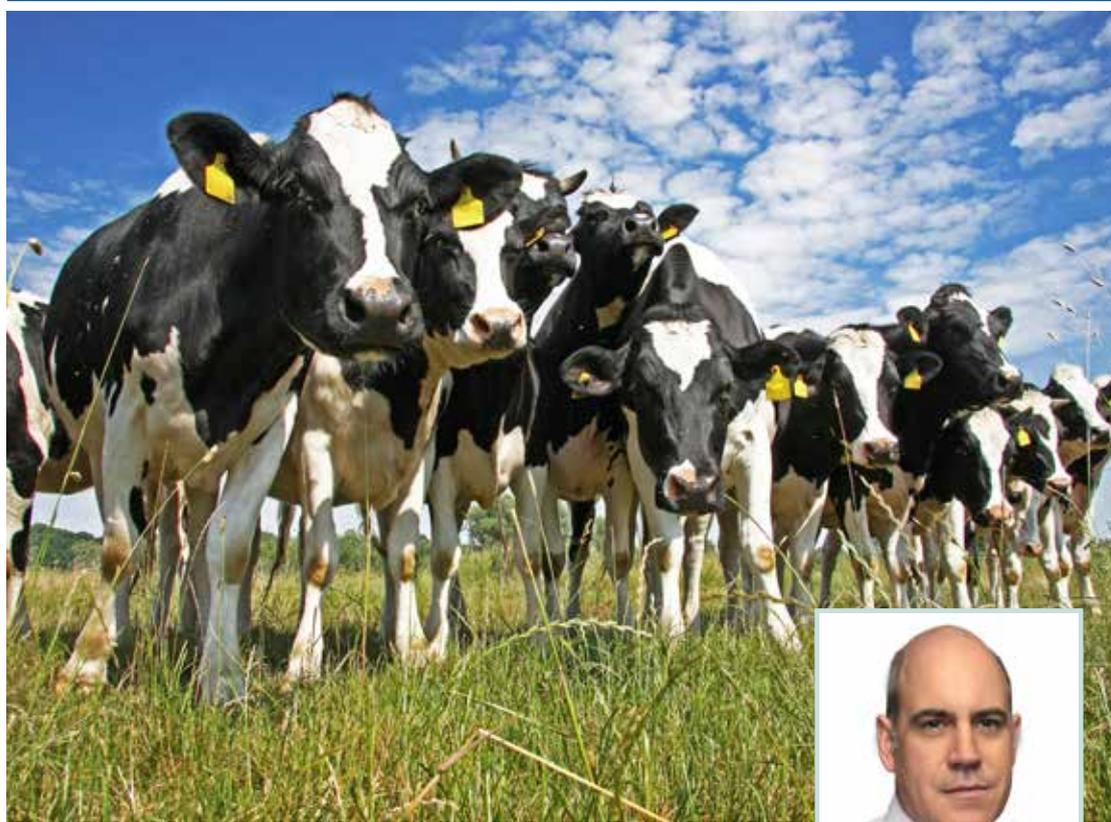


Tackling diffuse agricultural pressures

USING WFD MEASURES



Ian Codling
Senior Consultant, Catchment Management, WRc plc.

BACK IN 2009, when the first cycle of river basin management planning under the Water Framework Directive (WFD) began,

one of the largest pressures causing observed impacts on surface freshwater and groundwater bodies was diffuse pollution from agriculture. So after six years of intensive activity, where are we on the journey to Good Status, and have the impacts from this pressure been reduced?

In December 2014, draft River Basin Management Plans (RBMPs) were produced for all of the River Basin Districts across the UK. These redraw the baseline based on progress in the first cycle plans and set the objectives for the next phase of improvements to rivers, lakes, groundwater, estuaries and coastal waters up to 2021. The European Commission summarised the state of play with WFD implementation in 2015 in its fourth

implementation report. One conclusion of the Commission communication was that further so-called 'basic' measures (ie compulsory measures based in regulation) are required to tackle diffuse water pollution from agriculture. The Commission believes that many Member States are relying too heavily on voluntary measures that can only effectively close a fraction of the gap to Good Status. But to what extent does this apply in the UK?

Welcome to the spring issue of the FWR Newsletter



The European Commission recently stated that further measures are needed to tackle the problem of agricultural diffuse pollution. In our lead article, Ian Codling from WRc explains the progress made so far towards tackling diffuse agricultural pressures using various WFD measures.

'The State of England's Chalk Streams' is a report commissioned by WWF-UK; it reveals that 77% of chalk streams are presently failing to meet WFD Good Status. The report sets out WWF's manifesto for these streams and actions for restoring such a valuable resource. Read more about this on page 4.

In our Wastewater Matters section we report on various recent events including CIWEM's Annual Conference on Water & Environment, 'The Value of Intelligence in the Wastewater Network' and FWR's Wastewater Research & Industry Support Forum. 'Managing *Cryptosporidium* - Sharing Wisdom': Mike Waite attended this recent conference and takes us through the day.

The David Newsome award for postgraduates is open for applications - see the back page for details.

For information on events and news highlights please go to our website www.fwr.org. You can also contact us via email (office@fwr.org.uk) or telephone (01628 891589).

Maxine Forshaw - Editor

THIS ISSUE

DIFFUSE AGRICULTURAL PRESSURES

by Ian Codling, Senior Consultant
Catchment Management, WRc plc **1**

Chalk Streams Report **4**

Managing *Cryptosporidium* **5**

Wastewater Matters **6**

Postgraduate Award **8**

FWR News **8**

FWR Publications **8**



Manure spreader

Diffuse pollution from agriculture contributes to nutrient (nitrogen and phosphorus) and pesticide pollution of surface waters and groundwater, as well as adding to the sediment load in rivers and lakes from soil erosion and faecal contamination of bathing and shellfish waters where these are located downstream of livestock farming areas. Clearly, other sectors also make their contributions and sewage effluent is significant with respect to nutrients and faecal contamination. The relative contribution from each sector varies spatially across the country, reflecting changes in land use and in wet and dry conditions as rainfall mobilises pollutants from some sources more than others.

So what exists in the UK pollution prevention toolbox to tackle these sources, and how might these be applied in the coming years to nudge the level of achievement of WFD objectives forward to the 2021 targets?

The Nitrates Directive is considered to be the diffuse pollution partner of the Urban Waste

Water Treatment Directive as it aims to control nutrients (primarily nitrate but also, to some degree, phosphorus) from agricultural sources. At present around 58% of agricultural land in England (and much less in Wales, Scotland and Northern Ireland) is designated as Nitrate Vulnerable Zones (NVZs), and is subject to controls set out in the Nitrate Action Programme. In 2016, NVZs will be subject to their routine four-yearly review to determine whether or not further designations are required. For the first time, the Environment Agency and Natural Resources Wales will be undertaking independent reviews for England and Wales respectively. The measures in the most recent Nitrates Action Programme are thought to deliver reductions in nitrate leaching from agricultural land in the region of 1-8% at the catchment scale, and somewhat less for phosphorus.

One control mechanism that has proved to be effective for a wide range of agriculture-derived pollutants, in areas where it operates, is Catchment Sensitive Farming (CSF). This

Natural England and Environment Agency led (and Defra supported) programme was recently evaluated (August 2014) and was able to demonstrate agricultural pollutant loss reductions in the region of 5-12%, translating to 3-7% reductions in terms of in-river concentrations. CSF appears to have been most successful in reducing sediment and phosphorus losses, but is also making an impressive contribution to declining pesticide loads to receiving waters and the proportion of samples with pesticide concentrations below the drinking water limit of 0.1 µg/l. These reductions are beginning to translate into ecological improvements, especially at more polluted sites and in response to the pollutants, such as sediment, that are being tackled most effectively.

The secret of its success appears to lie in the long-established partnership approach adopted by CSF that has built trust with farmers and enabled them to implement advice backed up by financial contributions in the form of capital grants. Not to be underestimated is the importance of the built-in evidence and evaluation programme that has enabled vital performance information to be collected and evaluated as CSF has evolved, and which underpins the sound scientific basis of the business case to continue. After 2016, CSF is to be more closely aligned with the new Rural Development Programme supported 'universal countryside stewardship scheme' which will have a greater focus on environmental outcomes than before.

Supplementing the CSF programme in England are catchment programmes supported by the water companies, and those falling under the umbrella of the Catchment Based Approach (CaBA). The focus of the majority of water company schemes remains the improvement of raw water quality abstracted for public supply, but some schemes are diversifying to secure dilution capacity in receiving waters by controlling diffuse sources of phosphorus. While these schemes are not directly focussed on WFD objectives, the nature of many of the schemes results in contributions to diffuse pollution control.



The Catchment Based Approach provides a mechanism for the integrated local delivery of WFD objectives at the operational catchment scale in England. Defra has supported the establishment and early development of catchment partnerships with the technical back-up of the Environment Agency. The ongoing evaluation of the programme reveals a spectrum of success, ranging from early establishment of partnerships to viable continuing concerns, demonstrably making a difference in the catchments in which they are

active. Over 100 partnerships are operating and, while some are able to use core Defra funding to attract additional investment on the scale of a factor of three, only 25% of partnerships have secured non-Defra funding beyond March 2015. So the future of this delivery mechanism is less than guaranteed, but the examples provided by the more successful partnerships to date suggest that the approach could still deliver a contribution towards the delivery of WFD objectives by 2021 and beyond.

The European Commission recently screened draft RBMPs for all River Basin Districts in the EU where these were available (including all of those in the UK), looking for evidence that issues identified in the first RBMPs had been recognised and addressed in the second cycle plans. These were undertaken by WRC and published on the Commission's website as consultant reports (http://ec.europa.eu/environment/water/water-framework/impl_reports.htm#fourth). Among the issues identified in the first cycle plans for the UK was the need for a transparent quantitative apportionment of pollutant sources to sectors as a basis for a programme of measures, and evidence that the pressures originating from the agricultural sector were being addressed.

With regard to source apportionment, the Commission is very keen to get to the point where the pathway to Good Status is mapped, and where measures deliver quantifiable steps on that journey. This message was recently succinctly summarised as 'more maths and less adjectives' when describing what a programme of measures will deliver. Source apportionment for pollutants derived from the agricultural sector has been undertaken to the degree that measures can be broadly attributed to the appropriate polluters. However, much uncertainty remains about how much an individual measure, or package of measures, will contribute on the pathway to Good Status.

As for evidence that the pressures from the agricultural sector are being reduced, the screening of the second cycle plans in England indicated dissatisfaction that sufficient progress had been made. The primary regulation-based measure remains the Nitrate Action Programme for land within designated NVZs. Outside of these areas, the measures are dominated by advice and incentive programmes, such as CSF, and are largely voluntary in nature. The picture is different in Scotland where general binding rules apply everywhere and can be used to control the full spectrum of pollutants arising from agriculture. The European Commission has advocated the implementation of this additional layer of regulation-based protection throughout the UK. This is likely to feature in a proposed Government Review to reconsider and develop a revised package of tools needed to support delivery of objectives for the second cycle of river basin management planning.

Currently, the UK environmental regulators are scrutinising responses to their public consultations on the draft second cycle RBMPs and are taking on board the initial views of the European Commission as they craft final RBMPs to publish in December 2015. It is clear that the control of diffuse pollution from agriculture is work in progress with some way to go. No doubt the UK's newly elected government will play a role in fine-tuning these plans too!



Crop spraying



Receiving water

All images are courtesy of WRC plc

The State of England's Chalk Streams

Maxine Forshaw

Foundation for Water Research



TEN YEARS AGO the Environment Agency published the first report on the state of chalk stream health, recognising the high conservation value of these streams for wildlife, water supply, recreation and culture. They then set out a vision to restore and protect these watercourses.

WWF-UK (World Wide Fund for Nature) have now published their report which provides a snapshot of current health, progress to date, and the remaining pressures on England's chalk streams.

The report reveals that:

- 77% of chalk streams are failing to meet Good Status (Water Framework Directive).
- Only 12 out of 224 chalk streams have protected status.
- The chalk aquifer – the engine room of the chalk stream – is classed as being in poor health with phosphate and nitrate levels dangerously high.
- Chalk streams are still facing a multitude of threats – physical modification (eg for historic land drainage and industry), over-abstraction (particularly for public water supply), pollution from sewage works, septic tanks and agriculture; and increasing pressure from a growing population, climate change and non-native invasive species.

The report acknowledges that in the past few years there has been much activity and signs of progress, and that the problems have been identified. But the improvements made have been both small and very slow.

In the report, WWF set out their manifesto for chalk streams. These are the actions they believe must be taken to restore chalk streams back to good ecological health:

- Government leadership to champion chalk streams.
- Fit-for-purpose regulation for abstraction and pollution.
- A chalk stream forum for learning and scrutiny.
- Valuing our chalk streams.
- Protected chalk streams are restored and properly protected.

Access the report at:

http://assets.wwf.org.uk/downloads/wwf_chalkstreamreport_final_lr.pdf?utm_source=action&utm_medium=print&utm_campaign=loyalty

Below: River Itchen, Hampshire (courtesy Martin de Retuerto)



A broad definition of a chalk stream is one that derives the majority of its flow from chalk-fed groundwater – the classic characteristics are alkaline, clear water, flowing consistently over gravel beds, and at a fairly constant temperature of 10°C.

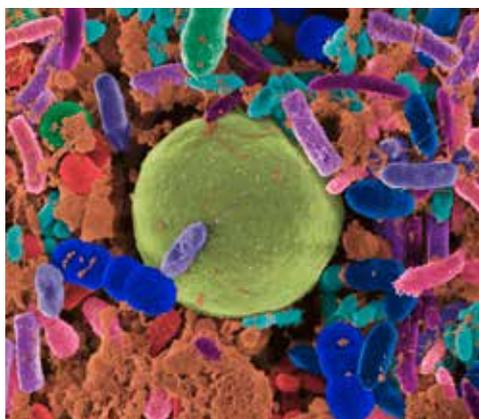
MANAGING *Cryptosporidium* – sharing wisdom

25 March 2015

Mike Waite

FWR Water Supply Co-ordinator

CIWEM hosted this very interesting meeting, attended by over 70 delegates and speakers at its London headquarters. Following a welcome by Michael Templeton, Chair of the CIWEM Water Supply and Quality Panel, the meeting started with a review by **Robert Pitchers** (*WRc*) charting significant events, from the discovery of the organism in mice in 1907, through the first recognised waterborne outbreak in 1984 (Texas), the first identified UK outbreak in Swindon and Oxfordshire in 1989, and the huge Milwaukee outbreak in 1993 which affected over 400,000 people, and included 67 deaths. He also provided a useful account of the work of the Badenoch and Bouchier committees and the ensuing regulatory actions. He noted that despite all advances in understanding, waterborne outbreaks continue to occur.



Cryptosporidium protozoan. This is a coloured scanning electron micrograph of a Cryptosporidium parvum protozoan oocyst (green) with unidentified bacteria. (courtesy Science Photo Library)

In the absence of **Gordon Nicholls** (*Public Health England (PHE)*) Robert also presented a paper on his behalf in which he provided some statistics on outbreaks in England and Wales and their seasonality. Swimming pools and travel overseas are important sources of infection. He concluded that improvements are needed in the sensitivity of routine diagnostic methods, along with the need to improve the timeliness and completeness of reporting.

John Watkins (*Centre for Research into Environment and Health*) then described the evolution of methods for the detection of *Cryptosporidium* which have raised recoveries from 1–10% up to a possible 85%. There are many critical factors to take

into account and external quality assurance (EQA) is essential. It was noted that PHE no longer publish summaries of waterborne disease outbreaks.

The second session dealt with operational experiences, beginning with a paper from **Margaret McGuinness** (*Scottish Water (SW)*) on 'Treatment Challenges in Scotland'. She referred to the difficulties of having a large number of treatment works (256), and a large variety of catchments which are not under Scottish Water's control. SW has established a Sustainable Land Management team which works with farmers and landowners and seeks to restrict livestock access and run-off into vulnerable sources. The team carries out risk assessments for *Cryptosporidium* and carries out audits of sources and treatment plants. SW was required to identify alternative treatments to membranes for control of *Cryptosporidium* and carried out pilot plant tests using various combinations of multimedia filters, carbon filters, Granular Activated Carbon (GAC), UV, cartridge filters and electrocoagulation. Using a weighting system to take account of the various requirements of a sustainable process, three combinations were identified as being suitably effective – multimedia plus cartridge filter (with or without GAC) and sequential cartridge filters of reducing pore size.

Carol Weatherley (*Dŵr Cymru/Welsh Water*) provided a brief account of the company's approach to *Cryptosporidium* with reference to an event in 2012 following which DWI recommended that treated water should be sampled before and not after UV so that any positives can be typed. In 2009–2010 Welsh Water installed UV treatment at all of its groundwater sources (boreholes and springs).

Fiona Waller (*Affinity Water*) spoke briefly about the problems of *Cryptosporidium* in sources with fractured aquifers, and noted that catchment inspections are often carried out in good weather when problems are less likely to be apparent.



Elinor Cordiner (*Severn Trent Water*) described an event in 2012 in which taste and odour complaints led to the detection of *E.coli* and *Cryptosporidium*. The source was identified to be a main, recorded as being abandoned but which was not disconnected and Severn Trent is now carrying out checks on all assets which have been recorded as 'abandoned'.



UV disinfection equipment (courtesy Hanovia Ltd)

The afternoon session 'Research and Information Sharing' began with a presentation from **Stig Regli** (*US Environmental Protection Agency*) in the USA, via telephone link. He outlined the evolution of the USEPA regulatory framework which relates actions required to level of risk. **Gertjan Medema** (*KWR Water Research Institute*) then described how Dutch regulations are based on Quantitative Microbial Risk Assessment (QMRA) and specify a risk below 1 infection per 10,000 persons per year for *Cryptosporidium*, *Giardia* and viruses.

Rachel Chalmers (*Head of Cryptosporidium Reference Unit – Public Health Wales*) rounded off the meeting with a fascinating account of the application of molecular typing to the investigation of *Cryptosporidium* isolates and outbreaks. She explained that *Cryptosporidium* taxonomy was continually developing, and at present 26 species are recognised (with about 50 genotypes being of no taxonomic significance), of which *C. parvum*, *C. hominis* and *C. cuniculis* present the greatest risk of outbreaks. Current molecular typing procedures involve the disruption of oocysts followed by DNA amplification in multiple aliquots using gene-specific primers. Restriction Fragment Length Polymorphism (RFLP) can be used to determine the presence of multiple species but is not species diagnostic. Real time Polymerase Chain Reaction (PCR) has applications but loop-mediated isothermal amplification shows promise as it is cheap, requires only a single lamp and multiple primers, and overcomes PCR inhibition in UV treated samples. This procedure, however, is not yet validated.

The meeting was a valuable résumé of how knowledge and practice has developed, and indeed is continuing to do so. You can access outputs from the meeting at this link: <http://www.ciwem.org/events/events-outputs.aspx>

WASTEWATER MATTERS

Tim Evans,
FWR Wastewater Section Co-ordinator



Tim Evans (left) and Norman Lowe, CIWEM president.

THE THEME of this year's CIWEM Annual Conference on Water & Environment

was 'Challenge and Change: how regulatory innovation and partnership working can deliver the needs of customers and the environment'. A bit long perhaps but a good sentiment! Change can be difficult to accept and indeed there was a hint of 'push back' against Totex (Total Expenditure). Unquestionably the massive capital investment since the water industry was privatised has improved water supply, wastewater management and the environment, but the National Audit Office concluded that the water industry had evolved a culture of avoiding risk rather than managing it. Ofwat has changed the regulatory paradigm from favouring Capex (Capital Expenditure) to Totex and hopes to evolve a culture that will be more open to innovation, but evolution takes a long time ...

At the CIWEM conference 'The Value of Intelligence in the Wastewater Network' held on 18 February 2015, it was said, with no sense of embarrassment, that post project appraisal (PPA) has been the exception rather than the rule in the UK water industry. Under the old 'outputs' model the target was to build stuff and to complete the capital programmes; to me, it appeared that it was less of a priority whether or not it worked or whether the company's employees were capable of operating it. In the absence of PPA it was possible to build 'outputs' that, by design or operability, did not deliver the intended 'outcomes'. CIWEM's Water and Wastewater panels have both observed that there is a skills gap at operational level in the water companies. I would observe that intellectual capital and knowledge have been shed in easy wins to reduce Operational Expenditure (Opex) and R&D departments have been decimated. Consultants cannot substitute entirely for in-house personnel because without sufficient in-house knowledge it is not possible to either ask the right questions nor to judge the answers.

This might all sound a bizarre way to run commercial companies. Why wouldn't you decide capital investment on the basis of

whole-life cost? Why wouldn't you look to see how well something works once it has been built so that the knowledge can be used to improve the next one? To me this appears to be a consequence of regulation – albeit an unintended consequence and distortion.

At the last meeting of FWR's Wastewater Research & Industry Support Forum, Mike Bowes from the Centre for Ecology & Hydrology (CEH) discussed a farm-scale experiment into the effectiveness of grass margins (which earn agri-environment credits) for reducing phosphate in streams. The test site is on clay textured soil in Buckinghamshire. The experiment compared margins of 6 m and 30 m in width, sown with phosphate accumulating plants. The largest phosphate loss from fields is 'particulate-P', which is phosphate attached to soil particles. The objective of the margins is to trap soil particles and filter the runoff water.



Trial site in Buckinghamshire (courtesy of CEH)

The design comprised four replicate treatment blocks. They found that the width of margin had no effect on the concentration of soluble reactive phosphate (SRP) measured in the stream and neither did the seed mixture, which indicated that a 6 m width was adequate. However, there was an unexpected finding: even in this rural area with no conurbations upstream, 200 mgSRP/l or more was found in some of the blocks and this was accompanied by boron, which showed that septic tank and misconnection contributions overwhelmed the diffuse inputs from farmland. (Perborate

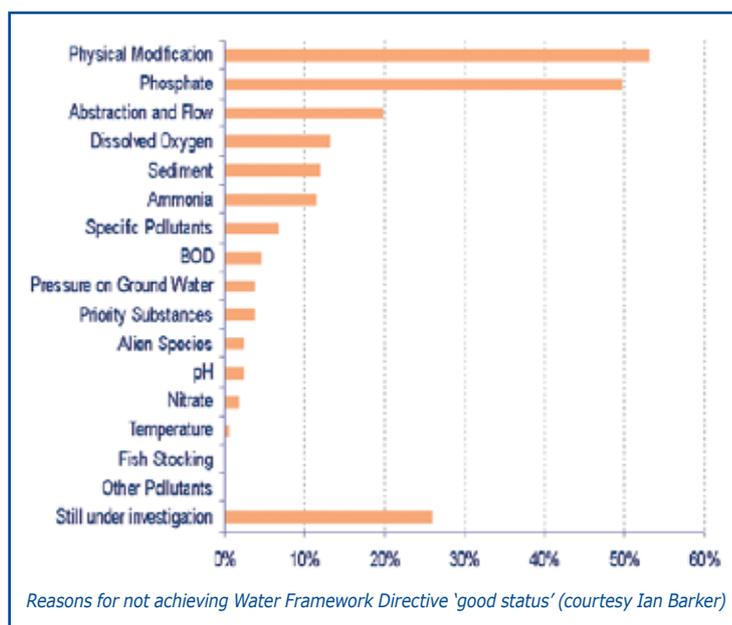
is a whitener in some detergents.) Reducing sediment runoff into streams is useful but grass margins cannot solve the SRP issue when there are other, greater, and hitherto unrecognised sources. Bob Middleton from Natural England told the CIWEM conference about the Catchment Sensitive Farming (CSF) programme, which he described as 'highly targeted and focused' but septic tanks and misconnections are not included in the targets. They might make five or more visits to a farm but until now have not checked to see whether these particular 'stable doors' are open. In my opinion, the results of CEH's work should amend the focus and targeting of CSF.

The final paper of the conference was from Fergus O'Brien and concerned Dŵr Cymru/ Welsh Water's 'RainScape' programme to manage surface water by retrofitting green infrastructure (GI). DCWW has been at the forefront of retrofitting GI for rainwater since modelling that business as usual (putting ever larger pipes and tanks in the ground) was not going to solve the approaching problems and that just using GI for new developments would not be sufficient either. DCWW realised that there are many opportunities for retrofitting rain gardens, etc, even in their densely developed communities and with their high rainfall. Fergus described a rain garden that DCWW created on a small triangle of grass in an area of steeply sloping streets heavily developed with Victorian terraced housing. Runoff reduction was even greater than the design predicted and subsequently the performance has continued to improve.

Ian Barker (Water Policy International) opened the second session of CIWEM's annual conference with his presentation 'Crisis? What Crisis? Will regulatory innovation deliver what's needed for sustainable water management?' in which he showed the reasons for not achieving 'good status' under the WFD criteria which, to me, says that although these waters have not achieved the criteria of 'good status', nobody has told the fish that live in them, which is surely more to the point. Fish have recovered in our urban rivers to the greatest

variety of species and highest population numbers since the dawn of the Industrial Revolution. Should that be considered a success? And should the limited funds that are available be directed to adapting to climate change and increasing risk of flooding? Is it time to adapt another of our paradigms?

You can access the outputs from CIWEM's Annual Conference at: <http://www.ciwem.org/events/events-outputs.aspx>



Catchment Based Approach Funding Award for 2015–16

We are pleased to report that the South Chilterns catchment has been awarded a total of £23k from Defra's Catchment Partnership Action Fund. This includes a payment for project work in both the Wye and Pang watercourses, plus a contribution towards partnership hosting for FWR. Details and progress of the project work will be covered in a future newsletter.

WRc Innovation Day

29 April 2015

Mike Waite

FWR Water Supply Co-ordinator



This was WRc's fifth annual Innovation Day and I attended as one of over 350 guests. The day began with three keynote addresses. Mark Fletcher (Arup) spoke on fresh thinking for water, referring to growing worldwide urbanisation and the need for a global look at the water cycle. He stressed the need to look critically at current assumptions, and gave as an example a project in Leeds in which proposed high flood prevention walls were rendered unnecessary by weir remodelling to increase flow capacity.

Steve Lee (Chartered Institute of Waste Management) considered current waste management practice and future challenges. He stressed that with growing demand and fixed reserves of resources, the cost of many resources such as copper is rocketing. As an example of innovative thinking he showed an edible drinking water container which could obviate the use of plastic bottles.

Finally, David Morgan (Synthotech) spoke briefly about the need for innovation in the gas industry and how the privatisation of around 1000 gas companies in 1986 has led to much more money being available to fund innovation.

About 80 exhibitors attended and it would be unfair to pick out any particular one but, as a former drinking water regulator and microbiologist, I was interested in ALS Environmental's use of MALDI-TOF, a mass spectrometer based technology for rapid confirmation of a wide range of microorganisms; also of interest was South West Water's use of a very simple membrane mount to adsorb pesticides over a long period which could be missed by spot sampling. The afternoon was devoted to a novel session bringing delegates together in small groups to consider a number of innovation issues. As a laudable innovation, pupils from Isambard Community School were present throughout the meeting, producing and showing an excellent video record of the day.



IWA Young Water Professionals' Conference Glasgow, 15–17 April 2015

For the fourth year running FWR supported the IWA YWP Conference, held this year at Glasgow's Strathclyde University. A total of 175 delegates, plus exhibitors and the largest number of presenters so far, made the conference an event to remember. The sessions were complemented by a careers forum, a civic drinks reception hosted by Glasgow City Council and a gala dinner at the Òran Mór venue. Two site visits were included in the final day's programme, the first to Scotland's National Mining Museum, and the second to Dryden Aqua's Technology Centre, manufacturers of unique water filtration media. The day ended with conference games back at the University.

All images courtesy of Neil Tytler



At the National Mining Museum of Scotland



Coal cutter/loader



An update on the activities of the FWR

Caryll Stephen

Chief Executive of the Foundation for Water Research



Hopefully summer is now well on its way – the swallows have returned which is usually a good sign and the countryside is becoming greener with each passing week.

FWR is again envisaging another busy six months, particularly on the exhibition scene with a number of public boat shows and Water, Sewerage & Waste events on the agenda. Our website continues to

attract more visitors and three further Reviews of Current Knowledge are expected to be published shortly.

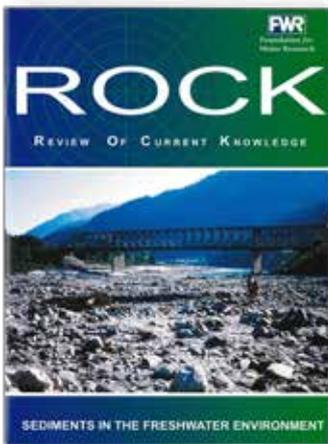
Following the UK launch of the Regulation for Water Quality book in January, the first training course, based on the book, was organised and hosted by Cranfield University in April and was well attended; this will be covered in our next newsletter. We were also delighted to be awarded a further contribution from Defra for the South Chilterns catchment which this time also covers project work – habitat improvement will be carried out on the Wye and the Pang, and this will start in the next few months.

As always, a very big thank you to all who contribute to our work.

New FWR Publication

Sediments in the Freshwater Environment

FR/R0022 February 2015



This ROCK (*Review of Current Knowledge*) concerns the movement of sediments in the freshwater environment, an important and complex subject. The review provides an outline of the topic and a description of some of the principles used in the analysis of the many complicated processes.

Erosion of the earth's surface by water, wind and ice has occurred over geological time scales. Sediments released in this way undergo successive periods of deposition and re-erosion as the landscape changes.

In the distant past the processes of erosion and deposition were natural phenomena which were largely unaffected by human activities. However, in the last millennium there have been significant changes caused by such activities and these changes have intensified following the Industrial Revolution. The rapid growth in population together with changes in land use practices for industry, housing and agriculture mean that we now have a significant influence on the movement of sediments.

A knowledge of the complete cycle of detachment, entrainment, transportation, deposition and consolidation of sediments, as outlined in this ROCK, provides an understanding of how sediments move through the landscape. It also provides a means of predicting future changes as affected by our activities.

Copies are available from the Foundation, price £15, less 20% to FWR members, or may be viewed at: <http://www.fwr.org/water/fr0022.pdf>

David Newsome Annual Award for Postgraduates

FWR's mission is to advance the education of the public in the water sciences. One way of doing this is by the production of 'Reviews of Current Knowledge' (ROCKs) which aim to explain **the current knowledge of a specific field**, in a format which can be understood by the intelligent layperson.

FWR makes an annual award of £5000 to commemorate the contribution made to FWR by the late David Newsome. The award is granted, once a year, to an appropriate postgraduate student and their supervisor to write a booklet suitable for publication in the FWR ROCK series. Examples of current ROCKs can be found at <http://www.fwr.org/rocks.htm>

Applications for an award are welcome in any of the following fields:

- water resources
- water supply, water treatment, wastewater
- surface water issues in rivers, estuaries and coastal areas
- management of the water environment.

Applications are invited for the 2015 award, to be submitted by end of July.

Initial inquiries please to Debbie Ruck at debbieruck@fwr.org.uk

Produced by the Foundation for Water Research © FWR 2015

It is FWR's policy to improve our services in every way and so whilst details set out in this publication were correct at the time of publishing, we are unable to guarantee that changes have not subsequently taken place. We therefore reserve the right to alter content at any time without notice.

This publication may not be copied for distribution or used for any commercial reason without prior permission from FWR.

Design Agency - <http://www.connellmarketing.com>



Foundation for Water Research

Allen House, The Listons, Liston Road, Marlow, Bucks SL7 1FD.

T : +44 (0) 1628 891589

F : +44 (0) 1628 472711

E : office@fwr.org.uk

W : www.fwr.org