



River Restoration NEWS

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NEWSLETTER of the RIVER RESTORATION CENTRE

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A transformed river with habitat not fit for a signal crayfish

Prior to the restoration scheme on the Lambourn Bruce Wheeler, the river keeper, caught signal crayfish by the cage load. This project demonstrates how habitat improvements can be made, whilst controlling these unwanted species. Russ Money (Natural England) and Simon Cain (Cain bio-engineering) summarise the story of a transformed SSSI river.

The Lambourn, in Berkshire, is a designated SSSI SAC chalk river flowing for 24km from the village of Lambourn to Newbury where it meets the River Kennet. As an important wild trout fishery, the river supports luxuriant beds of water crowfoot and a rich diversity of associated plant and animal species including brook lamprey and bullhead.

The project focused on an 800m reach managed by the Bagnor Estate at Hunts Green. Past physical modifications had left it straightened, over wide and over deep. Consequently the river was sluggish, silty and sparsely vegetated. The soft, organic-rich alluvium banks are ideal crayfish burrowing habitat. Despite trapping efforts bank collapse, over widening and silt pollution continued.

The aim was to restore classic chalk stream features including a clean gravel bed and extensive beds of water crowfoot. Re-profiling of the high banks and re-alignment of the channel achieved angler aspirations and met Natural England's nature conservation objectives.

A variety of techniques such as brushwood mattresses, deflectors, causeways and berms were used to increase channel sinuosity and in-stream turbulence. This resulted in the re-generation of geomorphic forms such as pools and riffles with associated substrates. Key to design success was marginal habitat promotion on both banks whilst allowing for single bank angler access.

Built-in Crayfish resistance was a critical consideration. The restoration deliberately set out to create un-favourable bank conditions for crayfish to inhibit burrowing and reduce their numbers. This was achieved using a variety of approaches appropriately designed for the flow conditions and channel alignment.

These included:

- Flow deflection and brushwood silt traps to encourage silt margins

*Reprofiled bank and low gravel berm
- May 2006 (Russ Money)*

- Low angle bank re-profiling to support marginal plants
- Gravel and cobble to protect the bank toe designed below summer water levels.

In light of the recent drought conditions in south-east England the

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For further information on the RRC and its activities please view our website: www.theRRC.co.uk

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project also tried to design in features that would accommodate lower than average flows in the expectation that such events might become more frequent. Thus the restoration was designed using a two stage channel approach with the creation of low-profile gravel sills to maintain high velocities during low flow periods whilst providing the necessary channel capacity at high flows.

The results so far have been very positive in terms of habitat improvement despite the 2006 drought conditions. This project provides a model of how quickly and cost effectively a scheme can be successfully delivered especially

when there is a close partnership between fisheries, statutory organisations and contractors. The scheme was delivered expeditiously from a start up meeting in January 2006 to completion a few months later in April 2006 at a cost of £80K with additional work in kind (ca. £25K) provided by the Estate (ie manpower, site supervision and locally won materials).



3 months post construction - restored channel and revegetated berm (Simon Cain)

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Natural England provided funding, Cain Bioengineering Ltd designed and installed the scheme. This was delivered through a management agreement between Natural England and the Bagnor Estate.

WETLANDS: A VICTIM OF CLIMATE CHANGE BUT A WEAPON AGAINST IT

Wetlands were identified as an invaluable resource at CIWEM's World Wetlands Day conference. Harriet Greene (CIWEM) and Alice Fellick (RRC) provide a short account.

World Wetlands Day is celebrated annually to mark the signing of the Convention on Wetlands on 2nd February 1971 in the Iranian city of Ramsar. Activities which promote the value of wetlands are organised all around the world ranging from art competitions for school children to lectures and guided nature walks.

This year's World Wetlands Day conference, organised by CIWEM, took place in central London on 31st January – 1st February. The conference was entitled 'Developing Practice on the Ground'. Presentations were given by a wide range of speakers. Some of the underlying themes included a strong emphasis on the economic value of wetlands and the services that they provide; strong concerns over the threats to these important ecosystems; the need for a more integrated approach; and the importance of community involvement in developing project ownership and success.

During his opening speech, Barry Gardiner MP, Minister for Biodiversity, Landscape and Rural Affairs, called for a rethink on the way we treat our wetlands. Although we're supposed caretakers of this planet, he described how we have over-exploited it for short-term gain. He said that wetlands are a major resource, not least because they are 'a weapon against climate change, not just a victim of it'. The Minister went on to highlight recent projects in the Humber estuary and at Wallasea Island, Essex, where wetlands have been re-created to manage flood risk and provide important habitat for protected bird species. The Minister warned that such crucial ecosystem services must be considered in government decision-making processes.

Professor Charles Simenstad from the University of Washington, Seattle gave an international dimension with his presentation on the challenge of restoring wetlands in coastal Louisiana. Here, 90km² of wetlands are lost each year on average. Post-Hurricane Katrina, the challenge has become even greater because authorities have mistakenly regarded extensive high-walled levees as the best protection, despite scientific evidence suggesting that wetlands can lessen storm surges.

Another highlight was Helen Smith's presentation on the Little Ouse Headwaters Project, a small community-run project which was last year awarded the RSPB/CIWEM Living Wetlands Award. She described how the project, based on the Norfolk-Suffolk border, was set up by local people wanting to re-develop a synergy between themselves and the Fens. Managing 40 hectares of riparian habitat across 5 sites, the volunteers have created a haven for nationally-important wildlife, accessible greenspace for recreation, and even bolstered the local rural economy by the awarding of contracts locally. The project is a great example of the multiple benefits from sustainably managed wetlands.

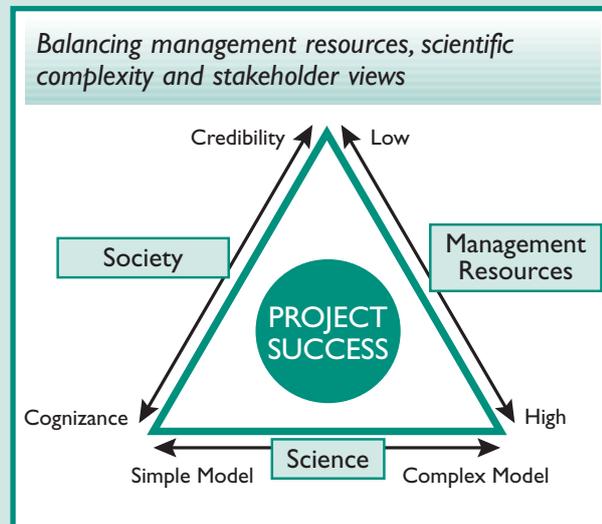
The conference generated a lot of very interesting discussion. Aspects of the wetland environment that are overlooked by policy such as ponds and small water bodies were highlighted, whilst the many case studies gave a bright outlook for the future of UK and international wetlands - but only if wetland restoration works remain a government policy priority.

Accounting for sediment in rivers

Colin Thorne, Nick Wallerstein and Philip Soar outline how a Flood Risk Management Research Consortium (FRMRC) toolbox may help river restorers.

The importance of ensuring connectivity in the fluvial sediment transfer system is not only recognised in many restoration design methods (Copeland et al. 2001)¹ but is also an important component of the hydromorphology element of the Water Framework Directive (WFD). Restoration designs that disrupt sediment connectivity may require unsustainable maintenance to prevent channel instability from later destroying valuable habitats in the restored reach. Further, in streams covered by the WFD², failing to account for sediment may lead to a scheme missing the required environmental standard when the proposed restoration design is assessed using the Morphological Impact Assessment Tool – MIMAS³.

In the UK, sediment dynamics are currently considered in restoration design by geomorphologists, using the 'Fluvial Audit' approach (Sear et al. 2003)⁴, which places local sediment issues properly within the catchment context. The Fluvial Audit provides a practical approach that can be applied across a range of catchment scales. It does not, however, explicitly indicate whether a proposed restoration design is consistent with maintaining sediment continuity and connectivity in the fluvial system. The sediment computations required to define sediment continuity are seldom addressed by geomorphologists but are conventionally performed by engineers, using iSIS Sediment⁵. However, the high cost (in both technical resources and data acquisition) of applying iSIS sediment tends to limit its use to flood defence applications and it has been applied to only the most well financed river restoration schemes and then usually when restoration is being undertaken as part of a flood alleviation scheme.



It is in the context of the limitations of conventional qualitative and quantitative methods of accounting for sediment that the FRMRC⁶ has assembled a toolbox that could be useful to river restorers faced with the need to account for sediment in restoration design within the constraints imposed by limited resources of time and money.

Toolbox tools include: Stream power screening tool; River Energy Audit Scheme (REAS); Sediment Impact Assessment Model (SIAM); Hydraulic Engineering Center – River Analysis System (HEC-RAS 4.0); iSIS Sediment; Cellular Automaton Evolutionary Slope and River Model (CAESAR). A recent account of the sediment toolbox may be downloaded free from the FRMRC⁷ website by following links to the User Focused Measurable Outcomes (UFMOs).

The tools range from simple, screening level tools that do not require sediment transport calculations to 1 and 2-dimensional models capable of computing sediment fluxes and morphological changes over large distances and long timescales. Selection of a tool that is appropriate to the

application at hand is crucial. Selection must consider not only the need for the scientific basis for the tool to match the difficulty of the sediment issue being addressed, within the resources available; but also the need for the outcome to strike the right balance between stakeholder credibility (which may be low for simple, low cost methods) and cognizance (perhaps a

problem for the more analytically complex models) (See figure).

A factor common to all the tools is that they are intended to *build on* rather than *replace*, the Fluvial Audit. Hence, the methods and models included in the toolbox all start by assuming that the user already has a sound, qualitative understanding of the fluvial and sediment systems, gained from a Fluvial Audit or equivalent methodology.

River restorers interested in accounting for sediment in their scheme designs are invited to review the sediment toolbox. Tools are currently being tested by the FRMRC through application to selected sites across the UK in collaboration with the River Restoration Centre. The results will be available later this year. The toolbox will then be made available for beta-testing. Once the testing phase is complete it is anticipated that training workshops will be offered, starting in mid-2008, with the aim that accounting for sediment can become best practice in restoration design by the end of the decade.

For further information and references please refer to page 8

Island creation at The Broads,
Upper Woodford

STREAM - Management

demonstration site aims to provide a 'toolbox' of techniques that fishing clubs can use to help integrate the needs of riparian ecology with fishery management.

The restoration works carried out included brushwood and chestnut stakes in-filled with flint to create vegetated islands and the construction of a causeway just above water level to narrow the channel, by approx. 25%, and create a sheltered backwater area. A combination of log weirs and D-shaped deflectors, made of brushwood, were used to encourage variation in flow and morphology. The design of structures was critical not only in terms of their success for the hydro-geomorphology but also in order to ensure that the valuable water vole habitat on site was protected.

Iron hatches, Fovant - River Nadder

This site is also over sized compared to the current range of flows as a result of historical dredging. The bed is relatively homogeneous with little aquatic vegetation. A sluice at the downstream limit of the reach is used to maintain water levels, leading to slow flows and heavy siltation.

The restoration works carried out at this site aimed to modify the channel to a more appropriate width and shape (approx. 30% of current width) thus allowing the impoundment downstream to be reduced and improving in-channel and marginal habitats. Selective coppicing of trees on the adjacent south river bank, to allow light to reach the channel and encourage good bankside vegetation cover, formed the first phase and provided on-site material for the in-channel restoration. The tree works had to be carefully managed since the woodlands at this site are known to be valuable habitat for

STREAM is a 4-year LIFE-Nature funded project focusing on the River Avon Special Area of Conservation. Jenny Wheeldon (STREAM Project Manager) and Alice Fellick (RRC) together with a contribution from Joanna Eyquem (Royal Haskoning) provide an insight into the project after the first phase of the restoration works.

The project

In 2003 an ambitious partnership project was launched - the River Avon and Avon Valley Initiative (RAVVI). This project, featured in Issue 17 of RR News¹, encompassed the entire River Avon system and its tributaries in Wiltshire and Hampshire. The project developed following publication of the River Avon cSAC Conservation Strategy² which identified the main issues affecting the ecological health of the River Avon Special Area of Conservation (SAC), and agreed on a range of actions required to address them. To put this strategy into practice the partnership put forward a bid to the LIFE-Nature fund entitled STREAM - the STRategic REStoration And Management of the River Avon (SAC) and Avon Valley Special Protection Area (SPA). This bid

was accepted and the project began in September 2005.

STREAM is a £1 million, four year partnership project. The aims of the project are to demonstrate and monitor river restoration at six sites; link management of the lower reaches of the river with the floodplain; disseminate best practice to UK and European river managers and specialists; and raise awareness of the river system and the project in the local community by holding open days and events.

Restoration works

Restoration works at the six sites in the Avon Valley will be staggered over the four year life span of the project. To date, restoration works have been completed at two sites, which are the focus of this article: The Broads at Upper Woodford on the River Avon and Iron Hatches at Fovant on the River Nadder. These sites were restored in September – October 2006.

The Broads, Upper Woodford - River Avon

This site is overwide with respect to the current flow regime (25m–30m), with a uniform bed profile, poorly sorted substrate and very little in-channel vegetation. The objective of the restoration was to demonstrate a range of bio-engineering techniques, that are useful for narrowing overwide rivers and hence increase flow and substrate variation. This

Electrofishing — part of
Royal Haskoning's
monitoring programme

Strategic Restoration and Management of the River Avon SAC

bats, and it was thus important to safeguard their protection.

In the second phase of the works deflectors, made from the felled trees, were installed, filled with brash and topped with pre-planted matting to allow rapid vegetation growth. In addition, existing in-stream gravels were redistributed to increase the gravel depth in the faster flowing narrowed channel.

A deflector at Iron Hatches, largely constructed using wood from on-site



Survey and monitoring work

All too often restoration projects are completed with limited or no monitoring. From inception, the project team were keen to ensure that a programme of project appraisal and monitoring would be an integral part of the restoration process. Natural England have worked closely with consultants Royal Haskoning to establish an appropriate monitoring protocol that employs a variety of complementary techniques and is realistically achievable within the confines of available resources.

Royal Haskoning will undertake physical and biological monitoring at the six restoration sites, comprising one pre-restoration and one post-restoration survey at each site. Reach-scale mapping techniques, including physical biotope mapping, Fluvial Audit, River Corridor Survey and repeat photography, will be

used to monitor change at all restoration sites. Two of the sites will also be subject to more detailed surveys and include control sites. Detailed monitoring techniques will comprise macrophyte survey, fisheries survey, cross-section levelling survey and depth, velocity and substrate measurements.

The monitoring surveys will be used to document the restoration works and comparisons will be made concerning the physical and biological relationships identified at the time of survey, whilst bearing in mind other potentially influencing factors and processes. It is hoped that the project will demonstrate that it is possible to undertake a useful monitoring programme within the confines of a limited budget which may encourage the inclusion of monitoring within other river enhancement initiatives.

Along side this the River Restoration Centre (RRC) is carrying out an assessment of all the sites pre, during and post restoration works. The restoration methods will be reviewed against their design objectives using the expert judgement and the experience of the Centre staff. The RRC will consider the monitoring results in the context of its experience of river restoration projects throughout the UK to assess the likely long-term outcomes at each site. This assessment will provide a summary of success and failure, and importantly, comment on longer term predicted success of the project.

Together the RRC and Royal Haskoning monitoring and project appraisal approaches will be used to report back to LIFE-Nature. The surveys should help to

demonstrate how the use of relatively low cost techniques can help to increase stream physical habitat. It is anticipated that outputs will increase confidence in the benefit of advocating such techniques to fishing clubs and other local interest groups keen to improve river habitat quality.

Project support

The project is supported financially by the European Commission's LIFE-Nature fund. Project partners Natural England (formerly English Nature), the Environment Agency, Wiltshire Wildlife Trust, Hampshire and Isle of Wight Wildlife Trust and Wessex Water have also committed funding and support.

Further details

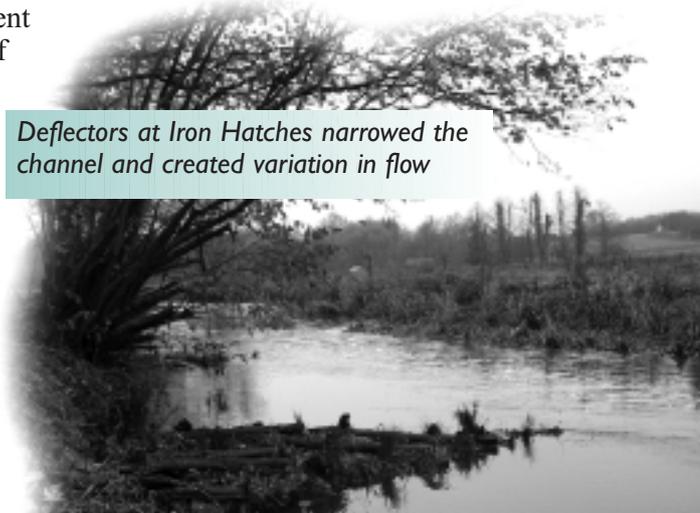
The STREAM website will go live imminently. It will contain details of all aspects of the project, all reports and publications, plus details of all events. The website will be updated as the project progresses.

Please visit: www.streamlife.org.uk

¹ Past issues of RR News are available from the RRC website.

² The River Avon cSAC Conservation Strategy (2003) can be viewed and downloaded from: <http://www.english-nature.org.uk/lifeinukrivers/strategies/Avon/avon.html>

Deflectors at Iron Hatches narrowed the channel and created variation in flow



James Bond does River Restoration

So you thought that James Bond was busy tracking down the banker to the world's terrorist organisations, but it seems it is not his only mission of late. In Washington State, USA, Bond and his accomplices (including 'n' (Manning's), 0.007, Frieda Trees and the Dam Queen to name but a few) have been on a not-so-secret mission to 'Free Rivers from their Bonds'. The River Restoration Centre was invited to attend the River Restoration Northwest's (RRNW) latest meeting (which had a James Bond ice-breaker theme) to discover how river restoration could play its part in this mission. Jenny Mant, RRC's secret agent (alias Mayfly Nymph) reports...

On the RRC's Secret Service

In a hotel near the Columbia River, Washington State, situated between the steaming Mount St Helens volcano to the north and the film location for *The Shining* to the south, 380 delegates met in February, 2007, to discuss the current success of river restoration. Although the conference focused primarily on northwest United States restoration, so far reaching is the river restoration communication network that delegates gathered at this venue from all parts of the USA and Canada and even as far a field as Germany and the UK.

The World Is Not Enough (climate change)

The conference did not start on an upbeat note. The first two papers provided a Canadian perspective on the impacts of climate change for environmental habitats. Future

climate change scenarios, based on data from a recent (early February 2007) Intergovernmental Panel on Climate Change (IPCC) working group report, suggest that within a few decades many of the native cedars on the west coast of the USA would be under threat. So have we already over-stepped an 'ecological footprint' and upset the world's equilibrium too far to reverse current human induced global climate change? Are we in a situation where whatever we do to reduce global climate change might be in vain or, do we need to reduce energy consumption by 90% of its current level to have any hope of reducing current climate trends? Strong words indeed and certainly sufficient to wake up any jet lagged audience.

These messages were soon moderated by the thought that many species are resilient to change;

salmonid species have previously found enough habitat niches to survive past glacial periods, so why not the current climate change? It is this belief that provides the impetus for river restoration and rehabilitation aimed at providing, at the



(Figure 1) Cedar Creek limiting fish passage: approx. a 6m barrier

very least, refugia for riverine species whenever the opportunity presents itself.

Never Say Never Again (monitoring)

Donald Rumsfeld's (ex US Secretary for Defence) poem "The Unknown" was seen as particularly relevant to this conference, especially with respect to monitoring protocol. *'There are things we know we know. We also know there are known unknowns... But there are also unknown unknowns, the ones we don't know we don't know.'*

An inspiring talk from Phil Roni (Northwest Fisheries Science Center, Seattle, Washington), backed up by a series of case studies from other presenters, stated that millions were spent each year on rehabilitation of aquatic habitats. As such, scientists had a duty to ensure that techniques used are effective to guide future restoration



The anti Bond Girls doing their bit to free rivers from their bonds

efforts (i.e. reduce the unknowns). He emphasised that the best chance for understanding aquatic habitats was through field experiments but this could only be achieved with continued public support. He also stressed that it was critical that the reason for monitoring was clearly stated in project objectives and driven by defined questions. In some cases, for example, the key objective may be to establish status and trends where annual measures of abundance and habitat condition would need to be measured, whilst for other projects, implementation and issues surrounding the project construction and robustness of technique should be the main focus of the project appraisal. Only once the rationale for the monitoring is established can the correct parameters be selected and the appropriate spatial and temporal replication sampling protocol be defined.

‘Q’ meets ‘n’ (restoration design is full of stress)

The River Restoration Centre advocates careful design as a key component of restoration success. The importance of considering the fundamental relationships between stream discharge and bank strength/stress (as a combination of sediment and vegetation type and quantity) in the design process was a continuing theme throughout the three days.

The west coast of the US is blessed with many rivers where there is space for natural unconstrained river processes to occur. River restorers are therefore in the fortunate position of being able to trial techniques on natural rivers before demonstrating them in more vulnerable and restricted locations. Whilst UK restoration may need to scale down some of the techniques designed and demonstrated at this conference, we can certainly learn from the work already completed.

A refreshingly honest presentation by Douglas Shields (US Department of Agriculture) about the design of

large woody structures is a good example. At one site where large wood was part of the restoration design, many of the structures were destroyed or damaged following seasonal high flows. This led Shields and his colleagues to re-examine the design criteria. They recognised that Manning’s *n*, drag and lift coefficients, wood density, and structure porosity were all fundamental to confident design and appropriate anchor load. This however, was not the end of the story. The importance of natural river processes should never be far from the mind of the river restorer. In this case, applied design safety factors were directly related to substrate type and its propensity to move during high flow events.

For Your Eyes Only (those dam dams)

Whenever fish become a key restoration objective in the UK, fish passage is invariably a concern. Well, if you thought you had a problem, spare a thought for those working on the Cedar Creek dam removal scheme in Washington State as shown in figures 1–3. Before the dam could be obliterated, about 15,200m³ of sediment needed to be removed behind the structure. And how do you go about dewatering the system before you start the work? Subsequent restoration included re-planting and bank stabilisation through the use of geo-textile matting and large engineered log jams (a technique of which the Pacific northwesterners are particularly fond).

So can James really help?

Bond himself may be busy tracking down criminals around the world but under current climate change scenarios the same urgency to secure habitat niches for environmental gain can be seen in the restoration community. With new gadgets and *n*’s ingenuity, it



(Figure 2) Removing 15,200m³ of sediment prior to Cedar Creek dam removal

(Figure 3) Post-dam removal grade control incorporating engineered log jams



seems that whilst river restorers might not be poised to take over the world, they are a force to be reckoned with in terms of ensuring our world (and its rivers) IS enough to sustain a diverse range of habitat types.

Further information and acknowledgements

The presentations given at this conference will soon be posted on the RRNW’s website:
www.rrnw.org.

For those of you attending the RRC conference this year their conference organiser Janine Castro will be attending and will be more than happy to answer any further questions.

In the meantime, if you have any burning questions please contact the RRC.

Figures 1 - 3 courtesy of Bill Norris, Inter-fluve Inc.

News and Events

Further information for 'Accounting for sediment' article (From page 3)

Authors:

Colin Thorne, Nick Wallerstein - School of Geography, University of Nottingham;
Philip Soar - Jeremy Benn and Associates, Atherstone.

References:

- 1 http://libweb.wes.army.mil/uhtbin/cgiirsi/34NBxfln50/ERDC_VBG/185360025/523/6480
- 2 www.wfduk.org/
- 3 www.sepa.org.uk/wfd/standards/index.htm
- 4 www.defra.gov.uk/science/project_data/DocumentLibrary/FD1914/FD1914_11_47_TRP.pdf
- 5 www.wallingfordsoftware.com/products/isis
- 6,7 www.floodrisk.org.uk

Conferences

Climate Change and Aquatic Ecosystems in Britain: Science, Policy and Management

May 16th 2007 – University College London

For more information visit:

www.ecrc.ucl.ac.uk/content/view/349/151

British Society for Geomorphology (BSG) Annual Conference

July 4th – 6th 2007 – University of Birmingham

For more information visit: www.geomorphology.org.uk

Change in Aquatic Ecosystems: Natural and Human Influences

July 4th – 6th 2007 – University of Plymouth

For more information visit: www.aquaticchange07.org

FBA Scientific Meeting: The Ecological effects of Our Use of Water

September 5th – 6th 2007 – FBA Windermere

For more information visit: www.fba.org.uk

Freshwater Habitat Management for Salmonid Fisheries

September 18th – 21st 2007 – University of Southampton

For more information visit: www.salmonidhabitat.com

4th ECRR International Conference on River Restoration

June 16th – 21st 2008 – Venice, Italy

For more information visit: www.ecrr.org

Courses

River Restoration short courses 2007

Portland State University, Oregon, USA.

For more information visit:

www.epp.esr.pdx.edu/riverrest.html

River Restoration Monitoring Workshop

In December 2006 the RRC organised a multi-disciplinary workshop. The aim was to bring together key people from a range of natural science disciplines and backgrounds to agree a practical monitoring protocol for river restoration projects. It provided an excellent forum for discussion and significant progress was made towards realising the workshop goals and highlighting ways forward to achieving a monitoring protocol.

A workshop summary will soon be available on the RRC website: www.therrc.co.uk.

This workshop was supported and sponsored by Environment Agency, Scottish Natural Heritage and Scottish Environment Protection Agency.

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RRC is most grateful to all those who have contributed text or photos for this Newsletter

The following statutory organisations provide Core Funding for the River Restoration Centre and their Representatives form the Advisory Board who together with RRC's Directors make up the RRC Council.

