River Restoration and Chalk Streams

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University of Hertfordshire, College Lane, Hatfield AL10 9AB

Organised by *the* River Restoration Centre

in partnership with

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Environment Agency, Thames Region

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INTRODUCTION

Workshop Objectives

- To facilitate and encourage interchange of information, views and experiences between people working with projects and programmes with strong links to chalk streams and activities or research that affect this environment.
- To improve the knowledge base on the practicalities and associated benefits of chalk stream restoration work in order to make future investments more cost effective.

Participants

The workshop was specifically targeted at individuals and organisations whose activities, research or interests include a specific practical focus on chalk streams. Participants ranged from those involved in river habitat conservation and rehabilitation, pollution control and integrated land management projects to those with a policy interest. A list of participants is included in Appendix I, followed by a summary of the projects or activities in which they are engaged in Appendix III.

Format

The first day of the workshop was split into eight individual classroom sessions attended by all participants. Each session was led by one or two facilitators charged with introducing the session and then leading and stimulating discussion on the assigned subject.

Reporting

The report which follows makes no pretence of comprehensively exploring or documenting each of the above subject areas. Rather it is intended as a ready-reference summary of the key points covered by presentations made at the River Restoration and Chalk Streams workshop, and arising during subsequent discussion. The format reflects the variation between individual sessions depending on subject matter and facilitators. Conclusions are included if and when these were discussed or could be surmised from discussion, thus some of the sessions have no conclusion element. For the sake of clarity, points raised are documented under the most appropriate session heading rather than strictly verbatim.

SESSION 1: FLOW RESTORATION

Facilitators: Doug Wilson (Environment Agency) and Matt Johns (Entec)

Why worry about flow restoration?

Although the past winter has been the wettest since the 1870s, climatic change implies drier summers and more frequent droughts in future. Low flows are therefore a highly significant issue to consider. More specific reasons for maintaining or restoring flow are as follows:

1. Ecologically important – Species such as *Ranunculus* and *Callitrichae* are in themselves of nature conservation importance, but equally valuable are the fish, birds and other species which depend on these plants, which in turn depend on sufficient flow in chalk streams and rivers. Flow is also significant to the quality and extent of adjacent riparian habitat, including wetlands and water meadows, on which orchids, iris, waders and many other species depend. Water flow is important in the exchange of nutrients between rivers and their floodplains, and in the movement of wildlife between riverine and riparian habitats.

2. Fisheries interest – level and consistency of flow is critical to fish populations and movement.

3. Recreation and amenity value – typically decreases with reduced flow.

4. Sustainable use of water resources – EA is duty bound to balance water abstraction with environmental interest.

Impacts of low flows

- Increased susceptibility to drought
- Shift in biotic structure. Although inevitably there will be some winners and some losers from either floods or droughts, a long-term shift in flow will result in permanent changes in the species which chalk stream systems support.
- Changes to channel geomorphology including loss of available habitat and encroachment by terrestrial (particularly grassland) species.

Restoring Sustainable Abstraction Programme (RSAP)

The logic behind this programme is to establish an audit trail which will provide a consistent basis for making decisions. The essential precursor has been to compile a list of sites known to be affected or potentially affected by abstraction which if necessary can then be monitored. Nationally approximately 600 such sites have been listed, of which 120 are in Thames region, all of which are chalk streams. Asset Management Plans (AMPs) and Alleviation of Low Flow Schemes (ALFs) are then produced to embrace relevant sites.

Site prioritisation

The system established needs to be flexible but remain nationally consistent. Criteria used are:

- Habitats Directive (i.e. statutory obligation)
- Asset Management Plans (AMPs) (all AMP3 to be produced within 5 year deadline)
- SSSI with abstraction concerns (Spider book)
- LEAP (i.e. local concerns)

Management options

- Reducing/managing demand is preferable to having to alleviate flow problems,
- Modifications to the abstraction regime including relocation of abstraction point(s) outside or lower down the catchment where there is less likely to be negative effect on flow in the river system. In the Chilterns AONB high levels of abstraction have been compensated by stream augmentation from the greensand aquifer, although the ecological implications and sustainability of this kind of approach both for the chalk river system and alternative water source need to be carefully considered. Treatment of the greensand water such that it can be used for drinking water might be a preferable alternative, although associated habitats and full costs (i.e. not just monetary) must be taken into account.

- Changes in discharge regime – careful consideration needs to be given to the relative benefits of quantity versus quality - restoration of discharge high in the river system may have detrimental effects on water quality.
- Recirculation of surface or groundwater
- Augmentation from bankside boreholes.
- Changes to river/wetland management practices – individual abstractions may have impact but look at the wider picture
- River bed sealing may be necessary in some circumstances where specific leakages are identified but should be considered a last resort due to attendant risks of separating a river or stream from its natural geology and the resultant loss of character. It is questioned whether there is a role for a semi-permeable self-clogging membrane which will silt up more efficiently than bare chalk.
- Final option is to do nothing.

Factors to be taken into consideration when considering the most appropriate option include sustainability, fairness to abstractors and the relative costs/benefits (with inevitable implied difficulties in quantifying environmental benefits and disbenefits).

River Misbourne Case Study

The Misbourne suffers frequent problems with low/no flow in its lower sections, in part due to the relatively small catchment (which by geological definition is long and narrow). Sewage works for each individual town have now been amalgamated into one new treatment centre, as a result of which discharge is not being recycled throughout the river system. Three options were considered:

1. decrease abstraction by Thames Water in the upper catchment;
2. augment from boreholes in the upper catchment;
3. recirculate water from the bottom to the top of the catchment.

Phase I, implemented in 1997, has involved Thames Water reducing abstraction by 7 mg/l/day by supplementing with boreholes from the Thames catchment, and Three Valleys reducing abstraction by 8 mg/l/day through use of boreholes from the Colne system. It is recognised that the root cause of the problem is abstraction at rates greater than the river system can sustainably support, and there is no pretension that the approach adopted is ideal. However, 2000 was the first year when flow was maintained to at least some extent. Over time it is hoped that the river bed will silt and thus seal naturally, and that groundwater levels will be restored. There is considerable local pressure to implement a second phase of work including supplementary sealing of the river bed to promote flow through the whole length of the river, and possibly further reduction in Three Valleys abstraction.

Conclusions re. flow restoration

- Public awareness of the inherent value of chalk streams is generally low.
- Winterbournes are a natural feature of chalk river systems, dry periods and differential flow regimes according to season contributing to their nature conservation interest, but many members of the public (particularly those keen to maintain chalk streams as water features in their garden) expect and demand constant flow. Pressure may therefore result (as experienced by Wessex Water) to maintain or install artificial lining to the stream/river bed to maintain flow by reducing natural seepage.
- Abstraction is often not an issue in winter when flows are naturally higher, but may become a major concern in spring/summer when flow may be critical to maintain/enhance productivity of *Ranunculus* (which in turn is the driver of ecology of many chalk streams)
- Channel restoration can increase structural variability in chalk streams which will support a more viable ecology, but is unlikely to redress.
- Cost/benefit analysis of automating and rationalising sewage treatment works must take account of the implications on water flow and quality of where treated water is restored to the river system. Thames Water now has a strict policy on this issue to try and avoid past flow problems which have resulted from re-siting or amalgamation of sewage works.
- Current owners of many mill properties would prefer a pond as a garden water feature to restoration of the original mill function.

Information requirements

- Information is required on low flow alleviation technologies and techniques applicable to chalk streams.
- For future reference it would useful to know whether others have undertaken flow modelling on any of their enhancement works. By transposing others results to similar projects, on similar river types, it may be possible to reassure Flood Defence engineers.

SESSION 2: HABITAT RESTORATION

Facilitators: Allan Frake (Environment Agency, South-West region) and Vaughan Lewis (Windrush AEC)

Experiences in the Hampshire Avon and West Dorset Frome catchments

Past habitat restoration in both these catchments has tended to be on a reactive rather than proactive or strategic basis, and mostly to do with fishery improvement. In the last three to five years, attempts have been made to introduce a more holistic approach, although South Wessex recognises the high risks of its approach with 90% of funding targeted on action and less than 10% on planning.

Enlightened engineers are increasingly recognising the benefits of restoring floodplain function and increasing channel capacity through creation or restoration of backwaters as a cost effective flood defence mechanism. In theory this approach should be a win:win situation, not least in providing a conduit for flood defence funding/budgets to be used for habitat restoration. Recent floods have helped increased emphasis on the scope for habitat restoration which will also enhance flood defence mechanisms. MAFF ratification of use of Thames region's flood defence budget for habitat enhancement will hopefully have positive benefits for other regions. However in practice a fundamental change in attitude is required which may take time to develop.

Over-deepened channels

One of the most common problems is over-deepening and canalisation of the channel, now typified by emergent vegetation, as a result of dredging during the 1960s/1970s for flood alleviation and to control invasive plants. Work has focused on trying to restore habitat to its pre-dredged state, including recreating riffles by tipping gravel into the stream, faggoting to squeeze the stream into a narrower channel and so increase flow energy and restoration of a two-stage channel with wet margin. Work on main rivers has proved much more expensive. For example, attempts to increase diversity in a very fast, over-energetic river with low habitat/species diversity by reinstating a riffle sequence on a 60 m stretch cost £15-20,000.

While machinery was on site, opportunity was taken to create/restore other refuge areas, including a back channel based on a former ox-bow. Heston straw bales have been used as inert void filling to reduce gravel costs. *(Note: much discussion followed on longevity of this approach and its effectiveness long-term, some arguing that anaerobic conditions would prevent the straw rotting and hence gravel above collapsing into the void. The greatest problem in using straw bales in-stream, for example as temporary groynes, is trying to hold them in place and/or sink what has proved to be insubmersible material).*

Ideally samples should be taken and gravel sized and mixed to mimic what would be found naturally in the river, although this is generally too costly to be viable. Over-sized specification is generally cheaper and can improve sustainability (and therefore credibility of schemes) in streams with good sediment transfer where silt and smaller material travelling downstream will be trapped to build up a more natural matrix. Size and depth of material (and void spaces through which they vertically migrate) can be critical for invertebrates, the maximum density of which are found at 30 cm - cobbles and larger gravel may restrict habitat value in this respect.

Gravel previously dredged from streams and rivers by flood defence and land drainage engineers often found piled on the bankside can offer a cost effective source of material for reintroduction to the channel, for example for riffle creation. The ideal is to aim for one riffle per 25 widths of river. During major floods the riffles are likely to flood out and are therefore unlikely to have a detrimental effect in this respect, although the potential risks of downstream siltation from artificial riffle creation/restoration need to be carefully assessed. On the Avon gravel has been loaded into canvas or jute bags to help stabilise features, reduce siltation risk and minimise costs. Good quality gravel of the right size can then be placed on top of the stabilised base.

In some instances clean building rubble such as brick bats or chalk quarry waste may provide a cheap and sustainable void filler but its suitability will depend on erosive ability of the stream, specific site in question, local availability, and ability to type and certify the material as clean and inert. Given that there is as much movement on the bed of chalk streams and rivers as there is on the surface, even buried material is likely to emerge again at some point, usually downstream. Aesthetic implications should therefore also be taken into account as well as water quality. In addition to public relations issues, another consideration, the significance of which will depend on circumstances, is whether use of waste material may potentially set a bad example for lack farmers and landowners which may lead to dumping of inappropriate material in or immediately adjacent to watercourses (typically to redress bank erosion).

Over-widened channels

Poaching by sheep and/or cattle has caused many chalk channels to over-widen, with consequent loss of macrophytes and fish. Emphasis has been placed on restoring structure to the channel and then allowing, encouraging and enabling the river to sort itself out. Upstream facing groins at 60 degrees to the bank overlaid with gravel dug from the river bed have been used to create artificial meanders which prompt instantaneous accretion up and downstream of silt and sand. Even where these features are destroyed relatively quickly, they still create and provoke deposition which in turn helps the river to restore to a more natural diverse form.

Softer approaches using logs and brushwood (mattresses or faggotry) can be highly effective in reforming channels and can develop good macrophyte communities, although the temptation to simply decrease channel width should be resisted. Brushwood "snowshoes" staked to the stream bed create effective designer *Ranunculus* beds. Hampshire Wildlife Trust have successfully replaced former metal structures with spiling, and EA have used willow faggots to similar effect, both encouraging deposition of sediment around the structures which improve sustainability (still intact after 12 years).

Demonstration sites may be artificial, such as on the Piddle where there are over 50 examples of improvement techniques on a 50 m stretch including revetments, otter holts and development of fry areas, but are invaluable in convincing riparian owners of the need and scope for habitat restoration. Work in Salisbury has demonstrated the potential for and benefits of public awareness raising in relation to river restoration.

Conclusions re. habitat restoration

- An understanding of geomorphology is essential to ensure effective targeting and location of schemes.
- Need to define and achieve a balance of interests at reach and catchment level.
- Identify target habitats/species or morphology
- Clear objectives are critically important (but not always easy to formulate given current level of information and research on effectiveness of chalk river restoration rehabilitation techniques). It can also be difficult to achieve an appropriate balance of interests at reach or catchment level – do you target habitats, species or mend the river and hope for the best?
- Integrate existing scientific and practical knowledge into rehabilitation management.
- Accept potential limitations – rivers are complex systems.
- Accept a degree of empiricism – lack of knowledge should not curtail restoration efforts, but Anglia region point out the virtues of establishing a protocol which identified high risk areas where tight design guidance is necessary and low risk areas where there is greater justification for simply getting on with the work.
- Security of funding is a real issue, particularly given reluctance to commit long-term.
- Better monitoring and pre and post project appraisal will help inform future work, funding applications and decision making processes.
- Think holistic not piscicentric.

Priority information requirements

- Exchange of innovative ideas is needed re. the enhancement of the lowland reaches of chalk streams, watermeadow restoration and long term practical management of broad riverside margin land once removed from intensive arable or grazing management.
- Interchange of experience in the principle of temporary installations to encourage the river to mend itself, but which can then be re-used on another damaged section of river.

SESSION 3: SCHEME SELECTION

Facilitators: Dagmar Junghanns and Doug Kite (English Nature)

The Avon is a very managed river, historically for drainage and mills, hence there is an enormous density of structures impounding water. Many current mill owners would prefer a pond as a garden water feature rather than a working mill. Removal of weirs or mill heads to increase water energy can cause problems, hence there is real need for a precautionary longitudinal survey up river to avoid nick-points e.g. undermining of bridge abutments.

Drivers/impetus for restoration projects

1. Fishery/fishing improvements – *ranunculus* growth, clean gravels, bankside habitat, channel diversity - from landowners, angling clubs, fishery syndicates – usually channelled via EA, the main motivation being improvement of trout spawning and/or better fishing/fly habitats (anglers appear generally aware of the importance of vegetation for invertebrates etc. and hence need for habitat restoration)
2. Wildlife gain – channel vegetation, bankside habitat, wetted margins, channel diversity (mosaics) and dynamic habitats. Aim for a range of characteristic species and habitats (plants, invertebrates, mammals, fish et al).
3. Flood defence – channel capacity, bank robustness. Main aim to fulfil statutory flood defence and/or land drainage duties.

Wildlife Gain

English Nature (EN) is keen that any projects to which it is giving consent (and even more so if it is financially supporting) should demonstrate distinct wildlife gain.

SAC candidate (e.g. Avon)
Ranunculus vegetation; salmon; brook and sea lamprey; Desmoulin's whorl snail, bullhead.

SSSI (e.g. Avon, Kennet)
Vegetation (Holmes river type)
Adjacent habitat – wet woodland, fen/swamp, wet grassland
Water voles

BAP priority species/habitats
Chalk rivers/streams, floodplain grasslands, meadows, wet woodland, reedbed
Salmon, otter, water vole, SAC species, kingfisher, crayfish (many BAP target species/habitats are in good condition on the Avon but opportunity exists to enhance, particularly reconnecting river to its floodplain which would benefit a wider range of species by increasing habitat integration)

Existing/future plans and schemes
LEAPs
Site management statements
Agri-environment schemes (some tributaries of the Avon Valley ESA were previously in the water fringe habitat scheme option, now under Countryside Stewardship)
Regional/county BAPs
Rivers LIFE project (River Avon cSAC)
Water level management plan (SSSI) – will help identify were mills, water meadows or other structures are having a negative impact on the river
Water Framework Directive

Organisations
EA, EN, MAFF/FRCA, Wildlife Trusts, Fishing Clubs/Associations, Landowners/tenant farmers, NFU, water companies

Assessment of restoration schemes

EN used scoring system based on following criteria to establish wildlife gain compared with fishing benefits (the latter usually being dominant objective where applications submitted by fishing clubs)

- Nature of the problem at the site
- Costs

- Has river been damaged (e.g. by engineering works)
- External impacts beyond the landowner's control?
- Will proposed scheme benefit SSSI interests
- Will proposed scheme benefit SAC interests
- Will proposed scheme benefit BAP habitats/species
- Will scheme improve trout spawning potential (thereby reducing need for stocking)
- Will scheme provide a mosaic of good riparian habitats (e.g. wetted margins, clean gravels, range of flows)
- Does scheme enhance/relate to surrounding habitats (strategic improvements)
- Has scheme got experimental/educational/demonstration value
- Will the scheme harm any biodiversity/conservation interests
- Sustainability of proposed action.
- Naturalness of scheme
- Potential impact on wider catchment (e.g. Loss of emergent vegetation as a result of bank reprofiling or channel change could result in loss of Desmoulin's whorl snail – in assessing whether a scheme should receive approval/funding, assessment will be required as to whether net species loss will result or whether proposed activity will result in temporary redistribution

Other factors which may be relevant include:
- Need for a quick fix to justify/satisfy funding
- Availability of co-funding – in some cases potential to attract funds may equal conservation benefit
- Owner acceptability – how will farmers and landowners respond to proposals (one volunteer is better than 10 pressed men)

Future Projects for the Avon

LIFE conservation strategy runs for 18 months from February 2001:
- Bring together plethora of existing plans (highlights key issues and remedial/enhancement action required e.g. sedimentation from pigs and winter wheat cropping of downland)
- "research" qualifying interest – vegetation, geomorphology, habitat and species needs, conservation objectives
- Derive strategic priorities – repair damage, restore favourable condition, reconnect river to flood plain
- Reach scale works
- Landscape scale initiatives

Success will depend on a coherent plan, major funding and adequate incentives to inspire and enable action.

"Big" Questions for river restoration and rehabilitation

- What are we trying to achieve – repair, enhancement, constrain river's behaviour?
- How natural should the river be – what is natural, how natural is a chalk stream?
- How much knowledge is needed – micro (e.g. species data), macro (e.g. climate change)
- Should restoration compensate abstraction or other anthromorphological impacts – narrow channels to match depleted flows? (Agri-environment schemes are only a sticking plaster for problems emanating from CAP)
- Should you choose the really bad bits and make them reasonable, or the ok bits and make the excellent?

A typical example which raises all these sorts of questions would be proposals for restoration of a canalised river channel adjacent to a floodplain which has over the years been extensively drained and is now intensively farmed. In many cases EA is under pressure to invest considerable resources into weed cutting to maintain an artificially depressed water table which will support intensive cropping. Typical restoration proposals would be to drag or move part of the (artificial) adjacent floodbank back into the river, whereas a more sustainable and cost-effective solution would be to decrease weedcutting, with consequent environmental benefits for the former floodplain (albeit potentially disadvantageous to maintaining year-round winter cropping).

Key questions for individual restoration schemes

- What is the main objective (biodiversity/fisheries/land drainage/flood defence)
- What are SSSIs/cSAC/BAP opportunities/constraints
- How can schemes be linked/scope for strategic improvements
- Potential negative impacts
- What land use changes are required and how can this be achieved

- Methods to be used, including co-ordination of different landowners/managers
- What are the roles of different organisations and individuals involved

Conclusions re. scheme selection

- Further information is required on how to scope, initiate and fund projects, particularly big strategic projects.
- Information on application for LIFE funding would be valuable.
- Further interchange of information and experience is required re. methods being used to identify 'priority' target areas on a river system for rehabilitation i.e. the strategic approach.

Habitat Enhancement Assessment Criteria Scoring Process (Allan Frake)

• Co-Funding	0-25% = 4 : 25% -50% = 8 : 51+% = 12
• Collaborative partners (non-contributing)	2 for each group
• Watercourse Criteria	Sliding Scale 0–8 (matched to RRC assessment criteria)*
• Flood Plain Criteria	Sliding Scale 0–8 (matched to RRC Assessment criteria)*
• Chalk River	5 = chalk river ; 1 = non–chalk river
• SAC Qualifying Species	2 for each species
• BAP	2 for each BAP species
• Ease of implementation	4 = Easy : 2 = Moderate : 1 = Hard
• Educational Value	4 = High : 2 = Medium : 1 = Low
• Long Term Maintenance	4 = Easy : 2 = Moderate : 1 = Hard
• Degree of degradation	8 = Badly : 3 = Moderately : 1 = O.K.
• Urban Angling Value	4 = High : 3 = Moderate : 1 = Low
• Youth/Disabled Angling potential	4 = High : 3 = Moderate : 1 = Low
• Public Benefit / Access	4 = High : 2 = Medium : 1 = Low

Attribute scoring matrix as used on River Kennet (Mike Crafer, Thames Water Utilities)

Scoring attributes	Score = 0	Score = 1	Score = 2	Score = 4	Score = 8
1. Contributing to improving characteristic ecology	No improvement to chalk stream ecology	Improvements for common species and habitats	Improvements for *Ranunculus*	As 2 plus improvements for one or two other characteristic chalk stream species or habitats	As 2 plus improvements for three or more other characteristic chalk stream species or species
2. Degree/extent of works	N/A	Direct benefits to 50-200 m or 0.5-1.5 ha	Direct benefits to 201-300 m or >1.5-3ha	Direct benefits to 301-400 m or >3-5ha	Direct benefits to >401m or >5ha
3. Visual restoration of chalk stream character	Visual change imperceptible	Visual change perceptible, but no new characteristic and conspicuous chalk stream features	Adds one new characteristic chalk stream feature	Adds two new characteristic chalk stream features	Adds three or more new characteristic chalk stream features
4. Visibility and access	Not visible to the public	Change visible from a distance i.e. non-riverside footpath or bridge	Change visible and works at least partially carried out immediately adjacent to a footpath or bridge	Limited public access in vicinity of the project	Full public access to the project
5. Contribution to improving self-sustaining fishery	No diversity of habitat introduced	Some additional cover/food source introduced	Spawning habitat created	Spawning habitat and juvenile (fry and parr) habitat created	Diversity of habitats for all life stages created
6. Implementation and consents	Difficult consents needed e.g. planning or archaeological	Intermediate level of consenting required, e.g. felling or waste licences	Only EA/Land Drainage and EN/SSSI consents needed	N/A	N/A
7. Need for flood risk assessment	N/A	Risk assessment for houses/roads OR complex modelling of farmland/floodplain required	Assessment of risk to farmland or other interests by simple model required	Limited assessment required	N/?A
8. Cost per unit	>£16k/100m or 1ha	£12-16k/100m or 1ha	£8-12k/100m or 1ha	£4-8k/100m or 1ha	<£4k/100m or 1ha

SESSION 4: POST PROJECT APPRAISAL

Facilitator: Judy England (Environment Agency)

Basic principles of post-project appraisal

- PPA should be an integral part of any scheme, not just an afterthought.
- Appraisal is needed to assess the success or failure of a scheme.
- Clear and measurable objectives are essential (not least to facilitate effective PPA).
- PPA allows adaptive management. If we know what is happening as a result of a scheme, we can adjust to obtain more desirable results.
- PPA allows us to test scientific hypotheses about how systems respond to restoration.

A set of before and after photos taken from fixed points can be a very useful monitoring tool, particularly useful when communicating changes to non-technical audiences, but will indicate only visual changes without recording or explaining what is happening within the watercourse.

Habitat assessment

Habitat assessment can be either a simple record of habitat features, such as the number of riffles present, or numerical record of plant species and numbers, or involve more detailed point sampling and mapping of characteristics such as depth, substrate, flow and vegetation in a grid across the site. For example, depth contour maps plotted for a channel on which restoration work was undertaken indicate changes in channel profile over a two year period (pre and immediately post restoration work) from a uniform trapezoidal section to a narrower, shallower channel. Plotting of vegetation sampling records according to vegetation type indicate a clear increase in emergent and submerged vegetation. Flow sampling demonstrates a positive change from predominantly slow or slack pre-restoration to a more even distribution of flow categories (slow, slack, moderate, fast and spate) post-restoration.

Control sites are essential to ensure that any incidental changes in the watercourse to be monitored and taken into account in assessing the benefits or disbenefits of river restoration work. Comparative assessment of a target site selected on the basis of desirable characteristics will provide a yardstick against which progress in successful restoration can be measured, the overall aim being to recreate relative proportions of each habitat type, feature or characteristic (such as flow category) as measured on the target site.

Comparison with target sections of river or stream is more difficult with fish due to their mobility. A simple comparison pre- and post-restoration may be all that is possible. Fisheries surveys of a section of the River Colne straightened in 1989/90 and subsequently restored in 1993 show a drop in both fish density and biomass as a result of the channel straightening, and an increase in both following restoration work.

Alternative monitoring techniques are needed to assess different restoration work. As part of a scheme on the River Chess at Blackwell Hall Lane, the Agency were able to lower but not remove a weir. In order to make it passable to fish, the weir was changed to a pool and traverse fish pass. To assess the use of the fish pass, trout present in the river were marked differentially according to their location up- or down-stream of the weir. A follow-up survey showed that fish had moved both up and down the fish pass.

Monitoring of the impact of a scheme on the fish population may suggest too simplistic conclusions – in practice the impacts of restoration work on fish populations are dependent upon and interconnected with the impacts upon macroinvertebrates or fish food. Monitoring or macroinvertebrates can be very simple. Graphic representation of water quality monitoring on the River Chess over time clearly demonstrate an increase in BMWP score following restoration work as a result of change in habitat from a silty slow flowing channel to a narrow gravel channel. Schemes with less radical habitat change are unlikely to demonstrate such clear changes, especially with a water quality monitoring tool based upon the presence of absence of macroinvertebrate families. Reference to a control site is also important wherever possible to provide reassurance as to whether changing BMWP scores are directly attributable to work undertaken or reflect background change within the watercourse.

Multivariate analysis using DECORANA of more detailed baseline and follow-up macroinvertebrate survey results, each taken on a fixed number of replicates (10) from a control site and two sites within the restoration scheme, can be used to provide clearer quantification of site changes. Looking at the graphic representation of results, initially one would expect a spatial separation between the two sites on the degraded section of the channel and the target section. Although the location of the target samples may move on the graph due to background shift in the

macroinvertebrate community, the aim of restoration is for samples from the degraded section to move towards those of the target site. This type of analysis can also be helpful in demonstrating which environmental variables have had the greatest influence, for example depth, flow and substrate. The same data can also be analysed in a different way to reveal changes in domination of the sites by specific taxa pre- and post-restoration, species distribution, invertebrate density or biomass in terms of fish food.

Misbourne Alleviation of Low Flow Scheme

This scheme is an example of the extensive monitoring which would be the ideal for all sites if resources permitted. In order to assess the success of the scheme, detailed surveys were carried out at six sites along the river's length. Following comparison with two year's baseline data, it has been concluded that the following are providing significant results and are therefore likely to continue to be monitored: surveys of channel morphology, hydrological data, water quality, aquatic invertebrates macrophytes, otters and water voles, fish, river corridor, river habitat, and water quality. Phase I and II habitat surveys, common bird census, winter atlas (birds), surveys of adult odonata (dragonfly) and bats also undertaken will not be maintained.

Conclusions re. post project appraisal

- Emphasis should be placed on measuring the meaningful rather than making the measurable meaningful.
- The majority of monitoring is in fact recording or surveillance rather than appraisal in a meaningful sense.
- It is better to assess a few schemes well than a large number of schemes unscientifically, and to specifically target monitoring rather than adopt too generalist an approach.
- Control or target sites are essential – if not possible within the locality, nearby sites or similar watercourses can be used. At worst, a degraded control site will help provide comparison against which improvements are monitored.
- Post-project appraisal is particularly important when using new and novel techniques.
- Scale is an important consideration to overcome problems of assessing if species are moving in from adjacent degraded sections.
- Results may differ greatly long-term e.g. 10-15 years post restoration, hence duration of monitoring should be considered. EA have found that the greatest habitat change occurs after the channel forming high winter flows that allow geomorphological processes to take place.
- There may be benefit to attempting similar assessment techniques for different chalk river systems to collectively improve the knowledge base.

Priority information requirements

- Exchange of information and experience is required on which monitoring tools are being used, whether results produced are conclusive and how grades of gravel are selected.
- Feedback is required on evaluation being undertaken on other schemes, including assessment of long term survival of restoration schemes, and river's response to them, particularly schemes involving introduction of gravel.

SESSION 5: PROJECT PRACTICALITIES

Facilitators: Jackie Smith (Wessex Chalk Streams Project) and Sarah Bentley (Chilterns Chalk Streams Project)

Wessex Chalk Streams Project

The Wessex Chalk Streams Project was set up in April 1999. It aims to help wildlife to be better integrated into the many activities and management which are undertaken on the River Avon and its tributaries - Wylye, Nadder, Bourne and Till. The River Avon System is notified as a Site of Special Scientific Interest (SSSI) and is a candidate Special Area of Conservation (SAC) in view of its European interests. Opportunities for river enhancement and promoting best management practice are being identified and supported, through working with landowners and managers along the river.

The Project is a partnership project. The Project Officer is employed by Wiltshire Wildlife Trust and based at English Nature. Funding of the Project Officer is provided by Wessex Water, as part of the Wessex Water BAP and some funding of the river restoration projects is available from English Nature.

A Steering Group consists of representatives from Wiltshire Wildlife Trust, English Nature, Wessex Water, Wiltshire Fishery Association and is chaired by the Environment Agency representative.

Objectives

- Provide a single point of contact for landowners and occupiers within the River Avon System SSSI, within Wiltshire.
- Raise awareness of the river SSSI and its protected species, explain conservation issues and advise on management.
- In co-operation with landowners and river managers, draw up Site Management Statements on behalf of English Nature, in order to secure the wildlife interests of individual sites.
- Identify opportunities for river enhancement and restoration schemes, and target funding where possible.
- Promote best practice in river management throughout the river system by dialogue and liaison with interested parties, and specifically through the development and demonstration of river restoration and conservation techniques.
- Keep landowners and managers informed of news, events and initiatives on the river system (e.g. through Project newsletter - 2 per year).

Justification

The following impacts are encountered within work of the project, although direct involvement in resolving these issues (i.e. policy) has not been entered into at this early stage of the Project. It is felt to help that the project has a fairly unbiased approach over certain issues, e.g. planning applications etc. and these are left to the relevant statutory organisations to deal with.

over-widened channel	previous dredging work
silt	low flows
impact of control structures	water quality
inappropriate management and reduced biodiversity	swan damage

Science/Objectivity

To date the restoration projects which have been financially supported through the project have been the result of an approach made to the project officer by a landowner or fishing club. All financial support is in recognition of a scheme's benefit to wildlife.

In general, the principles of funding have been that:

- where wildlife and fishing benefit equally a 50% contribution to the costs will be given
- where there is a greater benefit to wildlife a greater percentage funding will be considered (100%

if there is no gain to the landowner/fishing club)

- where there is no real gain to wildlife, but the applicant agrees to use a more sensitive approach and materials a small contribution (e.g. 20%) may be given

The percentage funding is evaluated on site - attempts are being made to formalise this process. Through writing Site Management Statements and therefore learning more about the landowner's/river manager's specific management, it is hoped that enhancement sites can be more carefully targeted and prioritised in the future. Also, the River Avon LIFE project includes studies that will help identify strategic priorities for restoration.

Audit

Pre and post project monitoring of enhancement sites:

- River Habitat Survey (RHS), water vole survey and photo-monitoring (Project Officer)
  (Problem: increasingly time-consuming as the cumulative number of restoration sites grows annually - may not be possible to monitor each attribute each year.)
- Wiltshire Wildlife Trust River Monitoring Scheme - volunteer monitors. Attempts are being made to target river monitors to enhanced sites, where they carry out a monthly survey - aquatic plants, invertebrates, flow, photos etc.

Dissemination

- Newsletter - 1000 copies circulated within river catchment and to key partner organisations.
- Articles about the Project within relevant magazines/newsletters.
- Demonstration days for landowners planned.

Key lessons learnt

Positive	- single point of contact for landowners/river managers on SSSI issues
	- newsletter - information on river conservation widely circulated
	- co-ordination of local initiatives by partner bodies
	- stimulates interest in wildlife issues, provides back up information for that interest
Negative	- Project Officer could be seen to represent one or more of partners

Chilterns Chalk Streams Project - local action programme approach

Chiltern Chalk Streams Project is trying to develop an integrated strategic approach for each of eight streams. Local action programmes (LAPs) are being used to draw people back together with a common theme through the following process:

Workshop 1	Public consultation to formulate a vision for each stream (i.e. what everyone wants from it) and establish local priorities e.g. flows, species, pollution, recreational/amenity benefits. All of the resultant information and conclusions are then drawn together into a draft local action programme
Workshop 2	Consultation and review of likely success of LAP in achieving vision established at first workshop, as a result of which a final LAP is produced including a costed programme of proposed actions, linked to LBAPs, fisheries action plans (FAPs) etc.

Advantages of this approach

- Uses and builds on local knowledge
- Community involvement and consultation
- Jointed up thinking i.e. all activities can contribute to overall aims – guided walks look at potential enhancement sites, pumping station etc.
- Appropriate use of resources in the catchment, including what is already going on
- Enables/encourages people to see the bigger picture of the stream/river with which they are concerned in a catchment context rather than simply a water feature at the bottom of a garden.
- Potential to form basis of funding bids.

Disadvantages

- Public understanding often low so consultation can be difficult.
- Tends not to identify all potential restoration schemes and/or sufficient detail, consequently further input required to generate technical improvements required.
- Petty politics can be a distraction, and there is danger of becoming embroiled in local issues
- Pressure from funders to deliver quick fixes rather than necessarily the highest local priorities.

Steps towards restoration schemes – experience from Wessex chalk streams project

1. Site visit with landowner, typically in response to approach from landowner who has a particular project in mind.
2. Production of site management statement in conjunction with fishing clubs to promote more understanding of the river and its conservation, together with summary of legal requirements.
3. Assessment of whether proposed scheme will benefit wildlife and if so whether it satisfies funding criteria (EN has a pot of money for projects able to demonstrate sufficient wildlife gain, the higher the potential gain, the greater percentage of funding available). Negotiation of EN management agreement.
4. Applicant completes EA land drainage consent form.
5. Site visit to discuss amendments/concerns.
6. Site visit to check work in progress/on completion.
7. Arrange payment from EN.
8. Monitoring of success of scheme in meeting objectives.

Comparative analysis of this one-stop shop approach

Advantages	Disadvantages
• Single point of contact – particularly important for legal obligations re. consents and statutory designations	• Numerous consents to be considered (land drainage, discharge, abstraction licence, statutory wildlife designations, planning permission) which proves very time consuming. Bureaucracy attached to consents complex and implies delayed response time – fast track procedure for restoration projects would be highly beneficial.
• Conduit for funding from EN (50% contribution if wildlife and fishing benefit equally) and links to other sources of funding where necessary.	• Funding is time limited; criteria for funding percentage, prioritisation and targeting variable (draft scoring system being refined); various rules and regulations apply; delays in payment.
• Opportunity to learn from owners and occupiers and build relationship based on trust	•
• Neutrality i.e. divorced from statutory agencies and no legal function in relation to legislation.	• Danger of becoming embroiled in bureaucratic processes
•	• Large number of staff giving conservation/restoration advice
•	• Short window of time for practical work to avoid conflict with fishing season/water voles/EA requirements yet fit in with weather.
•	• Lack of simple publication(s) specific to River Avon to circulate to landowners

Conclusions re. project practicalities

- Success on the ground is likely to depend on selling the project to farmers and landowners.
- Demonstration days have proved highly effective in some areas in generating farmer/landowner interest in management of rivers and floodplain. Experience from other projects re. the most effective means of disseminating information to interested parties (fishing interest and farming landowners) would be useful.
- It is important to be able to show results to use as demonstration of best practice and justification of techniques to interested parties.
- Whilst recognising requirements on an individual site by site basis, approach, reasoning & advice given to owners on rehabilitation methods, land drainage consents etc. needs to be consistent (in general terms) between agencies (EA &EN) and between regions within agencies.

Information requirements

- Further information sharing is required re. what works and what doesn't work.

- Feedback from projects is also sought re. successful management of potential conflicts between angling and conservation interests, the approach adopted by different projects to planning permission & consent issues and how to minimise the bureaucratic load associated with preliminaries & consents for landowners who are keen to rehabilitate their river.

SESSION 6: BAPs, RESEARCH AND DEVELOPMENT – A look at the research and development aspects of chalk streams, from *"Ranunculus in chalk streams"* R & D group

Facilitator: Ed Darby (Loughborough Ecologists)

Following low flow conditions of the 1990s, problems with decline in *Ranunculus* were identified, to the extent of disappearance in certain stretches of rivers and replacement by other plants such as filamentous algae. Concern by public and fisheries interest was matched by EA's concern that previous research findings were not necessarily being disseminated in-house. In preparation for and in advance of declaration of SACs and EC directives, it was concluded that further research was necessary to establish the extent of the problems in relation to *Ranunculus,* its status and available information on restoration projects.

The first stage of the project was an information gathering exercise in the form of a literature search of all papers and reports referring *Ranunculus* distribution. In total 440 documents were analysed, of which 159 were papers, 90 reports and 51 articles or other references. 140 references were rejected on the grounds of inadequate reference to growth of *Ranunculus.*

Extensive consultation was then undertaken including EA and other contacts, all of whom were issued with pro-formas which asked respondents to rate and rank what were perceived as the most important influences on *Ranunculus* growth and distribution. Level of response varied, with 11 relating to the Avon, 8 to the Wylye and Kennet Rivers, 4 to the Test, Itchen, Frome and Chess, 3 to the Wey, Lambourn, Daret, Loddon and Misbourne and 2 to the Ver, West, Driffield Beck. Overall the following priorities were identified in decreasing order of importance:

Changes in flow (rainfall/abstraction etc.)
Velocity and climate change
Nutrient enrichment
Substrate characteristics (siltation)
Grazing
Vegetation management
Land use change
Competition with/management of other macrophytes
Physical and habitat changes e.g. flood defence, restoration work

Written references and the pro-forma responses were then amassed into a database. All documents were categorised in respect of how much useful information they provided in relation to the above criteria, and whether they related to laboratory research or were in themselves effectively a literature review. Further assessment of the references through the literature review identified drivers and factors much in line with the criteria identified through the initial analysis of pro-forma responses as follows:

Key drivers in relation to growth and distribution	Factors determining growth and distribution
Channel management	Competition, interaction, life cycle, colonisation
Enrichment from point sources	Discharge, seasonal annual changes
Natural climate cycles	Light/shade/temperature
Factors not linked to driver	Substrate and siltation
Other e.g. shading by algae	Velocity/depths/levels
Vegetation management	Water quality, enrichment, suspended solids
Abstraction, catchment, water use	Grazing
Land use and diffuse enrichment	Physical dimensions
Rehabilitation, augmentation, fencing etc.	

From these various analyses it has been possible to produce recommendations regarding which papers are likely to be most helpful in respect of potential influence on policy, strategy and further research needs.

Conclusions re. BAPs, research and development

- ***Caution:*** *Ranunculus* presence is not in itself necessarily a good judge of ecological quality of chalk rivers – some chalk channels have been modified to favour *Ranunculus* but at what cost to other species?

- The *Ranunculus* project (and many others) have clearly demonstrated the shortage of information on most chalk rivers. The tendency is to concentrate on the same few rivers for which information is available, not least because available data substantiates expenditure, but the problem with this approach is that it generates more information on these same rivers with none being collected on the many others.

SESSION 7: RESOURCE MANAGEMENT

Facilitator: Mike Crafer (Thames Water)

The overall objective of the River Kennet project is to design, implement and monitor, rehabilitation measures along 10km of the upper River Kennet in Wiltshire, to achieve a range of environmental enhancements and be a catalyst to encourage further restoration work in the future. Central to the achievement of this objective is to (i) ensure optimal use of existing river flows in the design of the rehabilitation works, particularly during periods of drought, & (ii) generate landowner support, & where possible contributory funds, to increase the scope of works that can be carried out. The project was convened as a partnership, led and administered by Thames Water, who are also providing in-house technical expertise. Specialists from the Environment Agency and English Nature are providing support in relation to survey, monitoring and consents. Implementation of the project works have been overseen by Hankinson Duckett Associates and Alconbury Environmental Consultants. Funding is principally from Thames Water with further contribution (in cash and in kind) from EA, EN and landowners.

Justification

- Desire to understand the relative impacts of different influences: ecology, channel morphology, flow etc. on the upper Kennet.
- The river is designated as a SSSI being one of the best examples of a lowland chalk stream in England. Despite SSSI status, sections of the river are far from being in pristine condition having suffered a legacy of major physical degradations resulting from impoundments for milling, land drainage and flood defence works. This has resulted in certain sections becoming over-widened, over-deepened with layers of accumulated silt replacing the characteristic gravel substrate. This damage is beyond the natural capacity of the river to heal itself.
- A combination of tried and tested techniques, e.g. willow 'faggotry' and more experimental measures, e.g. 'snow-shoe' mattresses & straw bale deflectors will be used to achieve alterations in the channel morphology and function, to create self sustaining habitats.

Project Components

A broad feasibility study undertaken in September 1998 was used to assess suitability of rehabilitation principles. The outputs of this study were fed into Phase I, which commenced in January 1999 and involved a demonstration project based on a 350m section of the River Kennet, undertaken with the support of the relevant landowner and local fisheries syndicate. Initial results appeared very promising with considerable scope to improve the river. Material (encased in hessian to avoid ripping out) was placed within the main channel, thus effectively narrowing the main channel, but still retaining a backwater between the infill and original channel bank and incorporating berms to diversify wildlife habitat.

An experimental *Ranunculus* planting trial was completed in July & August 2000 over a 130m section of river near Axford where it had been lost during the drought of 1988-92 and had not returned. *Ranunculus* was planted in 112 snow-shoe shaped frames pegged to the river bed to provide protection. Regrowth is being monitored to check the success of this experimental technique.

A combination of narrowing and bed raising on a 210m section of over-widened and over-deepened section of back channel at Ramsbury was completed in Autumn '00 to create a new riffle-run sequence to benefit species such as wild brown trout. Two other Phase 2 projects, postponed due to an exceptionally early break in the springs, will be completed in late summer/autumn 2001.

Two/three new projects are currently being discussed by partners for Phase III, the last of the construction phases, scheduled for completion autumn 2001. A monitoring programme is being drawn up to assess the effects of work, likely to continue during years 4 and 5 of the project.

Science/Objectivity

- A Site Options report, Dec. 1999, identified a long list of thirteen potential in-channel and flood plain projects for implementation as Phase 2.

- A site selection matrix was devised by the project team to allow comparative assessment of this list on an equitable basis, and allow four projects to progress to feasibility stage (NB: A copy of the matrix will be tabled on 22-23/1/01).
- Landowner & tenant support was an essential pre-requisite for a scheme to be taken forward, & each landowner's existing ideas for their land were discussed at an early stage.

Audit

Monitoring has been a key aspect of the project to determine the extent of change in key biotic and abiotic indicators pre & post-works. Surveys undertaken have included hydraulics (topography, high and low flows/water levels), archaeology, fixed point photography, macrophytes, macro-invertebrates, fish and species specific surveys (including water voles, native crayfish and Desmoulin's whorl snail). Many of the pre-project surveys have been carried out to facilitate scheme design and satisfy land drainage & SSSI consents. Post work monitoring is focusing on water levels, velocity and macrophytes.

Dissemination

- Two well attended project open days have taken place to date (29/4/00 & 1/10/00) in conjunction with ARK and it is intended to hold further community based events in the future.
- Two evening presentations to local landowners and their representatives have been completed (2/2/00 & 7/12/00) to explain the project objectives, encourage support for & ownership of the project ideals, and stimulate further rehabilitation works.
- A project leaflet, posters & video record have been completed and a number of articles have been submitted to both local newspapers and the technical press, e.g. Ecos.
- Presentations given to local Parish Council (18/10/99) and Secondary school.
- An end of project review report is planned to disseminate the experience gained from the different techniques and the results of the project monitoring programme.
- Key project findings will be fed into the RRC national database.

Key Lessons Learnt

- Completion of the Phase 1 demonstration project proved very useful as a local example to illustrate different techniques to nearby landowners, even though the delivery timescale was tight and that this first site was selected primarily on what could be set up and running quickly ('a trade off').
- Vigilance is needed at all times to check if any design changes (i.e. between feasibility stage, design stage & construction stage) require new consents.
- Straw bales (for shallowing over-deepened reaches) were found to be cheap to buy but not cheap to install; their buoyancy means that they have to be well tied/staked down. In future, larger units will be tested to ease installation problems.
- Early mobilisation of contractors essential to over come narrow 'window' to complete works.
- Flood modelling has proved a useful means of incorporating reactions of local people.

SESSION 8: CHALK STREAMS AND WETLANDS

Facilitator: Duncan Painter (Land Use Consultants)

LUC have provided consultancy support for an ongoing wetland restoration feasibility study entitled Gaywood Valley Habitat Restoration Project. The study was commissioned by English Nature (Andy Millar, Norfolk Team) and the King's Lynn Consortium of Internal Drainage Boards (Heidi Mahon) and aims to address the restoration of three river valley fen habitats in the Gaywood River valley which together are designated as a single SSSI (Leziate, Sugar and Derby Fen SSSI).

The main focus of the study is the restoration of the three fens and adjacent arable land in order to restore the biodiversity value of the site and to link fragmented habitats. The study may also focus on restoring the River Gaywood, a chalk spring fed river rising approximately two miles to the east of the study site. Within the site it flows over a geology of chalk and sandstone which gives rise to an intricate mosaic of fen, acid bog and heath habitats, but the iron-rich water feeding into the river from the IDB drains together with progressive straightening have resulted in the river becoming much like an IDB drain itself where it flows through the study area (over-deepened and over constrained).

Main components of project activity

- Desk study of land use, drainage, management and natural history of the site.
- Extensive topographic surveys including land, drainage ditch and river levels, and a review of existing river gauging station data and select groundwater level data to gain a better understanding of ground and surface water in the valley to inform options for scheme design.
- Identification of flooding and ecological risks and constraints.
- Provision of a series of three map-based outline costed restoration options (low, medium and high cost).

Justification

The three fens (Sugar, Derby and Leziate) are designated as a SSSI on the basis of the mosaic of river, fen, bog, heath and grassland habitats they support. Historic land drainage and agricultural improvement have however contributed to a significant decline in the ecological value of the three sites as evidenced by historic maps and plant community data, the former fens now being dominated by grassland, heath and scrub interspersed by intensive arable and intersected by main IDB channels.

The main driver for the project (a feasibility study at this stage) is the desire by EN and KLCIBD to restore SSSI, link its fragmented sections, and secure creation of new habitats in the Gaywood Valley.

Science/Objectivity

- Tufa deposits indicate that the site was previously spring fed, and parallel ridges indicate previous peat cutting. Baseline habitat assessment highlights the geological split between east and west, and the progression of the site to drier habitats.

- Ancient maps (1797) depict the study area as a fen with meandering river running through the centre. By the date of the next map (1826) the track shown on the earlier map had been replaced by a drainage channel running through the site, although it is uncertain whether this was as a result of marshland taking the line of least resistance along an inherently low lying feature or whether it was deliberate intention to drain. The 1890 map reveals extensive drainage discharging into the main IDB drain and the first phase of river straightening. Lenziate Fen was still marshland at this time, but Sugar and Derby Fens are by 1890 depicted as rough pasture and furze. The 1950 map records 50% of Lenziate Fen as rough pasture, although the area to the west is still marshland. Extensive botanical records demonstrate sedge fen communities interspersed by acid mire and bog habitats with small quantities of heath. There are no records of common meadow rue, the food species for marsh carpet moth which was earlier recorded on the site. The 19989 aerial photo indicates increasing dominance of Sugar Fen by wet alder wood with extensive scrub encroachment and increased drainage efficiency on all of the sites.

- A range of ecological surveys for higher plants, otter, water vole, and terrestrial invertebrates have been undertaken. Invertebrate survey including pitfall trapping, sweeping and beating has recorded 237 species, of which only one is a wetland relict. Water vole were found to be abundant, particularly in the main tributary from Derby Fen and behind the gauging station, although few were recorded on the main IDB drain. The trapezoidal channel of the main river offers few suitable otter breeding opportunities, and only one lie-up area was identified across the whole site.

- Three dimensional ground modelling reveals that the River Gaywood does not follow the lowest route, which may reflect former channels or former extent of the natural floodplain.

- At present the project has the willing support of landowners based on temporary re-wetting by field drain caps (rather than permanent changes) to allow re-flooding of the River Gaywood. A range of re-wetting options have been considered, including a minimal intervention scheme to block drainage channels and install sluices. Ground levels are being established which can then be related to plant communities. Another alternative option is to install two sluices to increase groundwater levels in Lenziate Fen, which ties in well with the distribution of old mire communities and reinstates the former meanders of the River Gaywood.

Audit

Further pre and post project implementation monitoring recommendations are made notably the need for:

- the production of a water level management plan for the entire area;
- ground water monitoring across the study area;
- ecological monitoring (notably of plant communities, otter and water vole);
- flood risk modelling of the River Gaywood prior to any re-instatement of historic meanders lost through past river engineering.

Dissemination

The project partners will use the feasibility study for the basis of choosing a scheme which will drive a matched funding application. A key objective of the project partners is to gain the support and enthusiasm of the local community including land owners and parish councillors.

SESSION 9: CONCLUSIONS AND INFORMATION DISSEMINATION

Facilitator: Martin Janes (River Restoration Centre)

Conclusions

- Climate change predictions suggest that recent floods are likely to be a more common problem in future, which strengthens the need and available funds for flood defence work. In many areas it is now being recognised that sympathetic river restoration is the most effective and sustainable flood defence mechanism, and also yields many other benefits including restoration and creation of wildlife habitat.

- Targeting flood defence funds may access budgets previously unavailable, but key questions nevertheless arise regarding direction and application of limited resources. Some favour focusing finance and manpower on maintaining existing good quality rivers/water/habitats, others suggest resources should be directed at improving moderate to good quality, or specific targeting of resources at the most degraded rivers or reaches therein. The cost of dealing with the most damaged sections of river can be disproportionately high – some would argue as not being cost-effective or beyond redemption. Others, suggest that in the absence of scientific data on the precise effects of channel manipulation and restoration techniques, it may be better to ignore for the time being river reaches which are in reasonable condition and concentrate instead on the worst sections where there is no doubt that restoration work will result in at least some improvement.

- It is hoped that once the Water Framework Directive becomes fully functional, a threshold "good ecological condition" will be set as a minimum target for all rivers.

- In practice, restoration work is often opportunistic e.g. request by a landowner on the River Chess to remove a mill head which led onto improvements on the whole river, although this attracted criticism from local people about expenditure being concentrated in one area, which in turn has forced EA to spread resources more thinly over a wider area. River habitat survey is now being used to justify a more strategic approach to enhancement work based on existing interest/value/problems. Sporadic opportunities can then be considered as part of a strategic plan which will provide a framework for decision making.

Information dissemination

- Seminars such as this are invaluable in forging links between those directly involved in river restoration and encouraging sharing of information and experience, but continual momentum is required to maximise use of limited resources and avoid unnecessary reinventing of the wheel.

- Some individuals/organisations/projects have amassed considerable experience and information from their years' of involvement with river enhncement work (and therefore feel that they have increased the range of techniques in their toolbox and understanding of their application). This information is not at present being communicated to others within and outwith EA and other national statutory agencies.

- Clearly existing scientific and practical knowledge needs to be more widely disseminated so that it can be integrated into rehabilitation management plans. In order to achieve this, communication needs to be sustained after the workshop.

One of RRC's main roles is collating and disseminating information derived from practical experience, largely in this country but also from further afield. Although it has amassed a considerable database,

much of the information is in summary format, and the majority of those involved in river restoration (whether chalk or other types) are still not feeding back through RRC experience which could be usefully shared with others. In order for the network to grow and the Centre to offer a continued support service to organisations who are undertaking river restoration and best practice river management, RRC needs to be kept informed of new developments and new projects. This provides the basis for the RRC database and a pool of knowledge that the Centre's advisory network can draw upon. In this way projects need not be undertaken in isolation, news and ideas (practical and funding) can be disseminated regularly, and advice can
be given on scoping/planning projects effectively.

By efficient sharing of experiences RRC hopes to play its part in ensuring river restoration activities grow with increasing efficacy in the future.

- There would appear to be considerable demand and support for one or more further chalk river restoration seminar(s) with perhaps three intensively focused interactive workshop sessions in the morning aimed at producing specific action points followed by afternoon site visits looking at restoration techniques on various rural rivers/streams, preferably at low flow (i.e. later in the year).

- RRC might usefully consider research and production of further technical information sheets for inclusion in their manual of river restoration techniques, including examples of chalk river restoration.

- Further guidance is required regarding what to monitor, how and for how long – collation of experiences in relation to successes and failures of what is measured, methodology and timing is an additional element which RRC might usefully adopt.

- Further discussion is required to identify other future research and information needs.

Required action: ***Each participant to complete RRC pro-forma for EACH project with which they are involved, and encourage others within their organisation to do likewise.***

SITE VISITS

Organised by Chris Catling (Environment Agency, Thames Region)

The chalk streams of the Colne and Lee catchments used for site visits were selected for site visits were selected on the basis of accessibility and the potential they offered to demonstrate a range of enhancement techniques. Geographic location in the midst of the commuter belt coupled with years of flood defence work, urbanisation and other human attempts to control the channels and flow have modified these streams to the extent that few, if any, still match the popular vision of a tranquil chalk stream flowing through open countryside. Nevertheless, within the two catchments there are pockets of reasonably healthy chalk stream. Given sufficient water of acceptable quality and a way of introducing or improving the energy of the stream, substantial enhancement is normally possible.

Site Visit 1- River Colne, Watford
"A Triumph of ecology over engineering"

The Colne runs along the chalk clay interface of the London basin. The water is primarily chalk derived, but can be peaky because of urban inputs. Unfortunately for the river, it ran along the planned route of the Watford M1 link road. As the NRA had not been formed at the time, there was little opposition to Watford Borough Council's proposals to move the river.

Channel realignment was carried out in 1989/90 to the standards of the day – i.e. an over-wide trapezoidal channel covered in silt. Although the banks were not artificially reinforced, they were steep and entered the channel at approximately 45 degrees, resulting in very little marginal vegetation being able to survive the peaky flows. Inlet channels for the three dry flood storage areas (slightly raised above river level) faced upstream, hence at times of flood water rushed into these areas, bringing with it pollution problems. Lack of breeding habitat and shelter at high flows resulted in a dramatic fish population crash. A fish survey just prior to the realignment recorded 270 fish in 1988, while a survey of the new channel in 1992 recorded only three fish!

The local authority agreed that the design may not have been perfect and agreed to a joint enhancement project, designed and implemented by EA. The main focus of the enhancement was to reintroduce marginal vegetation, produce flow variation and provide clean gravel and backwaters or off-river supplementation units (ORSUs). With Watford city centre immediately downstream, riffles and groynes had to be stable in reasonably high flows, therefore advice was sought from a geomorphologist as part of the design team.

Method	Reason
Install large rock 1t stone blocks pointing downstream *(note: contrary to much advice which suggests use of collapsible material for groyne construction which will move or collapse in flood).* Infill 1-1.5m downstream of groynes to avoid scour problems.	To narrow the channel producing velocity increases in specific areas, to create flow variation and produce a stable marginal fringe. (Traditional groynes would have been inappropriate due to variable flow and water quality, particularly problems with high suspended solids in river and discolouration, increasing with rainfall.
Introduce gravel (over-specified size to minimise movement/downstream siltation) against a small submerged blockstone (buried 150mm into river bed).	To create a series of stable riffles (3 no. over 40m length).
Radically remould the three dry flood storage areas by deepening (to maintain permanent wet areas), creating marginal shelves and creating downstream facing inlets (change in direction from original upstream facing inlets important to allow bypass of any pollution incidents) higher than both the deepened flood storage areas and the riverbed. Excavated spoil used to infill previous inflows and to resculpt a central hummock to form an island, then flooded and planted with range of native plants.	To create three ecologically rich backwaters capable of withstanding high and low flow conditions and robust against pollution events.

The project used one tonne granite blocks (free from the M25 QE11 bridge construction) and a couple of hundred tonnes of gravel. Watford Borough Council contributed £25,000 to the cost and EA £12,000 (excluding staff time and costs).

Fish numbers, biomass and species have all increased with barbel being found here for the first time in decades. Monitoring has demonstrated the importance of the improved backwaters as good refuge areas for juvenile fish, and including representatives of most species found in the main river. Although no macroinvertebrate baseline information was available for this scheme, survey work of the completed scheme has shown that the gravel introduction to the channel supports a diverse macroinvertebrate community including a range of characteristic chalk stream fauna. Water quality influences are now limiting full faunal recovery of the site.

With the benefit of hindsight, it would have been preferable to make the inlet channels shorter to minimise the deterrent to fish moving into the backwaters (presumably due to higher predation risk in these raised channels). The *phragmites* monoculture which has established also suggests that in future it is probably only worthwhile planting *phragmites* leaving other native plants to establish naturally rather than going to the trouble and expense of trying to establish a ready-mix at the outset.

Immediately downstream, the river is artificially constrained where it flows under a railway bridge, after which the banks have been armoured with gabions and a concrete mix to artificially restrain the river channel. Marginal vegetation is consequently very limited by lack of establishment opportunities. EA was unable to demonstrate sufficient technical grounds to prevent construction of a new additional bridge by Tesco, but under a section 106 agreement with the developer has secured £100,000 which is being used to design restoration plans which will remove the artificial 90 degree bend in the river, restoring a more natural meander with vegetated banks, including a *Phragmites* bed on the outside bend.

Site Visit 2- River Misbourne, Denham Country Park
"Teaching Old Dogs New Tricks" – or let the river dredge itself

This is one of the lower reaches of the Gade on the outskirts of Watford, on its way to joining the Colne below the town. At this point the river has just escaped from the Grand Union Canal via a side-spill weir. The channel through the park is of a reasonable gradient and has the potential to form a healthy self-sustaining chalk stream, but suffers from some typical chalk stream problems, including two weirs which impound the river, and a cressbed (designated county wildlife site). The upstream weir maintains water levels to feed the cressbed and the lower weir acts as a hydraulic break during high flows protecting a business park downstream.

The fact that the Gade dots in and out of the Grand Union Canal along its length causes problems such as a high sediment load and consequent sterility in terms of fish populations. Weir impoundments in Cassiobury Park caused siltation across the whole riverbed, although the 400-500 mm depth of natural gravel still formed the channel bed below the silt. The siltation and associated vegetation invasion threatened to block the whole river, causing both a flood defence problem and generating complaints from anglers.

This siltation had been a cyclical problem for decades as was solved by dredging every 10-15 years, which was both costly and disruptive to the ecology of the river. Following a proposal received by the conservation section for flood defence section to dredge the river, a site visit culminated in changing the planned works from the usual mass dredging to a small partial dredge and an alteration of weir levels to increase low flow velocities. The aim was to gain chalk stream conditions in a self-sustaining gravel channel, and to remove the need for expensive repeated dredging, which would be cheaper than the original plan and prevent repeated disruption to the ecology of the river. The design needed to maintain water supply to the cressbed and the hydraulic break, which helps protect a business park downstream.

Method	Reason
Notch the two weirs to allow a gradient of 1:700, each notch accommodating Q95 flows (i.e. 95% of the time the river will flow through the notch, at high flows the notches are drowned out and the hydraulic break still functions). The upper notch was to use the existing penstocks and be levelled to maintain a head of water to supply the cressbed.	To gain enough stream power to maintain a clean gravel bed.
Dredge a 3m channel into the existing silt.	To form a channel to the weir notches. If it was not dredged, the silt scouring due to the weir works would deposit on downstream gravels and silt below the new weir level would remain in place, still smothering the gravel bed.

Overall cost of the work was only around £500 i.e. this proved a very low cost but highly effective restoration option. Although no official auditing has been carried out, it can clearly be seen that the central channel has remained clear (compared with previous 100% *Glyceria* coverage above the top weir) and the gravels are now exposed throughout the entire length. Riffles have appeared through the middle reach and the channel now supports an excellent fish population. The latest fisheries survey picked up over 700 fish from a single electrofishing run, containing a good variety of species including barbel, bleak dace, gudgeon, chub and roach. Recruitment has also improved.

Site Visit 3 – Gadebridge Park, Hemel Hempstead
Turning worst practice into best practice

The River Gade, like the other chalk river tributaries of the Colne, drains the dip slope of the Chilterns on the edge of the London basin. It is a river which is highly modified throughout its entire length. Within Hemel Hempstead, the principle town through which the Gade flows, the river is held in a massive concrete straight jacket called the water gardens (this is where chalk streams go when sent to hell!). The flow through the water gardens is heavily impounded, and has a very high biomass of avian recreational units (mongrel mallards). The result is warm, nutrient rich water which is where billions of our unicellular algae spend their summer. Outside Hemel, the Gade splits its time between suffering from low flows to the north and masquerading as a navigation to the south. Nevertheless there are some reaches which are only moderately modified and have retained a reasonable water quality. Although isolated, these reaches could potentially support semi-natural populations typical of a chalk river.

One of these reaches is in Gadebridge Park, just upstream of Hemel Hempstead, where there is the added advantage of the river being in reasonable continuity with its upper reaches. However a number of major problems were limiting biodiversity, aesthetic quality and educational use, including minimal gradient as a millrace, five small weirs further impounding available water, and overwidening as part of a large estate. The result was that the river had no perceivable flow, silt had settled across the whole river bed allowing branched bur reed *Sparganium erectum)* and reed sweet grass *(Glyceria maxima)* to block the channel completely.

The local district council had decided to "improve" the river, and the local park keeper let a contract to re-dredge the river back to its 19th century width of approximately 20m. Primary objective of the work was to naturalise the river in an attempt to re-instate chalk stream habitat.
However the council had not applied for land drainage consent from the Environment Agency. On receipt of notice that the works had started, EA immediately suspended works and assessed work as damaging to the river's ecology. EA designed a new outline plan, radically different from the original proposals, and insisted that the local council carry these out. After negotiations it was agreed that the council would pay EA to fully design and implement proposals. Total cost was £37,000, of which EA agreed to pay the £12,000 difference between original contract price.

Method	**Reason**
Replace material removed by council	Material needed to form marginal shelves
Notch the five weirs to allow gradient of 1:700, each notch to take Q95 flow.	To gain enough stream power to maintain a clean gravel bed.
Cut a meandering 2.5m channel through the existing silt down to or below the designed grade line (no attempt made to impose set wave length for meanders). The channel was held in place using hazel faggots which prevented slumping until vegetation stabilises the channel. Marginal shelves formed by digging channel were levelled at approximately 50 mm below average summer water levels and planted using existing vegetation from the channel dredge.	To produce a channel with sufficient flow velocity to maintain a clean gravel bed and allow flow variation and enough room for gravel importation.
Gravel importation to slightly above average grade line.	To form riffles.

Although no formal monitoring has taken place, it is clear that the channel has remained open and the gravels clear of silt through two very low flow years. The main problem encountered during summer low flow is that the channel can disappear under floating mats of *Glyceria* or watercress, hence some weed cutting is still necessary, but under the cover the channel remains in good condition.

A baseline macroinvertebrate survey of the River Gade within the park showed that the macroinvertebrate community was degraded in composition with the flowing water sections of channel upstream. The degraded community was characterised by an abundance of still water animals and a lack of the flowing water species associated with a healthy chalk stream. Following the restoration work, the macroinvertebrate community changed to one more characteristic of flowing water conditions and typical of a chalk stream. Local schools have now started using the river as a safe river-dipping site.

Site Visit - River Misbourne, Denham Country Park
A Triumph of biology over aesthetics

(In fact we never made it to this site due to the weather, hence notes provided by Chris)

The Misbourne is a small chalk river which drains the dip slope of the Chilterns. The catchment has a mixed pastoral and arable land use. Until recently the water resources for the towns within the valley all came from the Misbourne's unconfined aquifer. The demand son the aquifer were unsustainable and the river was totally dry in the majority of its length in 1995. An Alleviation of Low Flow (ALF) scheme was put in place which imported water from the main Colne catchment some 10-15 km distant and allowed abstraction from the Misbourne Valley to be substantially reduced. The winter of 2000/01 has seen the third year of recharge since the scheme came into operation. In December 2000 the Misbourne was flowing from its perennial head to its confluence with the Colne for the first time since 1995. Interestingly, the upper reaches recovered after the first year's recharge and it has been the middle reaches around Chalfont St. Giles which have taken longest to return.

The enhancement in Denham Country Park is in the lowest reach of the Misbourne just upstream of the River Colne. It is the only reach to have had continuous flow throughout the mid 1990s thanks to the output of a sewage treatment works.

The biota of the channel is a triumph of biodiversity over adversity. The channel was artificially widened as part of a country estate from approximately 3m to 20m in some places, with most of the natural gravels removed. A Buddhist temple had installed a 1.5 metre weir in the river to supply water to a wheel of life. This had created a large backwater effect within the already over-wide channel. Further to this, as stated earlier, the river was approximately 95% sewage effluent.

As the last remaining section of the river still flowing it was considered important that it must be improved and naturalised enough to hold typical chalk stream species. Its one strength was the guaranteed flow, however the vast majority of the site was covered in silt ranging from 1m to 50mm deep. Flow was generally laminar and extremely slow, with river gradient varying between approximately 1:1,000 and 1:10,000.

The primary objective in restoration work was to expose any remaining natural gravel in a self-sustaining channel. These gravels would be augmented by imported gravel from the Colne valley. The methods chosen to achieve this were:

Method	Reason
Removal of the existing weir and rebuilding a much smaller weir in a different location	To increase the river gradient and reduce backwater effect. Remove the block to fish migration.
Channel narrowing using biodegradable materials	To increase water velocity and prevent sediment deposition. Provide marginal shelves.
Groyne installation.	To contribute to the narrowing and add flow type variation.
Gravel importation.	To replace previously removed natural gravel.

The results of the work were a biological renaissance but aesthetic Armageddon! This was one of the first enhancements undertaken in this area, and provided a steep learning curve.

Compared to the original objectives, the scheme has been an outstanding success. It has produced a self-sustaining gravel bedded river with flow variation. Further to this, and more importantly, the biota of the river has substantially improved. A post-project appraisal of this scheme was undertaken, monitoring habitat and macrophyte structure and macroinvertebrate composition. The results of the surveys showed that the scheme was successfully in restoring flowing water conditions to the majority of the channel. Within these areas the habitat and macrophyte composition was restored to that of the target section of channel. These areas were colonised by macroinvertebrates characteristic of flowing water conditions and establishing a typical chalk stream community. However …

1. Due to local opposition planned tree works to reduce the extensive shading were not possible. Thus marginal shelf and macrophyte colonisation has been retarded.
2. The log groynes were not keyed into the bank properly (more an aesthetic than biological problem but it could cause erosion on other sites).

3. The gravels used sere slightly larger than natural gravels to prevent too much movement. Unfortunately it may also reduce biodiversity.
4. Children were a real problem, removing carefully placed logs and stones and rearranging them in a more random way which destroyed the frontage of a couple of marginal shelves.
5. The rock groynes used stone which was recommended by geomorphologists as being stable in high flow conditions. Unfortunately, another classification system places them in the big and ugly category!!

APPENDIX I: DELEGATES LIST

Chalk River Restoration Workshop 22nd-23rd January 2001

Ronni	Edmonds-Brown	Organiser	University of Hertfordshire
Karen	Phillip	Organiser	River Restoration Centre
Martin	Janes	Organiser	River Restoration Centre
Doug	Wilson	Speaker	Environment Agency-Thames Region
Matt	Johns	Speaker	Entec UK Ltd
Allan	Frake	Speaker	Environment Agency- South West Region
Vaughan	Lewis	Speaker	Windrush AEC
Dagmar	Junghanns	Speaker	English Nature
Douglas	Kite	Speaker	English Nature
Judy	England	Speaker, Organiser	Environment Agency- Thames Region
Jackie	Smith	Speaker	Wessex Chalk Streams Project
Sarah	Bentley	Speaker	Chiltern Chalk Streams Project
Ed	Darby	Speaker	Loughborough Ecologists
Mike	Crafer	Speaker	Thames Water Utilities
Duncan	Painter	Speaker	Land Use Consultants
Max	Carstairs	Participant	Environment Agency- Anglian Region
Mike	Atkinson	Participant	Environment Agency- Anglian Region
Alison	Fowler	Participant	Hampshire Wildlife Trust
Graham	Roberts	Participant	Hampshire Wildlife Trust
Claire	Bishop	Participant	Hampshire Wildlife Trust
Simon	Johnson	Participant	Environment Agency- Anglian Region
Rob	Mungovan	Participant	Environment Agency- Southern Region
Ellie	Powers	Participant	G U Partnership
Phil	Smith	Participant	Environment Agency-Northern Region
David	Telford	Participant	Environment Agency- Thames Region
Simon	Worthington	Participant	University of Hertfordshire
Chris	Catling	Site visits	Environment Agency- Thames Region
Richard	Tyner	Site visits	Environment Agency- Thames Region
Vyv	Wood-Gee	Reporter	Countryside Management Consultant

APPENDIX II: FEEDBACK

Chalk River Restoration Workshop 22nd-23rd January 2001

1. What did you hope/expect to learn or gain from the workshop?

- Increase my knowledge of what other people are doing with chalk rivers and the problems they are overcoming elsewhere in the UK. X 5
- Exchange ideas and experiences re. rehabilitation of chalk streams, including planning, construction and monitoring protocols x 2
- Learn from other examples. X3
- Examples of practical chalk stream restoration
- Contact with other practitioners
- Broaden knowledge of habitat restoration in chalk streams
- Increase knowledge of current issues and new techniques
- Identify areas of potential conflict between EA /EN/Wildlife Trusts/academics/contractors/ consultants etc.
- Guidance on habitat restoration of chalk rivers with reference to flows, adjacent habitats and collaboration.

2. Have your expectations of the workshop been fulfilled?

Yes	7
No	
Partly	6

3. Have you any constructive suggestions on how the workshop could have been improved?

- Participative workshop to provoke further interaction/break up the day (particularly when audience flagging at the end!) x 4
- Breaking down topics into more focused workshops x 2
- Perhaps include a practical option such as undertaking a small amount of habitat construction or initial site walkover/concept design
- Specify clearer focus for each speaker's presentation sufficiently in advance to allow preparation (although arrangements still worked out well this time)
- More on monitoring and results
- Replace half day site visits with extra half day presentations
- Time site visits at low flow time of year so more visible and address these issues on site. (x 4)
- Wrapping up session/constructive conclusions – hoping for actions/a way forward – even where there are no immediate answers to an issue/problem, it would enable better focus on the right direction/info/contacts based on experience to date
- Participation/presence of individuals from each of EA regions would have provided useful opportunity to discuss and agree how all regions could work together and establish some ground rules for collaborative monitoring/assessment and production of best practice guidelines, which would have provided a useful conclusion for day 1 (including issues and action points to be addressed in future)
- Less formal venue to promote and facilitate discussion
- Greater focus/acknowledgement of considerable influence of abstraction on chalk rivers - greater focus on flow restoration, creation/restoration of habitat and physical features to accommodate lower flows and maintain chalk river characteristics.
- A few key (unidentified) chalk river people were missing, who would have added value to the workshop
- Site visits would have benefited from discussion re. how others would have tackled the problem differently, options and costings thereof (although hindered by weather)
- More targeted attempts to identify the main issues relating to chalk streams/rivers and means of resolving, or what issues need working on to resolve

4. Would you be interested in further workshops?

Yes	9
No	
Possibly	4

5. What areas would be of interest?

Focus More generalised

	More focused	2
	Similar focus	11 (but possibly different themes)
Structure	Conference (i.e. presentations)	
	Participative workshops	5
	Mixture	8
Subject	Rural river rehabilitation	3
	Urban river rehabilitation	2
	Mixed	8

6. Other suggestions

- Need to engage agency at a more senior level to drive best practice across regions
- Upland river workshop – how about something in Devon/Wales
- Promotion of buffer zones (aimed at the farmers and landowners) with strong emphasis on benefits to their land and environment.
- Monitoring methods and results/ measuring the difference
- Managing water quality – sediment and nutrients
- Weedcutting
- Appointment of facilitator assigned with responsibility for picking out main issues from presentations and discussions and drawing conclusions at the end of workshop (i.e. not just in report) including key points an agreed actions for the way ahead.

7. Were the site visits useful?

Yes	10	
Partly	2	(although limited due to weather and relatively high flows)
No		

8. Are they something you would like to see incorporated into other workshops?

Yes	10	(possibly p.m. as contrast/refresher to a.m. presentations)
No		
Possibly	3	(assuming relevant to subject)

Conclusions

- A very enjoyable workshop with lots to think about.
- Balance between presentations and field work was good and the range of presentation and numbers attended facilitated discussion.
- The only disappointment was the weather for the site visits.
- It was well worthwhile, informative and enjoyable
- Useful to meet and establish contact with others involved with chalk rivers elsewhere in the country

APPENDIX III: RRC Project information pro-forma

Chalk River Restoration Workshop 22nd-23rd January 2001

the RIVER RESTORATION CENTRE

PROJECTS DATABASE

The River Restoration Centre is dedicated to sharing information and experiences relating to river restoration and river management. There is a great deal to be gained from imparting to others information on your activities and experiences in this field. One way to do this is to help RRC collate a detailed database of information on projects relating to river and floodplain restoration and enhancement. To do this the Centre needs some basic information about your project work.

As a minimum please complete the summary form below as well as the 'tick-box' project features form overleaf. This should only take 10mins. If further information is also available then please complete as much of the rest of the form as possible. The entire form should take less than half an hour to complete if the project file is at hand. Please copy forms as required.

Project information is then entered in the RRC 'projects' database, while contact details are stored in the RRC 'contacts ' database. This information can then be used in a number of ways:

- to promote project work widely within the UK
- to use as examples given out to enquiries received by the centre
- to put practitioners of river restoration in touch with other practitioners
- to analyse trends in river restoration and enhancement

THE RRC 'PROJECTS' DATABASE CURRENTLY EXCEEDS 750 PROJECTS.
THIS INFORMATION IS FOR YOUR USE AS WELL AS OURS.

THE RIVER RESTORATION CENTRE – SUMMARY OF PROJECTS

Project name…….
Main River……Site county …….
Watercourse …….Site country…….
Site background……..…..
……..…
……..……
Project Objectives……
……..…
……

Main Focus/Driver

- ❑ Bank erosion
- ❑ Community Demand
- ❑ Development gain
- ❑ Fisheries
- ❑ Flood Defence
- ❑ Habitat
- ❑ Landscape
- ❑ Navigation
- ❑ Pollution mitigation
- ❑ Opportunistic
- ❑ Other…… ……

Project Status

- ❑ Proposed
- ❑ Detail design stage
- ❑ In-construction
- ❑ Completed (no monitoring)
- ❑ Completed (monitoring/appraisal)

Main Contact: ……Tel:……Fax:…….
Organisation:……...Email address:……...

Return forms to: Karen Phillip, River Restoration Centre, Silsoe Campus, Silsoe, Beds, MK45 4DT
Tel/fax: 01525 863341 Email: rrc@cranfield.ac.uk

PROJECT FEATURES

1. Identify which of the **5** generic **TYPES** was the **Primary** focus by ticking just one of the **grey** boxes.
2. If the other **4** generic **TYPES** were of **Secondary** or **Minor** (incidental) consideration please tick accordingly.
3. Next go through each section and tick the boxes where applicable (primary, secondary, minor).

NB You should not normally have more than **3 ticks** in the **Primary** column for each section.

		Primary	Secondary	Minor
Type 1	**Rehabilitation of watercourse features**			
1.1	Reach re-meandered (>500m)			
1.2	Reach re-meandered (<500m)			
1.3	Culverted reach re-opened (state approximate length)			
1.4	X-sectional habitat enhancement (>500m) – two–stage channel profiles etc			
1.5	Long section habitat enhancement (>500m) – pool/riffle sequences etc. restored			
1.6	River narrowing due to depleted flows or previous over-widening			
1.7	Backwaters and pools established/reconnected with watercourse			
1.8	Bank re-profiling to restore lost habitat type and structure/armouring removed			
1.9	Boulder etc. imported for habitat enhancement			
1.10	Gravel and other sediments imported/managed for habitat enhancement			
1.11	Fish cover established by other means			
1.12	Current deflectors/concentrators to create habitat and flow diversity			
1.13	Sand, gravel and other sediment traps to benefit wildlife			
1.14	Tree/shrub planting along bankside (only if covers >500m of bank or >0.5ha)			
1.15	Artificial bed/bank removal and replaced by softer material (>100m)			
1.16	Establishment of vegetation for structure/revetment (e.g. use of willows)			
1.17	Eradication of alien species			
1.18	Provision of habitat especially for individual species – otter, kingfisher etc			
1.19	Fencing along river banks; fencing floodplain habitats for management			
1.20	Aquatic/marginal planting			
1.21	Removal of floodbanks			
1.22	Other (please specify)			
Type 2	**Restoration of free passage between reaches**			
2.1	Obstructing structure replaced by riffle			
2.2	Obstructing structure replaced by meander			
2.3	Obstructing structure modified/removed to enable fish migration			
2.4	Obstructing structure retained, but riffle/meander structure established alongside			
2.5	Culverted reach re-opened/daylightened			
2.6	Obstruction within culvert (e.g. lack of depth, vertical fall) redresses			
2.7	Dried river reach has flow restored			
2.8	Other measures taken to restore free animal passage			
2.9	Other (please specify)			
Type 3	**River floodplain restoration**			
	**Water table levels raised or increased flooding achieved by*			
3.1	*Unspecified means/rationalised control			
3.2	*Watercourse re-meandering			
3.3	*Raised river bed level			
3.4	*Weirs established specifically to increase floodplain flooding/water-table			
3.5	*Termination of field drains to watercourse			
3.6	*Feeding floodplain with water (Sluice feeds, water meadow restoration)			
3.7	*Narrowing watercourse specifically to increase floodplain wetting			
3.8	Lakes, ponds, wetlands established (maybe flood storage areas)			
3.9	Lakes, ponds, wetlands, old river channels restored/revitalised)			
3.10	Vegetation management in floodplain			
3.11	Riparian zone removed from cultivation			
3.12	Substantial floodplain tree/shrub planting			
3.13	Other (please specify)			

Type 4	**Catchment Activities**				
	State key activities implemented …….. ……**Continue on separate sheet**				
Type 5	**River Management**				
	❑ **Maintenance changed**	❑ **Equipment changed**	❑ **Maintenance withdrawn (natural regeneration)**		

CONTACT, LOCATION AND BACKGROUND INFORMATION

If you feel that you can provide further information on your project please read on and give additional details as available. Linking objectives, drivers and site/catchment details helps in the assessment of success and failure of different techniques and features identified in the 'tick-box' form on the previous page. Information provided on project funding and partnerships with other organisations may be helpful to others when they are assessing likely costs and the potential for collaboration support. Please be as accurate as possible, but ranges of expenditure are equally useable. We would also like to record the team involved; their contact details will be entered on the 'contacts' database as part of a commitment to broadening the network.

NB The information requested in italics is useful additional information if easily attainable.

MAIN CONTACT (full details)

Name……Job title…….…….
Address……...
……
……Post code……
www links http://……..

PROJECT DETAILS

Project start date…….….Project end date……...
Location description……
……..……
…….……..
OS Sheet Letters……*OS 6 Figure Grid Reference*…….

SITE INFORMATION (PRE-PROJECT)

Section length (km) ……Width of river (m)……
River Substrate……Depth of river (m)…….……..
River Bed Gradient…….……
Floodplain soils……...
Was water quality a constraint?……
Habitat Quality (general)…….…….

CATCHMENT INFORMATION (OUTLINE)

Catchment type

- ❑ Upstream of urban area
- ❑ Within urban area
- ❑ Downstream of urban area
- ❑ Rural – Dominantly Agriculture
- ❑ Rural – Dominantly Forestry
- ❑ Other (please specify)……

Flow data (if available)
Dryflow cumecs…….
Bankfull cumecs……
1:5 Cumecs……
1:50 Cumecs……..
1:100 Cumecs……

(Please state if approximated)……

Catchment geology ……..
(Dominant solid or drift)

TECHNICAL ASPECTS

PROJECT FUNDS AND SOURCE

Total cost (£K) …….

Percentage breakdown of total cost
%Promotion/Design/Planning/Consultation……..
%Work Contact/supervision……
%Monitoring/Post Appraisal……..

Primary Funding Organisation……...£ …….
Other Funding Organisation (s)…… £…….
Other Partners……..….

PROJECT TEAM

Name/ Organisation Telephone number ……
Hydrologist……
Geomorphologist……..
Ecologist……
Landscape architect……... .
Design engineer……..
Works contractor……
Flood defence……...
Conservation……
Fisheries…….. ……
Water quality……..
Community liaison……
Other……

PROJECT COMMENTS AND DOCUMENTATION

Success and lessons learned……...
……
……..……
……..……
……..……

Documentation held

- ❑ Stated objectives
- ❑ Job specification
- ❑ Technical Specifications
- ❑ Contract documents
- ❑ **Audits**
- ❑ RHS/RCS
- ❑ Fisheries survey
- ❑ Monitoring reports
- ❑ **Photographs Pre works**
- ❑ Photographs Post works

Other documents……..
……
Journal citation ?……...

Return all forms to
Karen Phillip (Information Officer)
The River Restoration Centre
Silsoe Campus
Silsoe
Beds
MK45 4DT
Email: rrc@cranfield.ac.uk
Tel/fax: 01525 863341 www.theRRC.co.uk

Appendix IV: List of Project Summaries

- Avon Valley and West Hampshire Project

Chalk River Channel Reprofiling on the River Frome SSSI, Dorset

Chalk Stream Projects in Kent

Chiltern Chalk Streams Project

Ecological Assessment of River Restoration Schemes

Ecology of Chalk Rivers in Anglian Region

English Nature

Enhancement of Brown Trout Stocks in River Allen, Dorset

Environment Agency – Anglian Region

Environment Agency Hatfield Conservation Section

Environment Agency – South Wessex Area

Environment Agency Thames Region – North East Area

Gaywood Valley Habitat Restoration Project

- GU Partnership
- Hampshire Wildlife Trust Wildlife Awareness Team
- Investigation of *Ranunculus* in Chalk Rivers
- Lincolnshire Chalk Rivers Project
- River Kennet
- River Mimram Low Flows Study

The River Restoration Centre

River Wensum Rehabilitation Project

South East Otters and Rivers Project

University of Hertfordshire

Wessex Chalk Streams Project

Avon Valley and West Hampshire Project

Contact **Alison Fowler**
Hampshire Wildlife Trust
Woodside House
Woodside Road
Eastleigh
Hampshire. SO50 4ET
Tel: 023 80 688935
Email: AlisonF@hwt.org.uk

1. Project Focus

- Main aim is to provide appropriate habitat management advice to landowners and interested parties, within the Hampshire Avon floodplain and catchment. BAP species and habitat targets help direct and focus this work.
- The Project therefore covers the River Avon (exceptional quality chalk river, cSAC); the floodplain, associated remnant water meadow systems and floodplain wet grassland (SPA); tributaries of the Avon and their floodplains; the arable / mixed farming lands of the river terraces and catchment.

2. Components

- Riparian habitat – for example buffer strips :
  - to reduce silt ingress (siltation of gravels and negative impact on *Ranunculus* growth)
  - to establish suitable habitat for riparian mammals (in particular water vole)
  - reduce pollutant run-off (agri-chemicals etc)
  - grant payments through Avon Valley ESA or Countryside Stewardship Scheme

- Floodplain wet grassland – for example restoration of remnant water meadow systems :
- restoration of ploughed-out or silted-up ditches to facilitate controlled wetting-up of floodplain wet grasslands (Water Level Management Plans)
- restored / enhanced ditches offer great potential for fisheries (nursery areas etc) and an increase in habitat for riparian mammals

- Wider catchment - for example arable reversion adjacent to tributaries to reduce run-off and siltation etc.

- Education and awareness raising with all users of the River Avon and its catchment.

3. Justification

- Negative impacts of gravel siltation for fisheries, *Ranunculus* etc.
- Loss and fragmentation of riparian mammal habitat.
- Establishment of appropriate water levels at suitable times of year to benefit wildlife, plus ensure that the grazing of stock can continue in the floodplain (principally through Water Level Management Plans).

4. Science / Objectivity

- Sustainability is key – from the point of view of 'value for money', but more importantly from the farming landowners / fisheries point of view. Schemes have to be achievable and show a benefit – attracting grant-aid; enhancing fisheries performance; saving money (ie restricted inputs within buffer strips etc).
- Linking of sites to increase areas of positive management – within the river valley and extending out on to the terraces and floodplain as a whole.

5. Audit

- Site visit for initial assessment and meet with landowner / interested parties.
- Establishment of baseline data (survey; photo-monitoring).
- Developing ideas which focus on the potential of the site.
- Liaising with the landowner / interested party to establish what is achievable.
- Monitoring the changes which result.
- Using, where appropriate, as demonstration of best practice.

6. Dissemination

- Using the right techniques to reach the intended audience.
- Methods used :
  - Fact sheets / written literature (often most successful when combined with a site visit).
  - Demonstration days (where a working site can be viewed and the questions can be asked of individuals – conservation organisations and landowners etc).
  - Word of mouth and recommendation (one of the most valuable methods).
  - Using the successes of others as demonstration of best practice where local examples are not available).

7. Key Lessons Learnt

- Perceived miss-match of aims between fishing interests and conservationists – there is a long way to go to resolve this.
- Requirement to develop cost effective and sustainable schemes.
- Reaching the intended audience.
- Lots of organisations and people giving advice – often very confusing for landowners etc, and there is a danger of 'contact fatigue'.

Chalk river channel reprofiling at River Frome SSSI, West Stafford, Dorset

Contact **Douglas Kite**
English Nature
Slepe Farm
Arne
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1. Focus

Re-instatement of semi-natural chalk river morphology on a channelised channel.

2. Components

1997-98

- project identification and concept design - primarily by Charles Rangley-Wilson, Wild Trout Society in liaison with English Nature and landowner.
- SSSI Wildlife Enhancement Scheme management agreement with landowner for capital works and subsequent maintenance management.

1999

- pre-scheme baseline data collection.
- necessary authorisations tenders and selection of contractor - mostly by C R-W as Project Manager.
- capital works comprising fencing off wide riverside margin from grazed pasture, excavation of gravels in margin levee and return to channel to form riffles, import of additional clean gravel from nearby quarry, reprofiling margin to shallow grade with wet shelves and reseeding.

2000 onwards

- post scheme management trials and monitoring.

3. Justification

To address the following degradations:

- sharp bank transition from dry weather water level to gravel bank top levee lacking fen margin on opposite unmodified bank.
- deepened uniform channel morphology with uniform laminar flow.
- channel full carpet of brook water-crowfoot precipitating, major weed cutting management regime.
- channel bed of fine gravels and sand, except residual large gravel close to bank (assumed where excavator could not reach) unsuitable for salmonid reds.
- poor trout fishery though historical accounts from section of high trout take prior to channelisation.

4. Science/Objectivity

- to move beyond well trialed chalk stream restoration through implanting structures (eg spilling mattresses, deflectors, gravel filled bags) to restoring morphology, structure and dynamics of a chalk river channel with the naturally occurring channel materials.
- visual comparison of site with immediate upstream reach through woodland showing no evidence of channelisation.
- visual assessment that channel narrowing techniques using spilling on similar channelised stretch immediately downstream of site failed to adequately address all of the above degradations.
- requirement for a landowner sympathetic to objectives and to provide trial

demonstration and monitoring site.

5. Audit

Pre scheme

- transects across riverside margin and channel recording profile and plant species distributions and abundance.
- habitat score survey.
- proposed electro fishing survey not accomplished.

Post scheme

- repeat of transect recording in year +1 and plan for year +2, then depending on rapidity of vegetation change at increasing intervals. Repeat of habitat score survey.

6. Dissemination

- project site lies close to Game Conservancy demonstration site on River Piddle showing use of implant structures for chalk stream fisheries enhancement. In 2000 both sites used in a training day for chalk fisheries managers organised by the Wild Trout Society and Game Conservancy and also for a demonstration visit by English Nature's chalk rivers group.
- initial results of detailed vegetation monitoring to be presented in suitable scientific forum in future.
- articles planned in for example Enact once longer term outcomes of project are established.

7. Key Lessons Learnt

- support of the main stakeholders is essential, especially the land drainage authority, land owner(s) and fisheries rights owner(s), and possibly also the local planning authority.
- planning and implementation requires the focus of an on-site project manager, particularly useful if this is the land owner or fisheries rights owner.
- major engineering works rarely go exactly according to plan; make sure scheme/timetable/funding is flexible enough to accommodate problems. In this project the sub contractor with the gravel grader failed to show up!
- don't be too cautious about the immediate degree of change to the river (subject to flood protection and land drainage considerations) - river habitats have the capacity for re-establishment provided the environmental factors are conducive.

Chalk stream projects in Kent

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- Through the Land Drainage Consenting process the Conservation section became aware of proposed works at a key site for white-clawed crayfish. The landowner was approached in March 2000, and the possibility of creating specific crayfish enhancements was discussed.

It was decided that a collaborative project between the Environment Agency, the landowner and the North West Kent Countryside Project (NWKCP) was the best way to realise the project. The Environment Agency was able to assist in obtaining all of the necessary consents and authorisations, the NWKCP were able to collect materials and provide a team of volunteers to undertake the construction, and the landowner supplied local stone and the facilities to grade and clean it before use.

It was proposed to create a low-level aquatic ledge by using loosely positioned local stone held behind chestnut posts. The total length of the ledge was approximately 25 metres. The existing earth bank provided a relatively poor crayfish habitat. The ledge would increase the available habitat.

Existing river corridor surveys were checked and basic habitat surveys were undertaken prior to any work commencing to ensure that no damage would be caused to any habitats or species of conservation interest (ie water voles). A fish survey was undertaken to assess the present fish status. The opposite bank was left unaffected to act as a future comparison.

A search was undertaken (under licence) to collect and temporarily hold, in buckets, any crayfish that may be adversely affected by the construction process.

Chestnut posts were driven into the bed at intervals of approximately 0.2m. The line of the posts was such that it followed the existing bank contour. A pair of A-wing deflectors were incorporated into the design. The posts were cut at 0.15m above the normal water level.

Stone was used to fill the void created behind the posts. It was carefully positioned in a manner that created a range of refuge sizes and an over-hang. This was achieved by scattering 0.1m diameter stones on the bed. On top of these were placed relatively square flat stones of approx. 0.2m length. More stones of a progressively smaller size were then used to fill the void up to the top of the posts. The small stones should prevent the down washing of fine sediments and provide a matrix in which vegetation can become rooted.

The construction work could not commence until mid July as before this period the chance of disturbing crayfish with hatchlings is high and would not have been considered as best practice.

The construction work was completed in one day by a team of 15 volunteers. It was very important that the team was well organised and that all of the materials where available and ready to use.

Crayfish and fish surveys will be undertaken next year to assess the effect of the enhancement.

A report has been produced summarising the project, which should also act as a guide for others wanting to undertake similar work.

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Little Stour hand weed cutting exercise

- The Little Stour is a river identified within the Agency's Alleviation of Low Flows (ALF) project. The river provides a key habitat for water voles. Attention has been focused on 600m of river downstream of Littlebourne village in East Kent
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Aim of exercise

1) To trial the establishment of a self-cleansing channel by managing the existing vegetation and allowing a degree of natural vegetation encroachment to produce controlled local scour.

2) To trial a Flood Defence management regime that is more in balance with the present discharge carried by the Little Stour River, and that takes into account the habitat requirements of fauna and flora of nature conservation interest.

- The Flood Defence Function has a yearly maintenance programme, aquatic weed clearance of the Lt. Stour was part of this programme. The previous management regime had paid little attention to the conservation interest of the river. Discussion with Flood Defence provided an opportunity to review the river's previous management. Unfortunately this opportunity was rather "reactive" which limited the amount of pre-project information that could be collected.
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- Since August 1999 a more sensitive management regime has been adopted that requires a team of 3/4 men working by hand for one day. At least two cuts are required each year, one in late spring and another in late summer. The cost of the team of men is less than the previous management arrangements that involved a machine or a team of men working for more than three days clearing the channel in its entirety.
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- A presentation was given to the local villagers to inform them of the change of management and to increase their interest in the river.
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- The retained margins have increased the velocity in the central channel. Water crowfooot has replaced some of the more vigorous plants such as watercress and burr reed that had been of concern to Flood Defence.
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- A photographic record has been kept to monitor the change of the channel. Results observed after one year include increased sightings of water voles, brown trout parr utilising the higher velocity water and cover provided by the crowfoot, and increased numbers of wildfowl. And perhaps most encouragingly positive feedback from villagers who are now more aware of the need to retain a degree of in-channel habitat.
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- In the present period of high flows the river was able to convey its flow effectively even though some section had yet to be cut. The vegetation had been flattened down rather than being ripped out where it may have presented at risk to mill structures.
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- It is now generally acknowledged that the influence of the mills on the river is much greater than the in-channel vegetation. It is hoped to devise a strategy/agreement for the effective operation of the mills in periods of high flow.
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- It would be useful to know how other Agency areas have been able to influence the operation of mill structures, many of which may be in a poor condition and have liabilities or health and safety issues associated with their operation.

Chiltern chalk streams project

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1. Focus

- Led by the Chilterns Conference, the Chilterns Chalk Streams Project is a partnership of 15 organisations, including the Environment Agency, English Nature, Countryside Agency and local authorities. The project aims to:
  - conserve and enhance chalk stream habitats and to protect associated species
  - raise awareness and understanding of the chalk stream environment and encourage enjoyment of the Chilterns countryside
  - make the link between our use of water and the chalk stream environment.

  The project is focusing on eight chalk streams in the Chilterns Area of Outstanding Natural Beauty: the Chess, Misbourne, Ver, Bulbourne, Gade, Hamble Brook, Wye and Hughenden Stream.

2. Project Components:

- **Local Action Programmes** - the Chilterns Chalk Streams Project is working in partnership with local communities and partner organisations to develop an action programme for each stream. This approach uses local knowledge to identify the main priorities and concerns and how these should be tackled. Action programmes include water resources and water quality issues, habitat and species work and access and education. The programmes have been costed and linked to LEAPs and BAPs.
- **Habitat Enhancements** - enhancement opportunities have been identified in the action programmes and include channel reforming, reprofiling of banks, creation of buffer strips, pond creation and watermeadow restoration.
- **Low Flows** – the project acts as an information point for the public on low flow issues. Flow restoration schemes have been implemented on some streams. The project has instigated a further study of one stream in Buckinghamshire.
- **County Wildlife Sites** - the project works in partnership with the Wildlife Sites Projects in Hertfordshire and Buckinghamshire to survey and monitor chalk stream sites and provide management advice to their owners.
- **Species Survey and Management** - several Chilterns chalk streams continue to support water voles and maintaining these populations is an important aim for the project. Activities include survey, habitat management and a mink control campaign.
- **Access and Recreation** – access improvements, promoted walks and events.
- **Raising Awareness** – the project is producing education material for schools and raises awareness of the importance of the chalk stream environment and the impact of our use of water through promotional work.

3. Justification

Chilterns chalk streams have been affected by over-abstraction, channel alteration, impoundments, agricultural intensification and urban development. The restoration of these nationally important streams is an objective of the Chilterns AONB Management Plan, the

Chilterns Natural Area Profile, local and UK Biodiversity Action Plans and Local Environment Agency Plans.

4. Science / Objectivity

The project is employing a catchment-based approach, assessing the value of each stream for conservation and access and identifying problem areas and enhancement opportunities.

5. Audit

Individual components of the project will be monitored in the most appropriate way. Quantitative targets will be set where possible, e.g. percentage occupancy for water voles, etc.

6. Outputs:

Local Action Programmes for Chilterns chalk streams and their delivery
Reports on major schemes
Leaflets: chalk streams, wildlife of chalk streams, promoted walk leaflets
Education material for schools in the Chilterns
Posters for schools planned
Website currently being developed
Schools video planned

7. Key Lessons Learnt

The project and its partner organisations have gained experience in dealing with low flow issues. Public understanding of how chalk streams and the alleviation schemes work is generally poor and this has caused problems. Experience has also been gained in environmental interpretation, education, access improvements and community involvement.

Ecological Assessment of River Restoration Schemes

Contact ***Judy England****, Ecology Team Leader* (also part-time PhD student at University of Hertfordshire looking at post project appraisal of river restoration schemes)
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1. Focus.
The ecological assessment of rehabilitation schemes – including those on chalk streams.

2. Components.
- Assessing the physical habitat changes and adjustments following restoration work.
- Monitoring macroinvertebrate and in-stream plant colonisation following river rehabilitation, assessing both spatial and temporal changes.
- Scientific assessments of different restoration techniques.
- The implications of introducing gravel to stable chalk streams systems.
- Recommendations for future monitoring strategies.

3. Justification.
The work looks to justify river rehabilitation schemes by demonstrating the beneficial effects that result. The work will make recommendations about which restoration techniques have the best effect. The variety of assessment methodologies employed will make recommendations for future monitoring strategies.

4. Science/Objectivity.
A variety of scientific techniques are being employed within the study. Different schemes employing different techniques are being assessed. All monitoring includes the assessment of how well a scheme achieves it's aims and how the scheme affects the ecology in comparison with a target or control section of channel.

5. Audit.
The entire project incorporates auditing of river rehabilitation schemes.

6. Dissemination.
The work included within this study is being undertaken in fulfilment of a part time PhD at the University of Hertfordshire. The results will be presented both at the University and within the Environment Agency in the form of internal reports and publications in scientific journals. The work will go on to form the basis of internal policies and procedures. The results are being presented at meetings such as the Annual Winter Meeting of the British Ecological Society and the River Restoration meetings.

7. Key lessons learnt.
Scientific assessments can provide confirmation of the success of schemes but it is costly and time consuming. It is better to monitor a few schemes well rather than monitor all in an unscientific manor – this often provides inconclusive results that may prove misleading. The information gained from monitoring a few schemes well can provide more detailed information about the application of different restoration techniques and watercourse types. Control sites are essential to establish background changes within a watercourse.

Ecology of Chalk Rivers in Anglian Region

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Macro-invertebrate Study Methods

Water Quality

British Monitoring Working Party (BMWP) score; Average Score Per Taxon (ASPT) & Lincoln Quality Index (LQI). Each taxon is given a BMWP score based on its tolerance to pollution, which is used to generate a total BMWP score reflecting organic water quality. ASPT is this BMWP score divided by the no. of scoring taxa. ASPT provides an assessment of water quality which is independent of the no. of scoring taxa. Both of these indices are used to generate the LQI.

Water Quantity

Lotic-Invertebrate Index for Flow Evaluation (LIFE). This relatively new technique allows water quantity to be assessed by studying the relationship between invertebrate community structure and flow regime. The LIFE technique can be used at family or species level. Each taxon is assigned to a flow group depending on its preference of stream velocity. Using a matrix containing flow group and abundance, flow scores are obtained for each taxa. These are subsequently used to generate the LIFE index.

A Classification System for Flows

This is based on Ecological Flow Indicies (EFIs), which are obtained by dividing the observed LIFE index by the expected LIFE index. This has potential as a monitoring tool for flow on Chalk Rivers

Community Conservation Index (CCI) for aquatic macro-invertebrates

- Each species is assigned a score reflecting its rarity, and these scores are then used to obtain an index for the site. The index is robust enough to highlight a site that has just one or two very rare species or sites which are highly diverse. Anglian region (Central & Northern Area) biologists identify all invertebrates to species level during routine monitoring. This allows for an assessment of the conservation value of each site.

Special Surveys

Faunal Richness of Headwater Streams R& D Project

English Nature

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English Nature

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Note: This summary covers a general range of issues, rather than a specific project, relating to work carried out on the River Avon System SSSI and River Kennet SSSI.

1. Project/Activity

I am a conservation officer for English Nature's Wiltshire team, dealing with the River Avon System SSSI(includes the Wylye, Nadder and Bourne), River Till SSSI (both within the River Avon candidate SAC), the River Kennet SSSI and other SSSIs including wet meadows, fens and swamps. I am also the team's lead for freshwater issues, and have overall responsibility for the River Avon System SSSI/cSAC (it runs through Hampshire and Dorset).

The Wessex Chalk Streams Project (WCSP) Officer, Jackie Smith, is based at the EN office in Devizes and I work closely with her.

2. Components of Work

The work includes the selection and designation of SSSIs, and international sites (eg cSACs) and casework relating to them (eg liaison with owners and managers, development planning). The River Avon cSAC is included in the EN/EA Rivers LIFE project, and a project officer is just about to start work (based in Wiltshire) to produce a Conservation Strategy.

I have been involved in a variety of river restoration projects on the Rivers Avon and Kennet over the last 4 years, as most of the work requires consent from English Nature. These projects have ranged from small scale individual "bank repairs" to large linked rehabilitation works, often using innovative techniques and methods.

3. Justification

Most of the individual projects on the Avon have been directed at improving trout habitats and fishing, although increasingly biodiversity gain is deliberately built in (certainly where EN or EA is contributing to the funding). The Kennet project is tackling several stretches of the river, with biodiversity the main driver, although the fishing will benefit.

The main problem being addressed has been degradation to the chalk stream habitats, usually linked to historic drainage engineering works and consequent reductions in flow, and the works have aimed to restore velocity and restoring dynamism to the river channel. Where EN has contributed to the project we have aimed to enhance channel and bank habitats as well.

4. Science/Objectivity

Most of the individual projects have been proposed by the fishing club or riparian owner, and EN (and EA) have been approached for consent. Our role has been to consider whether the proposal could cause damage, and whether there are opportunities for wildlife enhancement. To date therefore, at least on the Avon System, the projects have been assessed reactively, rather than as part of a strategic enhancement scheme. However, the LIFE project will take an

overview, and bring together existing plans (LEAP, WLMP, Site Management Statements, BAP etc, etc), as well as incorporating existing and new research (eg a hydrogeomorphological assessment to identify key stretches).

The River Kennet project has been more strategic, insofar as a 10km length of river has been assessed , different problems identified and priority rehabilitation sites identified.

5. Audit

Has depended on the project - EN has not carried out any directly, although some of the schemes have been monitored by the WCSP, the fishing club, the EA, the Game Conservancy or (in the case of the Kennet) the project managers. Not all projects have been monitored.

6. Dissemination

Usually reported to the RRC via Allan Frake or the WCSP (EA South Wessex Area) for River Avon System, or Nigel Holmes (presumably) for the Kennet Project. WCSP has a newsletter to all River Avon System and River Till SSSI owners and managers, and EN has its own magazines that report some projects.

7. Lessons Learnt

- Lots still being learnt
- Relatively small works can achieve apparently spectacular results
- Sympathetic fishery works can greatly enhance a wide range of biodiversity - but need to build in from the beginning
- Respect the knowledge of the riparian owners and fishing clubs, even if have different priorities
- Difficult to co-ordinate different owners and managers to get larger schemes
- Need to identify the real cause of problems in a stretch before designing/starting works

Enhancement of brown trout stocks in River Allen, Dorset

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1. Focus

- The key focus of the project was the enhancement of self-sustaining salmonid stocks in the River Allen. Secondary aims included increasing the quality and availability of habitat for white-clawed crayfish, juvenile coarse fish and bullheads, whilst increasing hydrological continuity with floodplain meadows adjacent to the River Allen.

2. Components

- Provision of increased length of spawning and juvenile habitat for salmonids by the creation of 6 No. gravel riffles. Habitat for white-clawed crayfish and bullhead will also improve as a consequence.
- Raising of water levels in floodplain meadows as a result of the backwater effect of the riffle construction.
- Creation of associated lengths of 2-stage channel to create low level berms for emergent aquatic macrophytes, whilst providing flood compensation for riffle creation.
- Localised narrowing using faggot bundles to increase flow velocity.
- Provision of high flow refuge for juvenile coarse fish by the partial re-excavation of a meander loop cut off by a past land drainage scheme.
- Experimental trials with the use of straw bales as “void space” fill for riffles prior to overtopping with gravel.

3. Science/objectivity

- Site evaluation was undertaken by accurate mapping of existing river form and consideration of EA fisheries monitoring data. Data on range of flows experienced in the channel provided by EA.

Options for restoration were clear following assessment of habitat bottlenecks at critical lifestages of salmonids. Insufficient length of gravel spawning riffle was present to allow successful recruitment of salmonids. Importation of suitably sized gravel to create riffles was the only practical option available. Construction of riffles had the additional benefit of raising local groundwater levels, allowing the farmer on the left hand bank to achieve necessary criteria for a higher Countryside Stewardship tier.

Excavation of the redundant ox-bow was identified as providing a valuable high water refuge for coarse fish, adjacent to an existing copse likely to be used as a lying up area by otters.

4. Monitoring

- Pre-survey monitoring was extensive. Data sets extending to >10 years were available with respect to aquatic macrophytes and macroinvertebrates. Surveys for both were also undertaken in the months prior to the restoration commencing.

Detailed assessment of the location of white-clawed crayfish and water voles was undertaken prior to work commencing. Appropriate mitigation measures were implemented where necessary.

A quantitative fishery survey was undertaken at the proposed enhancement site and an upstream control site. In addition, HABSCORE assessment was undertaken with a view to monitoring the efficacy of the restoration work on fish stocks.

An extensive photographic record of the site was made before, during and after the restoration work.

Finally, a MSc project was undertaken in which groundwater levels in riparian meadows adjacent to the restoration were monitored before, during and after the work.

6. Dissemination

All outputs were completed to schedule as planned.

Project aims and results were circulated via local and national (Trout and Salmon magazine, Wild Trout Society yearbook, Daily Telegraph) media. Details logged on RRP database.

7. Lessons Learned

Riffle construction, backwater excavation, channel narrowing and creation of marginal shelves are tried and tested techniques. Future monitoring will quantify benefits to fish and other fauna including white-clawed crayfish.

The benefit of using the backwater effect of riffle creation to raise groundwater levels locally was proven by the MSc study. Monitoring showed an immediate and sustained rise in groundwater levels that enabled the farmer to achieve the requirements of a higher Countryside Stewardship tier.

The trial of using straw as a “void infill” as part of the riffle construction was unsuccessful. Standard bales proved incredibly difficult to submerge en masse. It seems likely that the effort required to put bales in place may outweigh any saving on gravel. In addition, the rapid decomposition of bales used to narrow the channel suggests that even if sunk, bales may not provide adequate long term support to overlaid gravels. Investigation of the efficacy of other infill material (e.g. clean builder’s rubble, faggots etc) is recommended.

Environment Agency – Anglian Regional (Central Area)

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Although the Anglian Region is not renowned for its chalk streams in their classical sense there are a number of rivers which rise from chalk aquifers, and flow for at least part of their length, through chalk. Each year we work with angling clubs in the catchment on fisheries habitat enhancement projects of varying sizes and costs.

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In addition, I have been actively involved in projects on Biodiversity Action Plan species such as the native white-clawed crayfish.

1. Focus

Chalk stream enhancement projects that I've been involved with this year include installation of boulder deflectors into the upper River Cam and the Heacham River. We also installed woven willow hurdle and brush willow bundle deflectors into the River Nar (SSSI). The latter project also aims to reduce siltation and loss of bankside habitat through cattle poaching, by fencing badly impacted lengths. Works have also been initiated with a member of the Wild Trout Society to install gravel point bars and riffles into the River Granta, a tributary of the Cam.

The key focus for all these projects is to enhance habitat for fish, thereby improving biomass and recruitment. Working with clubs to improve their fishery has the additional benefit of encouraging greater participation in the sport of angling with benefits to both the club and the Agency.

2. Justification.

Our projects look to address issues of under performance in fish biomass when compared to similar rivers or sites on the same river. In most cases the habitat has become degraded through historic land drainage schemes or current Flood Defence maintenance activities. With much of East Anglia being below sea level, flood defence is an important consideration to local people. This has led to many of our rivers being straightened, often overwidened and lacking in any riparian habitat. Subsequent problems include siltation, leading to a loss of diversity in the bed profile and smothering of spawning gravels. High winter velocities in these straightened rivers which are contained within high flood banks, has led to poor survivorship of juvenile fish.

Intensive agriculture has also had great impacts within the Area with the loss of riparian and littoral vegetation and increased siltation. Our projects look to address these problems and remove the factors limiting the fish populations.

3. Science/Objectivity

A number of techniques for site selection and project identification are used. Under performance of a fishery is usually identified through our rolling fisheries survey programme or through a decline in catches reported by the angling clubs and confirmed through investigative surveys.

Prioritisation of river reaches, where project expenditure is likely, is heavily influenced by the funding availability. Fisheries in this Region is financed almost exclusively through anglers

licences and therefore projects are targeted to maximise benefits to these licence payers. Rivers with low angling exploitation or potential are given a low priority. Further influences on the process include the presence of conservation designated species and habitat. Funding for capital projects also depends on the importance of the work as perceived by the Fisheries Technical Group.

Option selection is usually a trade off between the ideals, what's acceptable to other Agency functions and budget limitations. When assessing a stretch of river we look at the elements necessary for appropriate fish species to flourish e.g. feeding opportunities, spawning substrates, resting areas and cover, and assess which of these is limiting. The methods employed to remove the limiting factor are then considered in relation to what can realistically be achieved taking into account the land drainage issues, money available and the views of landowners and users.

4. Audit

Monitoring of invertebrates and fish within the project reach are always undertaken; and depending on the nature of the works plant surveys. These surveys are carried out using methodology that is easily repeatable both pre and post project, allowing us to assess performance against project objectives. Post project surveys are usually undertaken 1 to 2 years following project implementation.

5. Dissemination

Annually all fisheries capital projects are disseminated via press releases issued to local media. Further dissemination is achieved through presentations given to angling clubs, fisheries committees or the Institute Fisheries Management by Fisheries staff. Our regional fisheries magazine 'The Angle' provides another outlet for highlighting our work.

6. Key Lessons Learnt

The key lesson learnt from undertaking river enhancement work has been the need to identify and consult all stakeholders as soon as possible regarding proposals. This helps to identify problems early in the process, can add value to the work, and ensures smooth implementation.

The need to be resilient and persistent are also key lessons. In our experience a large percentage of projects identified fail to come to fruition due to problems associated with a stakeholder. You need to take a broad picture when considering issues surrounding a project and how to resolve them. For example, the insistence of our Flood Defence function that we accurately model the impact on the flow regime of our proposed works on the River Granta (described above), led us to obtain a quote from an engineering consultant as the expertise to do this was not available in-house. The resultant quote would make the project impractical, therefore, we are now considering the costs of undertaking compensatory works to increase channel capacity, and these could have additional environmental benefits.

Environment Agency Hatfield – Conservation

Contact **Chris Catling – Team Leader Conservation EA Hatfield.**

I have been involved in a number of chalk river enhancements over a 10-year period. It is estimated that at least 94% of these rivers in NE Area of Thames Region are man impacted. Enhancements have been focused mainly on reinstatement of biological and physical processes rather than on individual species i.e. sustainable habitat restoration. The main problems encountered in these highly modified rivers include:

1. Inappropriate channel morphology – Too wide, too deep, trapezoidal, straightened etc.
2. Lack of energy – numerous impoundments, no adjustment and numerous millraces
3. Inappropriate sediment inputs – most periglacial gravels have been removed and replacement with
8. fine sediments.
4. Altered water quality, both its chemistry and temperature.
5. Hydrograph changes – Few chalk rivers maintain a 'natural' flow, most have a perceived lowered flow with occasional excesses.

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- To help ameliorate some of these problems I have been involved in the following works:
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Habitat \ Species	**Location**	**Enhancement**
Chalk Streams		
	R. Chess @ Bois Mill	Weir lowering, channel narrowing, gravel importation and fish pass
	R. Chess @ Solesbridge	Weir notching, channel narrowing and back water reinstatement
	R. Chess @ Blackwell	Weir removal, channel narrowing, gravel importation and fish pass
	R. Ver @ Shafford	By passed mill and reinstated 1km of chalk stream
	R. Ver @ Pre Mill	Weir lowering, channel reinstatement and fish pass
	R. Ver @ Kingsbury Mill	Mill bypassed, reinstatement of 1km chalk stream and fish pass
	R. Ver @ Sopwell Mill	Weir removal and backwater installation
	R. Ver @ St Albans	Pool and traverse fish pass
	R. Rib @ Standon	Channel narrowing, weir lowering, wet berm creation and gravel installation
	R. Bulbourne @ Chaulden	Channel narrowing \ wet berm creation
	R. Bulbourne @ Piccotts End	Weir removal, channel narrowing
	R. Gade @ Cassiobury	Weir notching and cressbed re instatement
	R. Gade @ Gade Bridge	Channel narrowing, gravel installation, weir notching and wet berm creation.
	R. Colne @ Watford	Channel narrowing, gravel installation and backwater installation.
	R. Mimram @ Rose Farm	Channel narrowing \ wet berms
	R. Mimram @ Rye End	Channel narrowing \ wet berms

	ALF's see below	Chalk stream Alleviation of Low Flow schemes
Otter	Lee @ Hertford	Island creation and 2 holts (one is used)
	Upper Lee tribs	5 tree planting schemes

- Total cost of the above enhancements approximately £615 000

- Other chalk stream work includes:

Misbourne

The alleviation scheme for the Misbourne has now been implemented by TWUL and 3VW. In January 1998, TWUL reduced abstraction at Wendover Dean and Hampden Bottom in the upper catchment by an average of 7Ml/d. Abstraction at these two sites is now 2Ml/d on average and is for local use only. The replacement source is a sustainable groundwater abstraction at Medmenham, adjacent to the River Thames.

3VW completed a new 6.5km pipeline in 1997. The pipeline runs from West Hyde in the Colne valley to Chalfont St Giles allowing water abstracted from groundwater sources within the Colne valley to be transferred up the Misbourne catchment. In the spring of 1998, 3VW reduced pumping at Amersham and Great Missenden by an average of 8Ml/d. The total reduction in abstraction for the whole catchment is therefore 15Ml/d.

A number of boreholes were drilled along the river in 1991. Groundwater levels have been monitored in these boreholes on at least a monthly basis since then. This is planned to continue. Current meter gauging has been carried out along the river on a monthly basis since 1995. Ecological monitoring of the river has also been ongoing since 1996. Both gaugings and ecological monitoring are planned to continue.

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- Bulbourne

Halcrow carried out an initial study in 1995 to investigate the causes of low flows in the Bulbourne and to assess a whole range of options. This work included the development of a groundwater model. The study came up with four solutions:-

1) provide additional water from the Tring reservoirs either via the canal or direct into the upper reaches of the Bulbourne
2) back pumping from the canal
3) cease abstraction at Newground PS
4) combinations of the above.

TWUL proposed the solution of ceasing abstraction at Newground and bringing in a supply from West Marlow and Remenham, groundwater sources adjacent to the Thames. This would be a combined solution to the River Bulbourne and River Wye low flow problems with the water from West Marlow and Remenham replacing the abstraction at Mill End PS on the Wye as well as the supply from Newground. Groundwater modelling had shown that this was the best solution and so no further studies have been carried out on the other options.

The business case was approved by DETR in March 1999. 3VW have included this scheme in their strategic business plans to OFWAT and money became available for implementation from April 2000 and should be completed by 2005.

Four boreholes were drilled along the upper Bulbourne in 1994 and groundwater levels have been measured monthly since. Current meter gauging is also carried out monthly.

- Gade

Monthly current meter gauging along the Gade commenced in July 1999. Six groundwater monitoring boreholes are to be drilled adjacent to the Gade between Hudnall Corner and Hemel

Hempstead. Work should commence on the boreholes in September 1999. Initial studies into low flows in the Gade are due to start in 2000 and this will include the development of a groundwater model of the whole of the Colne valley. 3VW included costs for low flow investigations on the Gade in their AMP111 submission to DETR which was approved in March 1999. Money became available for this from April 2000. Current thinking is that EA will fund and carry out the initial studies with 3VW funding any further studies required. We are now at the pre-tender stage of companies bidding for the project.

- Ver

The Ver low flow scheme was implemented in 1993 with the closure of Friars Wash PS apart from emergency use only. Groundwater levels have been monitored monthly in boreholes drilled adjacent to the river in1991. Monthly current meter gauging has been ongoing since 1995 and ecological monitoring has also been carried out. It is planned to continue the current meter gauging for at least another three years.

- Mimram

Monthly current meter gauging along the Mimram commenced in July 1999. Nine groundwater monitoring boreholes are to be drilled adjacent to the Mimram between just above Whitwell and Digswell. Work should commence on the boreholes in September 1999. Initial studies into low flows in the Mimram are due to start in late 1999 and this will include the development of a groundwater model of the Lee Valley including the upper Lee, Mimram, Beane and Rib. 3VW included costs for low flow investigations on the Mimram in their AMP111 submission to DETR which was approved in March 1999. Money became available in April 2000 and any further studies required will be funded in this way. The groundwater model should be completed in Autumn 2001.

- Beane

Studies on the low flow problem of the River Beane commenced in 1996. Two phases, including groundwater modelling, have now been completed. The recommended solution is to close Whitehall PS and relocate the abstraction down catchment. Further modelling is required to determine the optimum location for such an abstraction, delivering the required yield but not adversely impacting on the adjacent catchments of the Rib and Mimram. The model developed for the Mimram study, as described above, will also be used to investigate further a solution for the River Beane. Boreholes were drilled alongside the Beane in 1995 and groundwater levels have been monitored monthly since.

- <u>Catchment Abstraction Management Strategies (CAMS)</u>

These strategies which are soon to be written for each catchment will set an environmental allocation for each river catchment. Progress on what this allocation will be is vital for base fed chalk rivers and is presently under investigation.

Environment Agency South Wessex Area

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- **Introduction**
- Chalk rivers of Southern England are historically amongst the most managed systems in the UK. There is little doubt that significant stretches of prime chalk river habitat have been severely degraded over the past few decades by extensive dredging and channelisation, initially during the last war to deter or restrict potential foreign troop invasion, and then by land drainage and flood prevention activities. The situation is frequently exacerbated by poor animal stock management (cattle/sheep poaching) which results in shallow over-wide channels with poor habitat diversity and direct damage to the in-stream & riparian habitats particularly where cattle are permitted access to the river.
- The chalk rivers of Wiltshire and Dorset in the upper reaches have always been recognised as prime trout fisheries and essentially most of the management and indeed the character of many sections of river are reflected in the activities of river keepers who over many decades have managed the river in order to maintain the predominantly salmonid fishery. River keepers have used a variety of traditional techniques in creating and maintaining habitats suitable for juvenile and adult trout eg weed cutting, silt and gravel management, creating holding areas etc and facilitating bankside access for angling.
- In recent years there is a perception that chalk streams are undergoing a progressive detrimental change as a result of abstraction, agriculture land use changes, and eutrophication generically termed the *'chalk stream malaise'*. In many cases some of the symptoms can be addressed by modifying the channel and the angling interests have been very proactive in becoming involved and promoting rehabilitation initiatives to benefit the fishery interests.
- Over the last few years, habitat enhancements initiatives for reinstating or promoting trout fisheries in Southern England chalk rivers have increased in number dramatically involved an interesting evolution of various 'bioengineering techniques' with extensive use of willow, brushwood and faggots to re-define specific channel characteristics. The objective has generally involved some form of channel narrowing where overwide or replacement of gravels where overdeep or a combination of the two, diversifying the flow and as a result improving the range of habitats for various fish life stages. The potential for additional benefits to improve the habitat availability for other components of the riverine flora and fauna is now being recognised but prescriptive objectives and techniques to optimise holistic benefits are at present, elusive.

Over 30 'reach scale' projects have been carried out in the South Wessex Area, the Agency contributing over £100k over the last few years and there is no doubt that most of the bioengineering techniques are perceived as successful both in aesthetic landscape terms as well as benefiting wild trout fisheries and improving the overall river ecology, however the

important conservation status of rivers such as the Hampshire/Wiltshire Avon has resulted in the general need for a more 'holistic' and less 'piscicentric' approach. As a potential SAC (Special area of Conservation) one of the qualifying target habitats (annex 1) is the 'Floating *Ranunculus spp*. of plain & sub-mountainous rivers'. A plethora of innovative experimental techniques have been used in South Wessex rehabilitation work and the main challenge is seen as satisfying fisheries, conservation and flood defence interests.

- **Key focus**
- To carry out EA statutory duty towards promoting nature conservation, fisheries and recreation; maintaining and enhancing biodiversity and achieving sustainable management of rivers.
- To fulfill the role expected of us by the general public & outside bodies and promote the potential for collaborative projects in partnership with other organisations.
- To experiment with and evaluate a variety of bio-engineering techniques in order to rehabilitate and enhance habitats while accommodating/complementing fisheries interests.
- Assess impacts on ecohydraulics, ecological and cost effectiveness with a view to establish 'best practice' for chalk rivers.

- **Project components**
- Evaluation of various 'faggotry' techniques in rural (and urban) environments for use as bank revetment, river narrowing, angler walkways, subsurface mattresses and 'snow shoe' plant colonisation structures. Rehabilitation of riffle/pool sequences of over dredged river sections by putting gravel back into river either by reinstating original dredged gravel or importing new gravel. Fencing to exclude livestock also normally associated with projects.

- **Justification**
- Impacts include over-widening of channels and destruction of in-river & riparian habitat by livestock due to historic over-enthusiasic dredging and reprofiling of channel for land drainage etc. Techniques also address siltation problems. Opportunity to identify some projects which have *flood defence* as well as conservation and fisheries benefits.

- **Science/objectivity**
- Focus of rehab projects at present is to look at the techniques and develop a 'toolbox' /best practice. There is no strategic objective of identifying priority areas in catchment for rehab. Projects are *opportunistic* and are carried out where partnership opportunities arise for funding and carrying out the work, primarily with high level of riparian owner/fishery interests support.etc.

- **Audit**
- Not practical to monitor all interests (fish, invertebrates, macrophytes, channel morphology, flow dynamics etc at 30 or so project sites. Monitoring involves selection of representative sites where different techniques are employed. Monitoring of parameters above to various levels of scientific integrity ! : using volunteers, in-house biologists or external contractors, Universities etc.

- **Dissemination**
- Copies of pre & post project monitoring reports sent to RRC. Originals including pre-project surveys held within EA at Area office.

- **Key Lessons Learnt**
- Need to be honest about potential limitations ; uncertainties will remain when dealing with complex systems.
- Accept degree of empiricism ; lack of knowledge should not curtail rehab efforts.
- Demonstration sites valuable - leads to and encourages investment in projects by private individuals once they see what can (and cannot) be achieved.

- Holistic approach to rehab projects tends to lead to positive collaboration between conservation and fisheries interests. However, significant time occasionally spent on conflict resolution probably as a result of the high risk strategy of spending minimal (10%) of project budget on planning and the bulk on 'doing'.

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Environment Agency Thames Region

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Key focus

Development and implementation of the Environment Agency's policy of the environmentally sustainable management of water abstraction in the medium and long term, and in seeking to ensure the proper use of water resources during drought conditions.

Main activities

- Restoring Sustainable Abstraction Programme Co-ordinator, Thames Region;
- Regional Drought Co-ordinator;
- Project Manager for the LIFE (Lotic-Invertebrate Index for Flow Evaluation) R&D Project;
- Chair of the Regional Water Resources Habitats Directive Technical Group, member of the Regional Habitats Directive Steering Group.

Justification

As part of the Restoring Sustainable Abstraction Programme (RSAP) the Agency has compiled a catalogue of sites (rivers or wetlands) which are either subject to work as part of the Habitats Directive Review of Existing Consents, included for investigation or implementation within the Asset Management Plan (AMP) process, or there is a perception that abstraction is having an adverse impact upon the environment. The database allows work on individual sites to be planned and prioritised alongside others within a Region. The catalogue enables an audit trail to be maintained of activity and decisions made for each site.

Science / Objectivity

Nationally agreed guidelines are used to prioritise sites on the RSAP database within each region. Guidance is presently being prepared on issues including: investigations, options identification and appraisal, options selection and implementation, and post project appraisal. The guidance is intended to give a consistent structure to RSAP work, whilst recognising the need for flexibility to allow for regional differences in water resource availability, abstractors requirements and environmental issues. Experiences of previous projects is fed into the process for managing and undertaking new work. This experience has been drawn upon heavily in the preparation of the RSAP guidance.

Audit

In certain cases where flow restoration has been undertaken, large scale monitoring programmes have been instigated to provide information about the degree of recovery and effects. This monitoring has taken the form of wide ranging ecological and hydrological surveys over long time periods. As far as possible this information has been used to inform the design of monitoring for other projects.

Dissemination

For individual schemes public meetings are held to both provide information to, and gain information from, the public. Findings from the pre- and post-scheme environmental monitoring are made publicly available. Any original scientific findings are published in recognised journals.

Environment Agency Thames Region North-East Area

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Contact **David Telford** – Consultant Civil Engineer/section manager in Flood Defence Improvements Team responsible for river maintenance and restoration and enhancement of rivers, lakes, ponds and wetlands

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The North-East Area of Thames Region covers land between the Chilterns and London, north of the Thames, including the whole of Hertfordshire and parts of Greater London, Buckinghamshire, Bedfordshire and Essex. Chalk streams predominate in the north and west of this area (Misbourne, Chess, Gade, Ver, Mimram and Lee tributaries), the east comprising mostly clay catchments (Lee, Roding, Ingrebourne).

Restoration and enhancement work has taken place over the past 8 years, involving some 80 schemes of which 30 have concerned chalk streams. Scheme value has ranged from a few thousand to over £100K, with construction being undertaken by both the Agency's in-house contractor and external contractors. The annual budget has varied between £150K and £200K.

- The range of techniques used has included:
- channel narrowing and meandering
- desilting and construction of faggot faced wetland shelves
- installation of hurdle and rock groyne deflectors
- formation of gravel bed and riffles
- removal or modification of control structures
- provision of fish passes and by-pass channels
- creation of ORSUs
- reed bed planting
- construction of toad subway
-

Copies of a schedule of schemes undertaken and a paper detailing the process and considerations involved will be available at the workshop.

Environment Agency Thames Region North-East Area

Contact **Richard Tyner -** Fisheries Officer
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1. Focus

i.) Monitoring of fish populations on chalk rivers.

ii.) Restoration of habitats for key fish species including brown trout ,stone loach and bullhead.

2. Components

- Assessing brown trout colonisation following provision of fish passage and habitat restoration on the River Chess, Hertfordshire.
- • Assessing fish population changes in response to low flow alleviation on the River Misbourne, Hertfordshire.
- Input to habitat restoration schemes for key fish species , brown trout, bullhead and stone loach.

3. Routine fish population monitoring is undertaken by the Agency under a rolling programme of fishery surveys designed to provide baseline ecological data for a range of outputs. Monitoring in response to flow alleviation was undertaken as part of a wider initiative to assess the ecological benefits of restoring flows. Fish surveys were undertaken in conjunction with Econ Environmental Consultants.

4. Standard electrofishing were used to assess brown trout densities on the River Chess. A mark and recapture exercise recorded the movement of brown trout between adjacent sections of river seperated by a newli installed pool and traverse fish pass.

Low flow alleviation monitoring was carried out using Point Abundance sampling (PAS) electrofishing methods to record biomass and density of recovering species.

5. Agency survey data is included in fish population survey reports & Local Environment Agency Action Plans (LEAPS) . The Misbourne ecological monitoring results will be compiled in a final report due for imminent publication.

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Gaywood Valley Habitat Restoration Project

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1. Key project/activity

LUC have provided consultancy support for an ongoing wetland restoration feasibility study entitled *Gaywood Valley Habitat Restoration Project*. The study has been commissioned by English Nature (Andy Millar, Norfolk Team) and the King's Lynn Consortium of Internal Drainage Boards (Heidi Mahon) and aims to address the restoration of three river valley fen habitats in the Gaywood River valley which together are designated as a single SSSI (Leziate, Sugar and Derby Fen SSSI).

The main focus of the study is the restoration of the three fens and adjacent arable land in order to restore the biodiversity value of the site and to link fragmented habitats. The study may also focus on restoring the River Gaywood, a chalk spring fed river rising approximately 2 miles to the east of the study site. Within the site it flows over a geology of chalk and sandstone which gives rise to an intricate mosaic of fen, acid bog and heath habitats, but the iron-rich water feeding into the river from the IDB drains together with progressive straightening have resulted in the river becoming much like an IDB drain itself where it flows through the study area (over-deepened and over constrained).

2. Main individual 'components' of project activity

- Desk study of land use, drainage, management and natural history of the site.
- Extensive topographic surveys including land, drainage ditch and river levels, and a review of existing river gauging station data and select groundwater level data to gain a better understanding of ground and surface water in the valley to inform options for scheme design.
- Identification of flooding and ecological risks and constraints.
- Provision of a series of three map-based outline costed restoration options (low, medium and high cost).

3. Justification

The three fens (Sugar, Derby and Leziate) are designated as a SSSI on the basis of the mosaic of river, fen, bog, heath and grassland habitats they support. Historic land drainage and agricultural improvement have however contributed to a significant decline in the ecological value of the three sites as evidenced by historic maps and plant community data, the former fens now being dominated by grassland, heath and scrub interspersed by intensive arable and intersected by main IDB channels.

The main driver for the project (a feasibility study at this stage) is the desire by EN and KLCIBD to restore SSSI, link its fragmented sections, and secure creation of new habitats in the Gaywood Valley.

4. Science/Objectivity:

- Tufa deposits indicate that the site was previously spring fed, and parallel ridges indicate previous peat cutting. Baseline habitat assessment highlights the geological split between east and west, and the progression of the site to drier habitats.

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- Ancient maps (1797) depict the study area as a fen with meandering river running through the centre. By the date of the next map (1826) the track shown on the earlier map had been replaced by a drainage channel running through the site, although it is uncertain whether this was as a result of marshland taking the line of least resistance along an inherently low lying feature or whether it was deliberate intention to drain. The 1890 map reveals extensive drainage discharging into the main IDB drain and the first phase of river straightening. Lenziate Fen was still marshland at this time, but Sugar and Derby Fens are by 1890 depicted as rough pasture and furze. The 1950 map records 50% of Lenziate Fen as rough pasture, although the area to the west is still marshland. Extensive botanical records demonstrate sedge fen communities interspersed by acid mire and bog habitats with small quantities of heath. There are no records of common meadow rue, the food species for marsh carpet moth which was earlier recorded on the site. The 19989 aerial photo indicates increasing dominance of Sugar Fen by wet alder wood with extensive scrub encroachment and increased drainage efficiency on all of the sites.

- A range of ecological surveys for higher plants, otter, water vole, and terrestrial invertebrates have been undertaken. Invertebrate survey including pitfall trapping, sweeping and beating has recorded 237 species, of which only one is a wetland relict. Water vole were found to be abundant, particularly in the main tributary from Derby Fen and behind the gauging station, although few were recorded on the main IDB drain. The trapezoidal channel of the main river offers few suitable otter breeding opportunities, and only one lie-up area was identified across the whole site.

- Three dimensional ground modelling reveals that the River Gaywood does not follow the lowest route, which may reflect former channels or former extent of the natural floodplain.
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At present the project has the willing support of landowners based on temporary re-wetting by field drain caps (rather than permanent changes) to allow re-flooding of the River Gaywod. A range of re-wetting options have been considered, including a minimal intervention scheme to block drainage channels and install sluices. Ground levels are being established which can then be related to plant communities. Another alternative option is to install two sluices to increase groundwater levels in Lenziate Fen, which ties in well with the distribution of old mire communities and reinstates the former meanders of the River Gaywood.

5. Audit

Further pre and post project implementation monitoring recommendations are made notably the need for:

- the production of a water level management plan for the entire area;
- ground water monitoring across the study area;
- ecological monitoring (notably of plant communities, otter and water vole);
- flood risk modelling of the River Gaywood prior to any re-instatement of historic meanders lost through past river engineering.

6. Dissemination

The project partners will use the feasibility study for the basis of choosing a scheme which will drive a matched funding application. A key objective of the project partners is to gain the support and enthusiasm of the local community including land owners and parish councillors.

7. Key Lessons Learnt

Too early to tell!

GU Partnership

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1. Key *Focus* of Project/Activity

The department provides scientific support to the Vivendi Water UK Group Water Companies (Three Valleys Water, North Surrey, Tendring Hundred and Folkestone & Dover). This incorporates a variety of water resources, hydrogeological, hydrological and ecological project work.

The department is also involved in carrying out Research and Development Work. This includes a project entitled Methodology to assess the impact of low flows on river ecology and habitat. This work has involved evaluating a variety of methods including PHABSIM and LIFE for their appropriateness in assessing lowland chalk rivers. This work is the primary focus for ecology within the department and is described in more detail below.

2. Main Components of Project/activity

A detailed literature review of existing methods and studies was undertaken to measure the impacts of low flows on river habitat and ecology. Consultation with the Environment Agency and the Institute of Hydrology was also carried out. The initial work has highlighted that there are many gaps in our knowledge of the interactions between groundwater abstraction, low flow rivers and ecological change.

The second phase of the project is underway, including a pilot study using the LIFE methodology.

Other work has includes a desk study of the history of low flow rivers within Three valleys Water's supply area was undertaken in 1998, which involved extensive archive searches to ascertain periods of low flows prior to formal flow records. Environmental Impact Assessments have been carried out to accompany abstraction licence applications, with a particular focus on the impact of abstraction on neighbouring river and wetland habitats.

3. Justification

The department is focusing on the impact of Group water companies' groundwater abstraction on chalk rivers. At present there are 11 Alleviation of Low Flow (ALF) rivers within the Group Water Company area at various stages of programme, including the Rivers Ver, Misbourne, Mimram and Dour. This work has particular importance to the business in light of the Environment Agency's Catchment Abstraction Management Strategy and more immediately with existing time-limited abstraction licences and the National Environment Programme for AMP3.

4. Science/Objectivity

The pilot study currently being undertaken by the department aims to apply the LIFE methodology to the Rivers Mimram and Ash in Hertfordshire. These rivers have been chosen on the basis of one being considered to be adversely affected by groundwater abstraction and

one that is not. There are situated in reasonably close proximity although there are notable differences.

5. Audit

The work to date has not involved any sampling and therefore not required auditing. However, the Company does have a Quality Assurance System in place, which is ISO 9001 accredited.

6. Dissemination

The work undertaken so far has been internal Research and Development for the Vivendi Water and thus the information has not been disseminated to external parties.

7. Key Lessons Learnt

The requirement for validated ecological and hydrological data in order to be able to successfully apply the LIFE methodology in order to assess its appropriateness to application in catchments identified as being affected by groundwater abstraction.

Hampshire Wildlife Trust Wildlife Awareness Team

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1. Project Focus:

- Main aim is to raise awareness and encourage community involvement in practical habitat management on publicly owned land. This involves giving appropriate habitat management advice to local authorities, parish councils, community groups and interested individuals.
- Provide training, assist with grant applications, draw up management plans and organise practical work parties for community groups.
- Promote BAP species and encourage involvement by community.
- Project Area**:** currently all of Hampshire, north of the Southampton to Portsmouth conurbation. In future to concentrate on West Hampshire, including the River catchments of the Test and Itchen, principally on publicly owned land or land with public access.

2. Components:

2.1 Projects – active support for projects – design & implementation

- Bank side restoration using traditional hazel faggots
- Construction of artificial otter holts, (sunken & log pile)
- Planting trees & shrubs for cover, bank stabilisation etc
- Management of coppice woodland, hedgerows
- Restoration of ponds and the creation of new ones
- Construction of pond & river dipping platforms
- Realignment of section of urban brook from culverted artificial watercourse, back to original position with introduction of natural features eg riffles, pools, meanders

Information - education & awareness

- Training – organising on site and formal training for staff & volunteers
  eg. riparian mammals, survey and habitat management
- Survey & Monitoring of BAP species eg. water vole,
- Production of education packs,
- Production of resource packs (eg habitat management, surveying, funding)
- Pond & river dipping for school groups and children's clubs

2.2 Promotion –

- Press releases, radio interviews
- Programme of guided walks & illustrated talks
- Production of newsletter

3. Justification:

- Loss and fragmentation of habitat for riparian mammals
- Promotion of biodiversity species and habitats to a wider audience of land owners and the general public

- Habitat degradation through development pressure (both housing & industrial), agricultural practice, drainage and flood defence
- Education and awareness raising – sharing experiences, promoting appropriate practical management etc

4. Science / Objectivity:

- Projects generally arise from initial approach by landowner/ manager and our role is to provide appropriate advice and support resulting in a sustainable scheme
- Projects must be sustainable – achievable, and show a positive outcome/benefit for the landowner/ community
- Connecting sites to increase area of positive management within river valley and surrounding land

5. Audit:

- Site visit for initial assessment with all interested parties
- Surveys of species & habitats (eg. water vole, mink, otter) involving community where possible
- Producing management guidelines/ plan in conjunction with landowner / community
- Monitoring of species and habitats - pre and post project monitoring

6. Dissemination:

- Newsletter – (1500 distributed 3 x per year) to key partner organisations, Parish/Town Councils, community groups, libraries etc
- Fact Sheets / Resource packs (own literature & general)
- Training days
- Demonstration / Open Days
- Word of mouth and recommendation – through network of neighbouring Parishes

7. Key Lessons Learnt:

- Promotion & publicity in advance - providing appropriate information for public prior to work taking place reduces complaints, misunderstandings!
- Timescales – allowing sufficient time to obtain all necessary permissions, consents; legal and Local Authority requirements etc.
- Need to develop sustainable schemes
- Reaching acceptable compromises between different interest groups eg .fishing & conservation

Investigation of Ranunculus in Chalk Rivers

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1. Focus

To collate all available material relating to Ranunculus growth in Chalk rivers and provide a detailed appraisal of the data gathered and the drawing up of future recommendations.

2. Components

Loughborough Ecologists is currently working with the Environment Agency on a project to draw together available material on Ranunculus in Chalk rivers. Phase 1 involved the collation of relevant source material, reports, papers, historic records, research, surveys and observations on Ranunculus growth in perennial Chalk rivers. Phase 2 requires a review of the source material and the drawing up of future recommendations. Included in the review will be an inventory of rehabilitation projects on chalk rivers.

3. Justification

The UK has accepted commitments under the Biodiversity Convention that identifies chalk rivers as requiring conservation measures. The Environment Agency has the co-ordinating role for delivering obligations within the Chalk Stream Biodiversity Action Plan, one of which is to maintain the characteristic plant community dominated by Ranunculus.

In the last decade considerable concern has been expressed about the apparent deterioration of Chalk rivers and in particular the decline of Ranunculus. Causes attributed to the decline include nutrient enrichment, over abstraction, the increasing presence of algal species, grazing by swans and changes in rainfall patterns. A key objective of the project is to refine the understanding of factors affecting Ranunculus growth and thereby assist the Environment Agency in its role to influence BAP and SAC environmental interests.

4. Science/Objectivity

A significant objective of the project is to identify the nature and extent of understanding of factors affecting the growth of Ranunculus and to categorise them under headings such as Quantitative, Qualitative and Inferred.

5. Audit

The project is being supported and peer-reviewed by a Project Board including key personnel from the Agency, English Nature, external interests and an independent scientist.

6. Dissemination

A report will be prepared for the Agency for internal dissemination. The results will inform internal policies and procedures.

7. Key Lessons Learnt

The project has still to be finished but the complexity of issues involved and the interaction of factors affecting Ranunculus is clear from the review. The lack of quantitative data relating to certain factors is also apparent. The main priority now is to identify areas where key knowledge is lacking and the most cost effective research on factors affecting Ranunculus to advise the Agency on R&D priorities.

Lincolnshire Chalk Rivers Project

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1. Key Focus

The National Habitats Action Plan for Chalk Rivers identifies that the following action is required, 'Assess the nature conservation value and potential for restoration of chalk rivers other than those which are SSSI/pSAC by 2001.'

The three targets within the Lincolnshire Habitats Action Plan are:-
1. To ensure that no further decline in chalk river takes place,
2. To review the need and potential for restoration by 2001 and
3. To prioritise and implement actions for chalk rivers in Lincolnshire to restore their wildlife interest.

2. Components

- Produce a definition for a Lincolnshire chalk river
- Produce a definitive list of chalk rivers in Lincolnshire
- Assess the nature conservation value of chalk rivers in Lincolnshire in a national and county context
- Identify key issues and information gaps.
- Determine what macrophyte and invertebrate communities are present in the rivers identified
- To establish a Project Group made up of members able to identify sites for the restoration of the wildlife interest on the Lincolnshire chalk rivers and to progress its implementation

3. Justification

- **Abstraction**. Abstraction from both groundwater and rivers for public water supply, industrial use and irrigation has contributed to low flows. This can lead to the rivers drying out, changes in aquatic vegetation, water quality and siltation.

- **Physical modifications occur**, such as impoundments for mills , lake creation for fisheries. Land drainage and flood defence requirements may result in structural changes.

- **Pollution**, including nutrients from sewage works and agriculture. This can lead to changes in plant and animal communities.

- **Catchment land use**, resulting from a switch in farming practices from grass to arable. Overgrazing on remaining grass can also be a problem. This change in land use has resulted in increased nutrient input into the rivers and also increased siltation.

- **Fish farming**, primarily for trout, leading to impoundment, enrichment of water through feeding and high stocking densities, potential introduction of non-native fish and diseases.

4. Science/Objectivity

By using purely physical traits, the definitions were:-

• Classic Chalk River	Water derived predominantly from chalk aquifer, surface geology largely chalk. *BFI >0.75
Mixed Geology Chalk River	Water derived predominantly from chalk aquifer, non-chalk surface geology. BFI >0.75

*BFI = Base Flow Index, the contribution of groundwater to a river.

These criteria were applied to 20 river stretches that the Agency believed might be chalk rivers. For sites where calculating BFI was impossible due to a lack of data, estimated flow characteristics were used. Hence, some rivers were only classified as possible chalk rivers, indicating a lower confidence in the data used. As a result, 17 were found to have stretches that were either classic chalk river or mixed geology chalk river. Classic chalk river stretches were found on the Waithe Beck, River Lud, River Lym, River Bain, River Rase, Thoresway Beck, and Aylesby Beck.

As a group, Lincolnshire chalk rivers were shown to contain six species associated to chalk rivers of National conservation importance* (brook/river/sea lamprey, spined loach, grayling, otter). Although less than the Southern chalk rivers (14 spp.), this is greater than the East Anglian chalk rivers (5 spp.) and the River Hull SSSI (1spp.). In addition, Lincolnshire chalk rivers contain five invertebrate species which are important at a National level that are not usually associated to chalk rivers, and a further 12 species which have regional or local conservation importance.

*protected by UK legislation

5. Audit

Those surveys conducted to obtain data to establish the extent of Lincolnshire Chalk Rivers (macrophyte and invertebrate) can be replicated as development occurs and extended as sites become available for enhancements. They will be supplemented by fish surveys supplementing fishery data already held.

6. Dissemination

The report 'Assesment of chalk Rivers - Consultation Document' has been distributed to EN, IFE, Local Authorities, Lincs Trust, Lincolnshire Wolds Countryside Service (AONB), and widely within the Agency for comment. Reports on surveys are being produced. Lincolnshire BAP Rivers and Wetland working group will record and report progress achieved on BAP Actions and targets.

7. Key Lessons

Accepting physical attributes for chalk rivers, local biotic indices may differ from national

River Kennet

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1. Focus

The overall project objective is to design, implement and monitor, rehabilitation measures along 10km of the upper River Kennet in Wiltshire, to achieve a range of environmental enhancements and be a catalyst to encourage further restoration work in the future. Central to the achievement of this objective is to (i) ensure optimal use of existing river flows in the design of the rehabilitation works, particularly during periods of drought, & (ii) generate landowner support, & where possible contributory funds, to increase the scope of works that can be carried out. The project was convened as a partnership, led and adminsitered by Thames Water, who are also providing in-house technical expertise. Specialists from the Environment Agency and English Nature are providing support in relation to survey, monitoring and consents. Implementation of the project works have been overseen by Hankinson Duckett Associates and Alconbury Environmental Consultants. Funding is principally from Thames Water with further contribution (in cash and in kind) from EA, EN and landowners.

2. Components

- The project commenced in January 1999 and will be completed over a five year period. Construction work will be focused in the first 3 years (Phase 1/2/3) with post-project monitoring continuing in years 4 & 5.
- Phase I (completed autumn 1999) involved a demonstration project based on a 350m section of the River Kennet, undertaken with the support of the relevant landowner and local fisheries syndicate. Initial results appeared very promising with considerable scope to improve the river. Material (encased in hessian to avoid ripping out) was placed within the main channel, thus effectively narrowing the main channel, but still retaining a backwater between the infill and original channel bank and incorporating berms to diversify wildlife habitat.
- An experimental *Ranunculus* planting trial was completed in July & August '00 over a 130m section of river near Axford where it had been lost during the drought of 1988-92 and had not returned. *Ranunculus* was lanted in 112 snow-shoe shaped frames pegged to the river bed to provide protection. Regrowth is being monitored to check the success of this experimental technique.
- A combination of narrowing and bed raising on a 210m section of over-widened and over-deepened section of back channel at Ramsbury was completed in Autumn '00 to create a new riffle-run sequence to benefit species such as wild brown trout. Two other Phase 2 projects, postponed due to an exceptionally early break in the springs, will be completed in late summer/autumn '01.
- Two/three new projects are currently being discussed by partners for Phase III, scheduled for completion autumn '01.
- A monitoring programme is being drawn up to assess the effects of work.

3. Justification - what impacts or degradations being addressed;

- Desire to understand the relative impacts of different influences: ecology, channel morphology, flow etc. on the upper Kennet.
- The river is designated as a SSSI being one of the best examples of a lowland chalk stream in England. Despite SSSI status, sections of the river are far from being in pristine condition

having suffered a legacy of major physical degradations resulting from impoundments for milling, land drainage and flood defence works. This has resulted in certain sections becoming over-widened, over-deepened with layers of accumulated silt replacing the characteristic gravel substrate. This damage is beyond the natural capacity of the river to heal itself.

- A combination of tried and tested techniques, e.g. willow 'faggotry' and more experimental measures, e.g. 'snow-shoe' mattresses & straw bale deflectors will be used to achieve alterations in the channel morphology and function, to create self sustaining habitats.

4.'Science/Objectivity' - key site evaluation and option selection procedures employed;

- Broad Feasibility Study (Sept 1998) to assess suitability of rehabilitation principles - outputs fed into Phase 1.
- A Site Options report, Dec. 1999, identified a long list of thirteen potential in-channel and flood plain projects for implementation as Phase 2.
- A site selection matrix was devised by the project team to allow comparative assessment of this list on an equitable basis, and allow four projects to progress to feasibility stage (NB: A copy of the matrix will be tabled on 22-23/1/01).
- Landowner & tenant support was an essential pre-requisite for a scheme to be taken forward, & each landowner's existing ideas for their land were discussed at an early stage.

5. Audit - pre and post project monitoring measures and/or appraisal;

Monitoring has been a key aspect of the project to determine the extent of change in key biotic and abiotic indicators pre & post-works. Surveys undertaken have included hydraulics (topography, high and low flows/water levels), archaeology, fixed point photography, macrophytes, macro-invertebrates, fish and species specific surveys (including water voles, native crayfish and Desmoulin's whorl snail). Many of the pre-project surveys have been carried out to facilitate scheme design and satisfy land drainage & SSSI consents. Post work monitoring is focusing on water levels, velocity and macrophytes.

6. Dissemination - outputs completed/planned, and where/how widely circulated;

- Two well attended project open days have taken place to date (29/4/00 & 1/10/00) in conjunction with ARK and it is intended to hold further community based events in the future.
- Two evening presentations to local landowners and their representatives have been completed (2/2/00 & 7/12/00) to explain the project objectives, encourage support for & ownership of the project ideals, and stimulate further rehabilitation works.
- A project leaflet, posters & video record have been completed and a number of articles have been submitted to both local newspapers and the technical press, e.g. Ecos.
- Presentations given to local Parish Council (18/10/99) and Secondary school.
- An end of project review report is planned to disseminate the experience gained from the different techniques and the results of the project monitoring programme.
- Key project findings will be fed into the RRC national database.

7. Key Lessons Learnt - both positive and negative are valuable to help others;

- Completion of the Phase 1 demonstration project proved very useful as a local example to illustrate different techniques to nearby landowners, even though the delivery timescale was tight and that this first site was selected primarily on what could be set up and running quickly ('a trade off').
- Vigilance is needed at all times to check if any design changes (i.e. between feasibility stage, design stage & construction stage) require new consents.
- Straw bales (for shallowing over-deepened reaches) were found to be cheap to buy but not cheap to install; their buoyancy means that they have to be well tied/staked down. In future, larger units will be tested to ease installation problems.
- Early mobilisation of contractors essential to over come narrow 'window' to complete works.
- Flood modelling has proved a useful means of incorporating reactions of local people.

River Mimram Low Flows Study

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Entec is one the leading multidisciplinary environmental and engineering consultancies. Entec's riverine and floodplain expertise includes: full EIA capability; river and floodplain habitat creation, restoration and enhancement; hydrological, water quantity and quality modelling; fluvial geomorphology; landscape planning; river basin management; flood risk assessments; surveys and management strategies for aquatic fauna and flora; fisheries management; RHS; PHABSIM; GIS and the implications of climate change.

Introduction

The River Mimram is a tributary of the upper Lee which it joins near Hertford; other tributaries of the Lee include the Beane, Rib and Ash. The Mimram is a chalk stream with a varying amount of glacial drift underlying the river bed and exhibits winterbourne behaviour in its upper reaches. It is characterised by a significant level of public abstraction of groundwater and minimal return of treated effluent to the watercourse. This is because most effluent sewage generated is piped downstream to a sewage treatment works outside the Mimram catchment before being returned to the Lee. There is therefore an overall net loss to the catchment as a result of water use; this has obvious implications for the functioning and sustainability of the river ecosystem.

1. Focus

- To identify which reaches on the River Mimram have been depleted by groundwater abstraction and determine the extent to which increases in river flow would be desirable, through a wide ranging review and analysis of hydrological, environmental, planning and historical/anecdotal information (Part 1);
- To develop a robust and defensible computer based regional groundwater model of the catchments of the Upper Lee, Mimram, Beane and Rib to assist in carrying out Parts 1 and 2 by simulating the effects of existing and potential future groundwater abstraction scenarios and their effect on the river system; and
- To identify and evaluate a range of options for low flow alleviation on the River Mimram, including an outline assessment of cost, economic benefit and environmental impact, and carrying out all necessary consultation both internally within the Environment Agency and externally with relevant authorities and interest groups, and presentations at public meetings (Part 2).

2. Components

Within the focus of the project, a baseline assessment of the physical habitat and ecology of the River Mimram is being undertaken. This assessment comprises:

- continuous river habitat (RHS) and river corridor (RCS) survey;
- continuous fluvial geomorphological audit;
- collation and review of fisheries, mammal, bird, and macroinvertebrate records;
- appraisal of the requirements of riverside designated sites (e.g. SSSIs, LNRs, CWS) and local Biodiversity Action Plans; and
- impact assessment of low flow alleviation and associated habitat improvement measures.

3. Justification

The impacts and degradations being addressed by the study include: loss or decline of species (e.g. white clawed crayfish), loss or degradation of habitat (e.g. aquatic macrophyte beds), effects of historic river management (e.g. dredging, realignment, impoundment, regulation), effects on water quality (e.g. contribution of sewage effluent to flows), and effects on hydrology and geomorphology (e.g. deposition of fine sediment particles).

4. Science / Objectivity

The key site evaluations are described in the components section of this brief (previous page). The options selection and appraisal procedure for the low flow alleviation and associated habitat improvements will include an Environmental Impact Assessment. This will take into account a range of different flow scenarios predicted by the regional groundwater model.

5. Audit

A baseline assessment of the physical structure and ecology of the River Mimram has been undertaken (described in the components section of this brief). Post-project monitoring measures/appraisals have yet to be undertaken.

6. Dissemination

Consultation with the Environment Agency and relevant authorities and interest groups have been undertaken, one newsletter has already been produced and two further newsletters will be produced during the course of the project, and the findings will be presented at a series of public meetings. A full report will be produced as a record of the project.

the RIVER RESTORATION CENTRE

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1. Focus

In April 1998, the River Restoration Centre (RRC) became the successor to the River Restoration Project (RRP) founded in 1992. The RRC aims to support the development of river restoration as an integral part of sustainable water management of the UK. RRC will provide support for its subscribers, and promote the benefits, concepts and practical issues relating to river rehabilitation on their behalf, through provision of information, project and promotion services. It is the only organisation with the sole objective of promoting river restoration, with a UK wide base, supported by a network of contacts working in the field.

2. Components

2.1 Information

RRC is under-pinned by a database dedicated to storing and retrieving information on river restoration projects, techniques and participating personnel. Available are:

- *Inventories of river restoration projects throughout UK by type, content, location and contacts, etc.*
- *Audit reports of example projects and programmes.*
- *Project summaries on the database available as summary sheets.*
- *Inventories and summaries of research programmes, legislative /funding developments, etc.*
- *Examples of legal/partnership protocols.*
- *Funding/grants summary information sheets.*

2.2 Projects

RRC will seek to actively support selective projects led by others. Involvement will provide opportunities of bringing together a wide range of experience to such projects, and enable RRC to remain actively involved at the fore-front of river restoration technology. Support includes:

- *Short advisory reports, often providing outline visions and options.*
- *Development of concept plans at the initial stages of projects.*
- *Guidance on integrating surveys, design, implementation, monitoring, etc.*
- *Participation in Project Steering and Working Groups for large projects.*

2.3 Promotion

RRC will continue to arrange/host site visits to river restoration sites of note, and support training courses, workshops, seminars and conferences. Media enquiries will be fully supported and contributions made to journals and in-house publications of its subscribers. The continuing monitoring of the performance of demonstration sites will be closely followed, and RRC will respond to government papers or assist subscribers to do so through advice and information.

3. Justification

Future river restoration activity in the UK will not be sustained, or grow, unless there is better exchange of information about how it can be best achieved, and the benefits that accrue. A co-

ordinated approach, with a feed-back system for disseminating information should ensure river restoration activities grow cost-effectively. Also, setting priorities for restoration in a more strategic, rather than opportunistic, manner needs to be addressed. RRC will also play a key role in minimising the risk of failure, and ensuring the principles of restoration become an integral part of integrated catchment management and be part of the policy and practices of all relevant organisations.

4. Science/Objectivity

Information on projects and contacts within the river management 'field' is collected to identify the scale of work being undertaken and by whom. This will feed into RRC's future promotional activities and enable specific areas/themes to be followed up in detail, where information is perceived to be lacking. Summary details of projects are not currently subject to scrutiny by the Centre, due to the time commitment that would be required.

Key projects that are 'supported' by the Centre are done so on the basis that they offer something new to the RRC's 'toolbox'. This is necessary to ensure that RRC continues to advise on state of the art practices from first hand experience.

5. Audit

RRC has carried out project 'audits' for several organisations, evaluating past rehabilitation schemes against their set objectives, recommending changes in techniques, approach and maintenance programmes. This process has identified the large discrepancies between projects with respect to pre and post project monitoring and objective setting.

6. Dissemination

- *Audit reports of example projects and programmes.*
- Manual of River Restoration Techniques*, updated and expanded biannually.*
- *Outline information via WWW.*
- *Newsletters - three per annum - covering main developments and stimulating dialogue.*
- *General information packs - introduction to river restoration.*
- *RRC publications (some free, others at discount to subscribers).*
- *Arranging/hosting visits to river restoration demonstration sites.*
- *Making presentations at seminars, conferences, etc.*
- *Delivering a range of training workshops and seminars for practitioners/decision makers;*
- *Workshops and reports on discrete 'Themes' in river restoration.*

7. Key lessons learnt

Some of the aspects which share a common theme are:

- *Many projects are being undertaken in isolation. Project managers are generally unaware of the existence and support available from other projects.*
- *Wide dissemination of practices, techniques, findings, successes and failings is limited, usually consisting of interim and final reports to funders.*
- *Funding is problematic, both in finding sources and achieving project objectives within the framework of the funders objectives.*
- *Monitoring and maintenance of projects is often not incorporated at the outset, thus lacking resources later on. This often detriments the scheme as its momentum dissipates after completion.*

River Wensum Rehabilitation Project

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Location and conservation designations

The Wensum is a chalk river and was designated as a SSSI in 1993, and a cSAC in 2000. This includes 71km of river from its source in North West Norfolk to the outskirts of Norwich. Two tributaries – the Tat, which may have been the historic course of the Wensum and the Langor Drain – as well as 20 parcels of land (mainly fen, red-bed and wet grassland) with a total land area of 393 ha are also included.

The water quality is high and has been classed as RE1 – water of very good quality suitable for all fish species – under the Environment Agency's River Ecosystem Scheme.

The Issues

- 1997 fishery survey results very poor, raised the following issues of concern:
- the apparent decline in roach biomass & density (middle & lower)
- the apparent decline in chub biomass (lower)
- the failure of the lower wensum to achieve fishery biomass target
- the middle wensum only just achieving fishery biomass target
- the observed increase of dominance by eels.

The agency's response

Issues above plus pressure from angling community 'percieved' decline of fishery. EA therefore commissioned the River Wensum Rehabilitation Study (Phase I).

Aims of study

Sought to confirm & understand the nature of any changes in the fish stock, both in quantitative and qualitative terms, if possible, and the factors responsible for any change

From this baseline, a series of recommendations for the rehabilitation of the river as a self-sustaining viable fishery were to be developed.

Feasibility study conclusions

Evidence from scientific and anecdotal (catch records) & scientific data (fisheries monitoring data) revealed major declines in species such as roach, dace, barbel, perch, grayling, trout (1940's – present). Potential causes of decline were identified as:

- demand for water
- water quality – re1?
- increases in nutrients (sewage & agri)
- ammonium (sub –lethal effects?)
- suspended material (3-fold)
- decline in habitat diversity
- land use change (decline in waterside meadows)
- increase in land drainage (inc in drainage ditch density 40% 1904 1970's)
- changes in channel form (removal of meander loops)
- channel maintenance (dredging & removal of 'obstructions' – woody debris)

Fishery impacts were identified as:

- increased sedimentation (50% of the bed of the Wensum covered by silt)
- reduction in diversity of fry habitat (refuges against flow & predation – food resource – decline in diversity & cover of macrophytes (food & flow) identified as being of particular importance to roach)
- reduction in the diversity of habitat for older fish (habitat complexity needed to fullfill all life stages)

The decline in fishery using agency and anecdotal evidence, particularly identification of poor habitat quality as a primary limiting factor on fishery interest, provided dear & identifiable justification to continue the project.

Phase 2

Aims

- A tiered approach to improving physical habitat structure in the wensum.
- Outline means of making general improvements to physical habitat structure
- Identify areas where maximum benefit to the fishery can be made in the form of 25 prospective habitat improvement schemes.
- Provide a more complete design for 10 'priority schemes' that can be implemented without the need for further extensive investigation.
- This catchment strategic approach to habitat rehabilitation, is with few, if any precedents in the UK.

Methodology

Comprehensive survey by Canadian canoe over entire SSSI 60km, on a reach by reach basis.
Key survey components:

- assess form & function of gross habitat features – 'how similar to the ideal'
- assess likely fisheries value (general habitat diversity + specific features–riffles, etc..)
- assess general ecological value (focusing on links between channel & riparian zone)
- assess scope for improvement and the type of improvement that may be adopted.
- note likely management procedures adopted and their potential contribs. to current channel and riparian zone form & function.
- not to re-invent the wheel!!!!
- (used existing data–wq,rcs,bio,fish add to knowledge base)

- build upon underlying principals of restoration.
- build upon & extend valuable habitats
- avoid areas of poor wq & min quantity
- exploit potential for natural recovery
- utilise areas with favourable land use, sedimemts & flow
- likely acceptance of landowners

Outputs

25 potential schemes (distribution map)
11 priority schemes (ecological & geomorphological design / appraisal)

Present situation

Funding – EU 5b matched funded for three schemes totalling £70k :
Fakenham - margin enhancement (underway as of January 2001)
Bintry – riffle emplacement, channel narrowing, fencing, flow deflectors (completed September 2000)
Billingford – meander loop re-connection (completed april 2000)

The Future?
Discussions with potential partners & funders have been very encouraging to formulate a bid not only around the remaining 23 schemes, but much, much more!

5 potential priority schemes in bidding round for 2001/2 business planning process.

2001
Attlebridge – re-connection of defunct meander loop (£30k)
Lenwade common – in-stream rehabilitation (£20k)
Hellhoughton – re-connection of meander loop (£15k)

2002
Costessey – in-stream rehabilitation (£15k)
Great Ryburgh – rehabilitation of channelised reach (£30k)

Consultation & local involvement has formed a central and key role in the project.
seminars (phases 1,2,3)
angling community (1930's – present day!)
fishing clubs x 7
norfolk anglers conservation association
english nature
frca
wensum valley project
internal drainage board
anglian otters and river project
north norfolk district council
anglian water services
john wilson
john bailey
landowners

Steering group
formed at start – fisheries, conservation, flood defence – english nature, dr m perrow (ecologist) prof. malcolm newson (geomorphologist).

lots of press interest (local / regional / national)

South East Otters and Rivers Project

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Aims

- To promote natural otter recovery throughout south-east England through habitat management advice, appropriate enhancements and greater awareness.
- By using the otter as a high profile flagship species, to encourage generally a more balanced approach to the way we manage and exploit wetlands.

Project Area

This covers all the river catchments that drain the four counties of Hampshire, Sussex, Kent and the Isle of Wight. Other wetland systems i.e. coastal marshes, certain lakes and ponds are also covered within this area. There are some significant chalk streams that have become a focus for many aspects of the project's aspirations and that of biodiversity in general. Due to the longevity of this project it has been possible to begin to understand the politics connected with these rivers and begin to make physical changes on the ground and encourage new ways of thinking with wider-interest groups.

- Positive achievements on some of the chalk streams include:
- Input to various strategies particularly Catchment Management Plans and now 'LEAPS'.
- Restoration of water-meadows and wet ditches.
- The promotion of and involvement in encouraging less intensive use of riparian land through Countryside Stewardship and ESA schemes.
- Restoration of ponds and the creation of new ones within floodplains of chalk streams.
- Creation of wetland habitats from derelict watercress beds.
- Creation of in-channel islands using traditional methods i.e. willow spiling, hazel faggots retained with alder poles and containing chalk infill.
- Bankside restoration using various traditional methods.
- Establishing dialogue with riparian landowners and their managers.
- Promotion to a wider audience and interest groups.
- Monitoring progress.

Justification

- Degradation of many sections of chalk streams through agricultural practice, land drainage, fishery management, and flood defense.
- Fragmentation of habitat and less sustainability of viable populations of dependent species.
- Lack of knowledge of practical measures to improve situation and opportunity to learn, share, make recommendations and promote widely.
- Promote 'biodiversity' through statutory requirements; designations; partnership approach.

Problems Experienced

- Vested interest i.e. fishing interests.
- Agricultural practices and subsidies encouraging this.
- Bureaucracy and time scales.
- Funding.
- Perception and confidence of landowners.

The Way Forward

- Strategic planning, priorities and time scales with achievable targets.

- Secure realistic funding.
- Dissemination of knowledge to date to all practitioners, partners and interest groups.
- Establishment of demonstration sites to promote sustainable good practice.
- Ongoing monitoring.

University of Hertfordshire

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Ronni Edmonds-Brown began her career as a Registered General Nurse. She specialised in Renal Medicine, dialysis and kidney transplants (there is a weak link with water here!). She gained her degree in Marine and Freshwater Biology and did her PhD at Queen Mary and Westfield College, University of London with Professor Alan Hildrew on Macro-invertebrate Community Persistence.

Dr Edmonds-Brown is currently a Senior Lecturer in Aquatic Ecology and lectures on Aquatic Ecology, Biodiversity, Ecological Modelling, Aquatic Habitats and Ecosystems, Aquatic Monitoring, Conservation & recreation management. She ran a MSc in Integrated Catchment Management for three years and is in the process of re-designing the course for web based learning.

Dr Edmonds-Brown includes River Corridor and River Habitat Surveying in the practical courses she runs and is an accredited River Habitat Surveyor. She has written on the application of SERCON to both urban and rural rivers. At present she is co- editing a book on Integrated Catchment Management for Pearson's Educational Publishers and is writing a chapter for the book on riverine ecology.

Her primary interest is Trichoptera, she is the recorder for Hertfordshire and rears caddis through their life cycle to construct life history tables. Practical applications of this type of research comes from much of the rearing data. This includes information on substrate and flow preferences and food requirements. This information may well prove useful for restorations and rehabilitation schemes.

Other research interests include the rehabilitation of urban streams and work in this area includes long term monitoring water and sediment chemical and heavy metal analysis and ecotoxicological work on top predators in these streams (mainly Hirudinae).

Ronni Edmonds-Brown is currently supervising two students doing their PhDs on chalk rivers. One has been dealing with low flows and he is presently writing up, and the other (Judy England) is working specifically on river restoration.

•

Wessex Chalk Streams Project

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1. Focus

The Wessex Chalk Streams Project was set up in April 1999. It aims to help wildlife to be better integrated into the many activities and management which are undertaken on the River Avon and its tributaries - Wylye, Nadder, Bourne and Till. The River Avon System is notified as a Site of Special Scientific Interest (SSSI) and is a candidate Special Area of Conservation (SAC) in view of its European interests. Opportunities for river enhancement and promoting best management practice are being identified and supported, through working with landowners and managers along the river.

The Project is a partnership project. The Project Officer is employed by Wiltshire Wildlife Trust and based at English Nature. Funding of the Project Officer is provided by Wessex Water, as part of the Wessex Water BAP and some funding of the river restoration projects is available from English Nature.

A Steering Group consists of representatives from Wiltshire Wildlife Trust, English Nature, Wessex Water, Wiltshire Fishery Association and is chaired by the Environment Agency representative.

2. Components

The Project aims to:

- Provide a single point of contact for landowners and occupiers within the River Avon System SSSI, within Wiltshire.
- Raise awareness of the river SSSI and its protected species, explain conservation issues and advise on management.
- In co-operation with landowners and river managers, draw up Site Management Statements on behalf of English Nature, in order to secure the wildlife interests of individual sites.
- Identify opportunities for river enhancement and restoration schemes, and target funding where possible.
- Promote best practice in river management throughout the river system by dialogue and liaison with interested parties, and specifically through the development and demonstration of river restoration and conservation techniques.
- Keep landowners and managers informed of news, events and initiatives on the river system (e.g. through Project newsletter - 2 per year).

3. Justification

The following impacts are encountered within work of the Project, although direct involvement in resolving these issues (i.e. policy) has not been entered into at this early stage of the Project. It is felt to help that the Project has a fairly unbiased approach over certain issues, e.g. planning applications etc. and these are left to the relevant statutory organisations to deal with.

over-widened channel	previous dredging work
silt	low flows
impact of control structures	water quality
inappropriate management and reduced biodiversity	swan damage

4. Science/Objectivity

To date the restoration projects which have been financially supported through the Project have been the result of an approach made to the Project Officer by a landowner or fishing club. All financial support is in recognition of a scheme's benefit to wildlife.

In general, the principles of funding have been that:

- where wildlife and fishing benefit equally a 50% contribution to the costs will be given
- where there is a greater benefit to wildlife a greater percentage funding will be considered (100% if there is no gain to the landowner/fishing club)
- where there is no real gain to wildlife, but the applicant agrees to use a more sensitive approach and materials a small contribution (e.g. 20%) may be given

The percentage funding is evaluated on site - attempts are being made to formalise this process. Through writing Site Management Statements and therefore learning more about the landowner's/river manager's specific management, it is hoped that enhancement sites can be more carefully targeted and prioritised in the future. Also, the River Avon LIFE project includes studies that will help identify strategic priorities for restoration.

5. Audit

Pre and post project monitoring of enhancement sites:

- River Habitat Survey (RHS), water vole survey and photo-monitoring (Project Officer) (Problem: increasingly time-consuming as the cumulative number of restoration sites grows annually - may not be possible to monitor each attribute each year.)
- Wiltshire Wildlife Trust River Monitoring Scheme - volunteer monitors. Attempts are being made to target river monitors to enhanced sites, where they carry out a monthly survey - aquatic plants, invertebrates, flow, photos etc.

6. Dissemination

- Newsletter - 1000 copies circulated within river catchment and to key partner organisations.
- Articles about the Project within relevant magazines/newsletters.
- Demonstration days for landowners planned.

7. Key lessons learnt

Positive
- single point of contact for landowners/river managers on SSSI issues
- newsletter - information on river conservation widely circulated
- co-ordination of local initiatives by partner bodies
- stimulates interest in wildlife issues, provides back up information for that interest

Negative
- Project Officer could be seen to represent one or more of partners