different sources produce different phosphorus types. Point sources can produce both available and potentially available phosphorus sources, as can diffuse sources. Further, unreactive phosphorus can become reactive (making unreactive phosphorus a source also) and available phosphorus can become unreactive due to the action of particulate material (reversible reactions). An equilibrium effect controls the baseline of available phosphorus. SRP can be released when SRP in surface water is low, or sequestration into the sediment when SRP is a higher levels.

The movement of sediment, which may act as sink or source depending on concentrations, is very important. Further study of the phosphorus carrying properties of the sediment (including catalysts which may be present in the sediment) is needed.

Phosphorus surveys in four sites across the Upper Itchen in July under base flow conditions looked at the relative abundances of SRP, SUP and particulate phosphorus. Where phosphorus levels overall were low (compared to 40 to 60 microgram/L benchmarks for chalk streams) it was found that SRP and SUP concentrations were similar.

There is an overall need to identify the primary mechanisms of the different phosphorus species. The University is currently in funding negotiations for further research.

The Bourne Rivulet Initiative

Professor Gail Taylor, University of Southampton

Progress report

The Bourne Rivulet Initiative (BRI) was born out of this Forum in 2007, and aims to develop a "learning by doing" approach by direct action to improve the condition of the Bourne for a wide range of stakeholders. It is hoped it will be used as an exemplar for other chalk streams.

The first PhD funded by the Trust on the Bourne has now been completed by Melanie Dixon. New research is also currently being commissioned. A study working with the Environment Agency and Natural England to understand what the good status of the Bourne should be, has been completed and a 2 year electrofishing study initiated.

The PhD focus was centred around Vitacress water use. Phenethyl isothiocyanate (PEITC) was identified and quantified with a study of *Gammarus pulex* survival. PEITC has many health benefits, including switching of certain cancer signalling pathways and is heavily present in watercress. Although we want these crops for our health, in the natural environment PEITC prevents plant damage by insect pests. The PhD showed that PEITC was found in watercress wash water consistently and that it does interrupt *Gammarus* mating behaviour. On site, Melanie compared *Gammarus* mortality due to untreated wash water compared to recirculated water and showed a drop from 18% to 3% mortality. This has translated to a change in management which has improved the *Gammarus* population (confirmed by EA data) and so considered a success story.

The University of Southampton has initiated the fish community survey, investigating angling fish and ecosystem services delivery of wider fish stocks. The intention is to conduct biannual surveys (the 1st survey has been completed) and to report on the data in more detail.

Last year, phosphorus was identified as an important issue to take forward. The BRI is currently developing research ideas looking at relative phosphorus contributions, different forms of phosphorus and phosphorus movement in the catchment.

St Mary Bourne is a very sensitive catchment with unique problems, sewage over pumping and flooding of homes occurs and there are many septic tanks of debatable efficacy. In the past this phosphorus input has been unquantified, and they hope to gain a better understanding of agricultural input versus sewage. The Vitacress Foundation has contributed £60,000 towards funding a new PhD research project in this area.

Q. William Daniel *Famous Fishing*

There is a gap between 18% and the 100% mortality of *Gammarus* identified in Clare Marsden's study. Have we identified what caused the rest?

A. Melanie Dixon *University of Southampton*

Clare had her cages in different locations, I placed cages purely on site in the watercress beds and in the feeder carriers. Therefore, I was purely looking at the input of factory water.

Q. William Daniel *Famous Fishing*

Are there other processes which have stopped, such as ammonia and chlorine previously put into the river?

A. Dr Steve Rothwell *Trustee – Vitacress Conservation Trust*

Yes, all derivatives of de-chlorination have been looked at with no change in Gammarus mortality. An improvement in Gammarus numbers was seen within 48 hours upon reduction of PEITC, whereas three years of other studies have revealed less significant results.

Q. William Daniel *Famous Fishing*

But we should not reduce the monitoring based on this one effect, with less EA monitoring we may miss a future catastrophe from other causes, I do not believe that PEITC is the only culprit.

A. Dr Steve Rothwell *Trustee – Vitacress Conservation Trust*

We have changed our fertiliser best practise due to previous advice, but this had no improvement in Gammarus number. However, I'm not saying that other factors do not impact.

The Upper Itchen Initiative

Graham Roberts, Hampshire & Isle of Wight Wildlife Trust
Progress report

Well into its second year, the Upper Itchen Initiative (UII) is gathering momentum and things are happening. They are in contact with a number of associated bodies and organisations, including important local riparian landowners.

Having declined dramatically over the past seven years, the Upper Itchen does not look like an idealised chalk stream river anymore, there is a lack of diversity of animal life living in the Ranunculus plant community. Overgrowth of filamentous algae, which has worsened over recent years, prevents fishing and reduces macrophyte populations. Septic tanks are also recognised as very important as discharge sources which need to be addressed.

The Environment Agency is delivering its best monitoring efforts with their current resources. However, their future challenges will be tough and we must help direct their resources ensuring effective delivery. We seek to work towards simplifying the process and aim to ensure continuity working with our current contacts and knowledge base.

Graham discussed a number of plans and initiatives currently implemented on the Upper Itchen including:

1. Recognition of the value of the Riverfly Initiative as an example of a successful independent initiative generating important trend data.
2. A new Ranunculus PhD study funded by the EA. Alexander Poynter is looking at the impact of Itchen stresses on the Ranunculus community (including agriculturally enhanced diffuse input, water abstraction, and the degradation of the chalk stream ecosystem) using aquatic plant communities as indication of chalk stream conditions.

3. Natural England's Water Level Management Plan for the Itchen – 10 schemes currently running with the second phase in planning with targets for the Water Framework Directive to be met within 2 years. The Diffuse Water Pollution Plan for the Test and Itchen is to be signed off at the end of the year, and covers many issues, with delivery towards achieving favourable river status (the Itchen currently in "Poor Status").
4. Higher Level Stewardship Schemes for capital works (10 currently, and more to be added or upgraded depending on funding) being very important in connecting landscape scale management plans.
5. River Restoration Strategy Plan – led by Tim Sykes and FRB team.
6. The Winnall and Abbots Barton riverbank restoration project, led by Martin de Reteurto, using materials on site. This was a very economic project, and within a few weeks of works clear water and salmon were seen. Experimental fish catches have been very positive, and a tenancy has been offered by the Hampshire and Isle of Wight Wildlife Trust to the Piscatorial Society who support sustainable wild fishery.
7. The Southern Chalk Streams Project, studying the decline of the whiteclawed crayfish which has suffered a 95% reduction since the 1970s. Vitacress have worked to help restore a local population. More monitoring of signal crayfish (a non-native species which carry crayfish plague which decimates native populations) is needed to protect these isolated populations.

Finally, in some instances we may run the danger of too many groups becoming involved in project development, and costs spiralling due to unnecessary bureaucratic process. Available financial support may well be better placed supporting on the ground practical solutions.

Still glowing

Dr Dominic Stubbing, Game and Wildlife Conservation Trust
Survival Rates in stocked wild brown trout

Dr Stubbings' presentation outlined the findings of a study investigating the survival of both wild brown trout and stock trout fry in the Candover Brook, a tributary of the River Itchen near New Alresford.

An EA led strategy coming in to effect in 2015 is looking at stocking trout as triploids, and developing breeding programmes based on wild fish brood stock. The Game and Wildlife Conservation Trust have undergone previous studies looking at spawning times and diets, and working on fry from hatcheries.

This study was conducted with EA using hatchery boxes on Candover Brook, on 13 selected sites covering a range of biological habitats (such as unfenced and fenced river locations). Brood stocks were collected from the river and their eggs stripped and fertilised. The eggs were counted to give an idea of

survival rates within hatchery boxes. Hatched fry collect in a collection chamber and are dispersed in the river. Some of the hatchery boxes were used to hatch stock fry.

The fry are marked to glow using calcein marking (an immersion treatment in salt and calcein, the calcein being combined into the bony tissues generating a fluorescence which can be detected by portable equipment in the field). There appears to be no impact on predation and the marking lasts for up to a year.

Hatchery box survival was found to be very variable, influenced by flow rates and potential impacts and blockages, as well as variance in fertilisation success and quality of brood stock. Hatchery box survival did improve in 2010 over 2009.

Marked juveniles were identified and recorded by site (1 to 13). It was found that there were more fish where stocked fish were introduced, but not within a 95% confidence limit. The findings suggest that the river does not naturally reach its full carrying capacity.

A greater density of stock fish fry was found in sites with riffles rather than pools and adult trout numbers predominated in pool habitats, which was as expected.

The fry migration study revealed competition between wild trout and hatchery trout (possibly for food). Stock fish also suffer from not having a territory to start off with and mostly migrated downstream. They may also have suffered from predation by birds.

Q. Andrew Thomas *The Wild Trout Trust*

How many wild brood stock did you collect in the Candover and from what length of channel to get enough fish?

A. Varied, between 3 and 4 pairs in a box collected over 100m. It varies because many fish which are caught are not ready.

Q. Andrew Thomas *The Wild Trout Trust*

Did you take into account survival rates vs spawning in the upper stream?

A. Less wild fish and less competition should have helped.

Q. Tim Nevard *Vitacress Conservation Trust*

Has this informed the debate about the cessation of stocking in 2015?

A. In understanding where fish populations bottle neck there is a need for an assessment of the need vs existing fish stocks and an understanding of where is the bottle neck (egg, fry or adult stage for example)? This will benefit the egg survival stage.

The Wessex Rivers Trust

Tom Davis, Test and Itchen Association

A brief background

Mr Davis's presentation focussed on the launch of the Wessex Chalk Stream and Rivers Trust, giving a background into the Trust's structure and aims.

The Trust covers a geographical area stretching from the Meon to the Stour, including the Rivers Itchen, Test and Titchbourne. Most, but not all, are chalk streams and considered internationally unique and of outstanding conservation and recreational value. However, they face current threats (including low flows, diffuse pollution, rising water temperatures and fragmentation) and significant recent deterioration, as well as the future threat of climate change.

The Trust was created from an idea three years ago in recognition of common regional threats, such as population increase and demand for water, which would be better handled by a larger group.

The Wessex Chalk Stream and Rivers Trust was formally launched on 30th June 2010, and is "a charity dedicated to the guardianship, protection, enhancement and maintenance of healthy functioning ecosystems within the river catchments and corridors of the Wessex region".

The Trust represents a broad spectrum of river interests, comprising 13 Trustees and 3 other officers, and is part of the Association of Rivers Trusts, filling a political and geographical gap in the South of England.

The Trust has an advocacy remit and wishes to influence governance and policy by working with government agencies and have set up a working group with the EA (across the two regions which the Trust straddles). It also wishes to influence development and planning, aggregates and abstraction with an emphasis on constructive engagement to achieve common goals by two way engagement.

The Trust seeks to inspire and inform the public, giving priority to schools and local projects in order to develop a sense of public responsibility for our rivers.

The Trust will also support scientific research, with a belief in sound science insofar as to make practicable decisions to protect the rivers and catchments with a focus on practical solutions. The Trust hopes to scope and fund those projects best suited to the works (eg through Universities, VCT, and other research organisations).

The Trust has identified priority research topics, including: Ranunculus community health as an indicator; the physical and biological attributes of rivers; nutrient pathways (especially phosphorus) in rivers, and their role in eutrophication and remedial solutions.

The Wessex Chalk Streams and Rivers Trust wish to increase their partnerships and associate organisations, and offer individual memberships.

Panel session – Facilitated by Tim Nevard, VCT Trustee

Q. Shaun Leonard, *The Wild Trout Trust*

If boron is a standard tracer for sewage effluent, are there other tracers which could be used for P inputs from aquaculture?

A. Dr Mike Bowes, *CEH*

The short answer is that I am not sure, I do not know what fertilisers are used, there could well be some rare elements which are specifically used for cress farming. So potentially yes, but I do not have the knowledge to answer that fully.

A. Dr Pete Shaw, *University of Southampton*

Yes, but we have not tested them yet. One possibility for this is to look at the organics that come from different sources, including sewage and agriculture. One of the more up to date methods we have is called scanning fluorescence spectroscopy, essentially a method of 'fingerprinting' organic materials in water which may give some insights as to what the problems of various organic fractions are. However, these methods are untested, as yet.

Q. Shaun Leonard, *The Wild Trout Trust*

Regarding the river fish stocking issue, accepting Dominic's own point that this is not a comprehensive piece of research, I believe that the work has outlined an important point that stocking is not a silver bullet, even in a situation with excellent juvenile habitat the egg box fish did not actually improve trout numbers. Surely it is better to do what we can to maintain the habitat and leave the wild fish to get on with it naturally?

A. Dylan Roberts, *Game and Wildlife Conservation Trust*

In principle I agree, if there are issues with egg survival then you need to clean the gravels and try and improve that. I think that stocking should really be the last resort, looking at other options of improving habitats and identifying bottlenecks and tackling those areas first. But if egg survival is very poor and you cannot do much to improve egg survival then stocking should be the next stage.

Shaun Leonard, *The Wild Trout Trust*

My concern I suppose is that you create a totally artificial system whereby the brood stock of subsequent generations arise from your egg box scheme. If you do not address the issue, which in the scenario that Dominic presented was a lack of spawning substrate, then that is a closed circle. I am concerned by the creation of a closed artificial spawning system which will not address the issue of a lack of spawning substrate.

Tim Nevard, *Trustee - Vitacress Conservation Trust*

Are the habitat creation schemes that Graham Roberts showed, the sort of things that you think focus should be put on?

A. Shaun Leonard, *The Wild Trout Trust*

Yes.

A. Dylan Roberts, *Game and Wildlife Conservation Trust*

I think that what the work highlighted that there was quite a lot of natural spawning, more than originally anticipated, and as Dominic showed in his graphs, where there was a lot of wild spawning the stocked fry did not do as well. If you have a situation with very few fry in the first place, then artificial stocking will have a higher success rate.

Q. Catherine Patel, *Environment Agency Southern*

I believe it is possible to register septic tank discharges on the Environment Agency website for free. This has not been an area for previous EA focus but obviously there is an opportunity and a growing interest. Large and industrial effluents tend to mask the impacts of smaller effluents, and while the EA has been concentrating on the larger effluents in the past, it has been recently focussing on smaller effluents and diffuse pollution. Legislation has moved on and now we have an opportunity to look at the impact on habitats through the Water Framework Directive – we have done a lot of work looking at nutrients which is a new statutory requirement and a relatively new area for us. We need a bigger understanding of the polluting species and how they interact. We will be focussing more effort on small input and diffuse pollution, focussing on ecological and water quality under the new legislation. The issue of Consents is still under review, the results of which will have an important impact.

Tim Nevard, *Trustee - Vitacress Conservation Trust*

Dr Bowes, an interesting thing that I picked up from your presentation was that you felt, in a number of cases at least, that what Catherine referred to as smaller pollution sources were ecologically more important effluents than the larger masking activities – is that right?

A. Dr Mike Bowes, *CEH*

The first thing we need to do is for the EA and the water companies to hit the largest sewage treatments works because they are major polluters to our river systems. I think that is in place and there is a rolling programme of sewage works treatments year after year up to 2015. But I feel as if the pendulum has swung too far the other way, and now all the effort is going into tackling agricultural diffuse pollution. I am really pleased that you have said that septic tank input and mitigation is not being ignored by the EA. Because of the timing of their input, the effect on river ecology is massively important during the summer months and we need to get a handle on the extent and the impacts of this.

A. Dr Linda May, CEH

It is interesting that the reason large sewage works have been targeted first and addressed was because of the European Waste Water Treatment Directive, which targeted sewage works which serve 10,000 people or more and so missed small sewage inputs. There may be a feeling that we've sorted the big problems, so the small inputs will be less of a problem. However we've increasingly seen that inputs from septic tanks are also a problem. The Consents issue is very important as effectively the EA look at the consented tanks only, which only accounts for 5% of actual discharge. Under the current review of consents the EA are accepting that the tanks are a bigger problem than previously thought. The first thing is to get the tanks registered and it's great that this can now be done through the EA website. However this needs a big stick for compliance, such as a charge for not doing so, otherwise people are not going to bother.

A. James Humphrys, Environment Agency

Thank you to Catherine for raising this point as I feel that this is a really fundamental issue that I certainly picked up from this morning. I feel that we do need to encourage people to do this, and a little bit of carrot and stick may be necessary. By way of reassurance, if you take into account the current economic crisis with cutbacks in spending, some of which will affect the EA, let me assure you that the Water Framework Directive is a core priority for the EA. I have been engaged in a lot of meetings in Birmingham and London over the last couple of weeks and it is abundantly clear that the WFD is the second, if not the first, priority with flood risk management of things that we must do and must get right. I think that there is no danger of a lack of finance in terms of delivering this kind of work. There may be constraints to resources on the ground as with any business, but this work will be done. The work on septic tanks has clearly got some way to go, but I promise it will happen and I certainly go away and drive this as fast as I can because I think it is very important.

Q. Peter Evans

Any phosphate study needs mass flow analysis requiring accurate flow data. Will the EA action discharge consent requirements for cress farms to provide a discharge volume weir? The standard discharge consent for watercress beds does include a requirement for a weir measuring method for discharge. Can weirs such as at St Mary Bourne be reinstated where the requirement seems to have been dropped?

A. Prof Gail Taylor, Chair - Vitacress Conservation Trust

My understanding of the research planned by Dr Shaw is that the mass balance will be absolutely essential. Can you add anything to that?

A. Dr Pete Shaw, University of Southampton

Regarding the flow measurements and discharges that is probably a matter for the EA but from a scientific point of view it would be very useful to have that data.

Tim Nevard, *Trustee - Vitacress Conservation Trust*

So to have a weir reinstated would help your work?

A. Dr Pete Shaw, *University of Southampton*

Yes, there are already stations on the Rivers Test and Itchen with a long standing record of hydrological data we can exploit in this research, but more detailed evidence would not do our research any harm.

A. Shirley Medgett, *Environment Agency*

I have been involved with watercress farms for some time. We have had many debates about the issue and we understand that knowing effluent volumes are critical to working out the loadings to a stream. However, we cannot apply that across the industry as a whole because of the problem with ground water issues into the beds, over which they have no control. So the effluent can be diluted by spring water, which makes it technically very difficult to do the loading equations. We are in conversation about measures to try and get round this but we do not have a volume measurement currently and this is not likely to be resolved in the near future.

A. Tom Davis, *The Wessex Chalk Streams and Rivers Trust*

I come from an industry which is a massive user of water, and the way the mining industry has improved its environmental act over the last decade was by really focussing on this whole issue of mass balance and the reconciliation of what goes in and what goes out. I would like to see a relook at the way we do our regulation on aquaculture, not just cress farming but other forms of aquaculture as well. It seems there are lots of accusations when it comes to spot sampling, such as using soluble phosphorus at known times of non-testing. My approach would be to ask each operation to understand its whole phosphate balance – they must reconcile all phosphate inputs and outputs and so build up a total model which is not reliant on EA monitoring and spot sampling in order to manage the P loading in the river. It's about what's actually happening in the environment looking at each operation's mass balance and flux.

A. Dr Mike Bowes, *CEH*

Mass balance seems like a good idea. Just doing monthly EA spot samples seems pretty pointless, you've got to design a higher-level campaign based monitoring for all operations, not just for cress farming and the same goes for sewage treatment works, whose output varies throughout the day but are only analysed between 9.00am and 5.00pm. Concentrations in effluents are probably much higher than the estimates, the errors are likely to be huge and we need much higher resolution monitoring.

A. Catherine Patel, *Environment Agency Southern*

We have been working hard with the Watercress Grower's Association to come up with a code of good practice, so there is a better understanding of the impacts of their operations on the river. It is our aim to incorporate that within a consent and we have worked with them to work out the effluent levels that we can get down to. That work is ongoing and the model will incorporate

more than just the effluent concentrations. Consents will include limits on phosphorus loading on the river inputs.

A. Robin Mulholland, Wiltshire Fishery Association

It seems to me that there is an excellent opportunity for the Rivers Trust and the EA and others to work together and put together an effective and accurate system for monitoring all aquaculture outputs. It is clear that the present system is not adequate.

Q. Anonymous

Are there simple Health & Safety approved additives for septic tanks which would stop P from overflowing?

A. Dr Linda May, CEH

There are additives but there are problems with the H&S side of it. People are trying to develop better additives to hold the P in, but the issue then is that the amount of P is the same, and is just retained for future spread on to the land. The only real longer term solution is to look at the benefits of the nutrients in the effluent and find some way of recycling the sludge on the land and cut down use of fertilizer.

A. Tim Nevard, Trustee - Vitacress Conservation Trust

In many Queensland local authorities it is mandatory for grey water from domestic sewage treatment plants to be recycled as garden fertilizer.

A. Prof Gail Taylor, Chair - Vitacress Conservation Trust

There is a global fertiliser shortage of P, which is recognised as a future limitation of food production over the next 50 years. There seems to be a massive future business opportunity here to develop new technologies and systems for the use of recycled P in agriculture.

Q. Anonymous

Some watercress farmers use less soluble P fertilisers, yet others use highly soluble P fertilisers which must wash out of the beds. If this is true, why is best practise not demanded from the EA?

A. Catherine Patel, Environment Agency Southern

The Watercress Growers Association code of best practice which is being worked on will look at base limits, best technology and best methods.

A. James Humphrys, Environment Agency

The key thing is that in the discussions about best practice that this point about soluble and less soluble P is included.

Q. Anonymous

What is being done to restore Alresford Pond to favourable status?

A. Graham Roberts, Hampshire and Isle of Wight Wildlife Trust

I wish I knew the answer! The pond has declined in terms of its ecological value dramatically over the past 30 years. There was a previous opportunity around 35 years ago to dredge the pond and clear the silt which was missed, and since then it has cumulatively received more and more organic silt and the problem is getting worse. There was talk of a possible future loss of designation due to its poor state which we hope will not happen but there must be a mechanism to sort this out. There is intensive aquaculture around the pond, making it a potential time bomb, with potential for phosphate release from the sediment into the surrounding SAC damaging some of the best chalk streams in Britain. The targets and the code of practice must be put into action and we must deliver on the ground.

A. Rue Ekins, Natural England

I agree, Alresford Pond is a time bomb. Under a previous management plan it was going to be restored which was not pursued due to cost. It is becoming increasingly clear from studies that the pond is not a contained problem, but a huge problem for the whole SAC downstream. This alters the cost benefit picture and the decision must be revisited looking at the political will, on the ground resources and funding in order to restore the pond.

Anonymous

Surely the pond will collect sediment again and the problem will be ongoing?

A. Rue Ekins, Natural England

In the past there has been a huge input problem from the Watercress beds around it and other inputs upstream. However, as we start to pick up and exercise more control over inputs such as through pollution control, catchment sensitive farming and watercress growing regulation we may be able to slow down the problem.

A. Dr Linda May, CEH

One of my key research areas is into pond and lake restoration. There is very little point trying to restore a waterbody without sorting out the causes of the degradation in the first place. It is key to sort out septic tank and agricultural inputs and soil erosion issues or else the same problem will recur in 1 to 2 years.

Q. Graham Roberts, Hampshire and Isle of Wight Wildlife Trust

We need a commitment from the industry and the policy makers to make change, how will this occur?

A. James Humphrys, Environment Agency

The Water Framework Directive is very important. There is a raft of current work going on with the intention of driving the creation of a better aquatic environment.

A. Paul Knight, *Salmon and Trout Association*

I agree there must be a link between local and national action. I sit on the EA WFD liaison group and we are just beginning to talk about genuine catchment management. Flood risk management and WFD must knit together and talk about all issues from the headwaters down. It is no good looking at waterbodies in isolation, such as Alresford Pond, we must look at connectivity and all EA work with all Trusts, joining up work nationally as well as locally.

Q. Anonymous

Why is the UK so inactive compared to Europe in banning P from detergents? We must stop the problem of P at source.

A. Dr Mike Bowes, *CEH*

The major source of P is from sewage not detergents.

A. Dr Linda May, *CEH*

A lot of people don't realise that dishwasher power is very high in P.

A. Dr Pete Shaw, *University of Southampton*

I cannot comment on the make up of detergents. The problem seems to lie in passing on the information so people can make informed decisions about various options.

Tom Davis, *The Wessex Chalk Streams and Rivers Trust*

I thought there was a government commitment to banning phosphates in detergents coming soon?

A. Dr Mike Bowes, *CEH*

This is expected in 2012

A. Prof Gail Taylor, *Chair – Vitacress Conservation Trust*

I understand there is a EU directive which will come imminently.

A. Tom Davis, *The Wessex Chalk Streams and Rivers Trust*

I believe detergents only represents 30% of the current P content of our current sewage effluent.

A. Catherine Patel, *Environment Agency Southern*

Phosphorus is also added to household water to prevent the release of lead from pipes.

A. Tom Davis, *The Wessex Chalk Streams and Rivers Trust*

It is my understanding that adding phosphorous for prevention of release of lead from lead pipes only works in hard water areas, but we are still dosing pipes in alkaline areas.

Jim Glasspool, *Test and Itchen Association*

It would be very helpful if we could have some literature to accompany commercially available water sampling kits for phosphate measurements, potentially saving on laboratory analysis fees and drawing attention to the issue. The Riverfly initiative for example has been very successful. Could we have a “Do-it-yourself” phosphorus measurement guide?

Tim Nevard, *Trustee - Vitacress Conservation Trust*

That is a very good suggestion. If anyone would like to send in a short proposal we can add it to the proceedings.

Q. Lawrence Talks, *Environment Agency*

Is there any relationship between base flow and peaks of P in rivers and algal growth – is it the base level or the peaks of phosphate discharge that makes the difference, or a combination of both?

A. Dr Pete Shaw, *University of Southampton*

It depends on the timing and duration of the peak. If a peak lasts for months it can do a lot of damage, if the peak flushes through it is not so much a problem. The phasing of peak P concentration in relation to plant needs may give advantage to some of the problematic species and affect competition within plant communities. However, this is not yet fully understood. River eutrophication does not follow a particular pattern. High levels of P do not always lead to eutrophication, flow and plant competition are very important and complex making this difficult to solve.

A. Dr Mike Bowes, *CEH*

We always associate excessive P concentration with excessive algal growth, but light and flow rate also influence algal growth. P is important, but many of our rivers have such high P levels that huge peaks have no effect. During some research on the upper Kennet, increasing the P concentration by a significant factor and saw no change in algal growth. Are the EA setting the right kind of targets – I suspect they are set too high at an annual average of 60, we should have a summer maximum of 60 which would be more realistic.

A. Dr Linda May, *CEH*

In standing water the situation is very different, and short term peaks become very important. Monitoring of Scottish Lochs revealed that short term ‘storm events’ can account for up to 800 times the amount measured from a routine spot reading.

Q. Michael Maylon

What damage are phosphates doing to our fly life?

A. Tom Davis, *The Wessex Chalk Streams and Rivers Trust*

There is some suggestion that they affect the blue winged olive eggs ability to stick to vegetation. This is being studied, but whether detergent or phosphorus is the cause is not yet known.

Q. Anthony McEwen, CPRE Hampshire

What are we going to do to protect the River Meon which has similar problems to the Rivers Itchen and Test and is surely just as precious but without the huge number of supporting partners?

A. James Humphrys, Environment Agency

We are conscious of the poor cousin image of the Meon. The point is well made and we are doing as much as we can to give the Meon more attention. The WFD is driving this in the right direction.

A. Tim Nevard, Trustee - Vitacress Conservation Trust

We hope that the initiatives that this Forum has put together in the past will be taken up elsewhere – as they seem to be effective. Graham and Gail's presentations today are intended to say "copy us" and maybe the BRI or UII approach could be relevant to the Meon.

A. Anthony McEwen, CPRE Hampshire

Under the Government's recent national planning revisions, we now have "neighbourhoods" on the agenda. The 'neighbourhood' of the rivers could be something that we could capitalise on, in spite of the concept being originally intended for housing and industrial targets.

Q. Robert Miles, Test and Itchen Association

What action and time scale are the EA taking to increase the levels of phosphate stripping in our rivers, such as below sewage outlets?

A. Catherine Patel, Environment Agency Southern

In terms of stripping, it works much better on a larger scale. 1mg/L is best available technology at which we can best treat water on a commercial scale. This may go down as technology advances, but will also require funding to make further reductions. Funding must be approved through Offwat as the cost will be passed on to the paying customer.

Q. Peter Evans

What is the dilution effect at the top of the river? If you reduce the mass balance of the whole system by reducing the amount of water that people use, abstraction is reduced and so the river will have greater flow and the phosphate would be more dilute.

A. Catherine Patel, Environment Agency Southern

Yes, we have looked at abstraction licences and we have a sustainable programme which aims to reduce the limits on licences. However, this falls under different legislation and we will have to compensate licence holders if we do tighten the amounts on the licenses. During planning consultations we go through the Code of Sustainable homes to keep water use down in new homes.

Q. Graham Roberts, Hampshire and Isle of Wight Wildlife Trust

Do we have enough evidence to ensure with the next periodic review of the asset management planning (AMP) with the water companies that we can actually push this forward. If perhaps only 5% of septic tanks are recorded in Hampshire we clearly need to find a mechanism to start addressing that now. I don't know to what level this is on the radar with Southern Water, should we be rallying more support from Southern Water to try and push this forward?

A. James Humphrys, Environment Agency

Speculating aloud, at the next round of AMP with Ofwat, Southern Water will probably say that septic tanks in individual homes are not their concern.

Q. Andrew Thomas, The Wild Trout Trust

Has there been any follow up on the research into PEITC? Are there other aquatic plants which will produce PEITC under stress such as when river weed is cut?

A. Prof Gail Taylor, Chair - Vitacress Conservation Trust

Many plants have natural chemical defences. PEITC is particularly important in members of the cabbage family (brassica). I am not familiar with any other aquatic brassicas.

Q. Peter Evans

With regards to the making available of research papers in our general field, we have a system available through the University for the Bourne Rivulet Initiative. Is this going to be made more publically available? For example, mass balance work on watercress was done in the 60s, should we be aware of this data?

A. Prof Gail Taylor, Chair – Vitacress Conservation Trust

I know there is some idea that in the future we may have a collection of data which is open, based at University of Southampton.

A. Dr Pete Shaw, University of Southampton

Still in its embryonic stage the intention is to create an electronic chalk streams archive which will be based at University of Southampton.

Closing Remarks - Professor Gail Taylor, VCT Trustee

It is always worrying when you arrange a meeting that there will not be enough interest, but that has certainly not been the case today. I have found today incredibly informative and learnt a tremendous amount from our speakers this morning.

We have a huge task on our hands and there is still a lot of work to be done in these meetings. It is very easy to bash the EA to do more, but we need to work together to turn our research into action in a timely manner – a challenge for all of us.

We have recognised the importance of phosphorus and have identified key issues such as mass balance. We must now go and address these issues and take action through management.

As a final point, I would like to mention that the Vitacress Conservation Trust has committed £60k to kick start some of the necessary work on phosphorous and it would be great to find some partners to move forward with us financially us on this project.

I would like to extend many thanks to you all for coming and for your contributions today, and many thanks to all the speakers.