

Presentation 1 – Holloway, James

The Executive Summary of the Nar Strategy document is attached below, in the poster format produced for the purposes of the wider public consultation session:

River Nar Site of Special Scientific Interest

RIVER RESTORATION STRATEGY AND PLAN

Executive Summary

Introduction

The River Nar is a 42 km long watercourse which rises from the North West Norfolk Chalk and flows west to enter The Wash at King's Lynn, having dropped from the higher ground into fenland below Narborough. Almost all of the river has been designated a Site of Special Scientific Interest (SSSI), in recognition of the valuable habitats and diverse assemblage of species they support – particularly the fact that both 'classic' chalk stream (upper reaches) and fenland river (lower reaches) ecosystems are represented. Compartments of land hydraulically connected with the river also form part of the designated protected area.

However, a long history of channel modifications has contributed to an assessed conservation condition of 'unfavourable' for the full length of the river SSSI. The Department for Environment, Food and Rural Affairs has a Public Service Agreement to commence action to remediate this by December 2010, via a River Restoration Project.

This River Restoration Strategy and Plan will guide measures to bring the Nar into favourable condition, with benefits for wildlife, recreation, flood risk, water quality and the landscape, by:

1. Presenting a complete assessment of the **current state** of the river, drawing together all currently available information and findings of a dedicated survey;
2. Developing a **vision** of the ideal future condition of the Nar;
3. Identifying the **issues** which need to be addressed in order to realize this vision;
4. Presenting **solutions** to these issues both on a whole river and a reach-by-reach scale, while highlighting the major **constraints** on what can be implemented and suggesting **delivery mechanisms** by which some of these solutions may be achieved.

Vision of the restored river

It should be the aim of restoration measures to reinstate natural morphological processes which allow the river to sustain and repair itself, rather than to attempt to recreate conditions from any one previous point in time.

From academic and historical evidence, and consultation with major stakeholders, the following high level vision of restoration objectives has been developed:

- I. **A river that is dynamic**, sustaining a diverse range of appropriate physical features with minimal intervention, but without compromising flood protection.
- II. **A river that is a haven for wildlife**, in favourable ecological condition, supporting healthy communities of the vibrant flora and fauna (including healthy populations of fish) for which chalk streams and fenland rivers are celebrated.
- III. **An integrated, functioning river corridor** which sustains rich adjacent wetlands and active floodplains which will naturally manage flood risk and intercept sediment.
- IV. **A river that reflects its heritage**, both in past and future landscapes, and in cultural, recreational and spiritual value.
- V. **A system that is resilient to change** and will continue to deliver objectives I-IV in the context of the environmental and human pressures it will face in the future.

Specific target physical characteristics are then presented separately for the upper 'classic chalk stream' and lower, 'low gradient fenland river', parts of the Nar.

Issues and impacts

There are a range of restrictions on the natural processes of erosion, deposition and ecological succession which would otherwise provide the full suite of physical features, such as cliffs, berms, pools, islands and woody debris, which support the diversity of habitats and aesthetic value of a naturally functioning river. On mainly groundwater-fed rivers such as the Nar, these processes tend to occur at relatively slow rates, owing to the rather stable flow regime, and this limits the ability of the channel form to correct itself.

Of particular significance are:

- **Canalization** (straightening, deepening and widening), which creates a uniform channel with very little habitat diversity and, owing to the slower flows due to an increase in cross-sectional area, encourages sediment deposition which smothers the naturally gravelly bed.
- **Impoundments**, often associated with historic mills, which hold back water, again encouraging sedimentation and also preventing organisms from moving down-, and particularly, upstream. This prevents migratory species such as Sea Trout from establishing.
- **High sediment input** from agricultural ditches and roads. Together with the impact of dredging, which keeps water and sediment off floodplains for more of the time, this increases the number and extent of depositional silt- and sand-dominated features at the expense of desirable gravel substrates which support a greater diversity of plants and animals.
- **Vegetation management.** Via shading effects, riparian and in-stream plant growth are closely linked, and complete absence of bankside trees in places results in extensive weed growth, rather than the more patchy distribution desired. Removal or spraying of aquatic vegetation where it is consolidating sediment and narrowing an over-wide channel may also be counter-productive. The lack of riparian trees also removes the source of woody debris to the channel, which is a key driver of morphological processes and valuable habitat. However, in places, cover from even-aged stands of trees presents dense shade which significantly limits the establishment of in-stream plants.

Solutions and benefits

Measures to address these issues are divided into changes to management regimes and physical modifications to the channel form. The specific recommendations for shorter reaches (termed 'Restoration Units') are given in Appendix G of the strategy document, where a range of options of varying cost and extent of impact on identified constraints can be found. A selection of the most suitable remedies is given below.



Changes to management

Allow woody debris (currently frequently removed from the channel), which will create a diversity of flow types, introducing local scour and a more variable bed form, which will create a wider variety of habitats and drive an active morphology.

Allow in-stream vegetation to narrow the channel. Where appropriate, natural encroachment of vegetation can be allowed to trap sediment and lead to local narrowing and increased flow velocities, creating a self-cleansing bed and habitat diversity in a similar way to woody debris.

Relaxing the management of water level control structures, e.g. leaving boards out of certain sluices, will reduce the impact of barriers to migration as well as ponding and subsequent sedimentation. Current management regimes may be a relic of now obsolete objectives, but the effects should be monitored closely for undesirable outcomes.

Allowing the natural **development of wet woodland**, establishing new patches, or reviewing management of existing areas will benefit both terrestrial and river wildlife. This cover is typical of the Nar valley, and where reasons for tree removal are now obsolete, opportunities for re-establishment should be exploited.

Physical modifications to the channel – some examples are illustrated in a separate poster

Removal or mitigation of weirs. There are a number of structures blocking the full width of the Nar, often associated with historic mills and lakes, which prevent the movement of organisms and nutrients down- and upstream. Their ponding effect often extends far upstream, causing siltation which smothers the natural river bed on long reaches of channel, and sometimes increases flood risk to properties. The original purpose of many of these structures has long since disappeared, and so their removal, or where that is not possible, mitigation via bypass channels or structural modifications such as notching or lowering, should be sought. The far-reaching impacts of these channel impoundments dictate that they should be investigated as a priority over local restoration measures on nearby reaches.

Cutting a new, more sinuous (meandering) course, or restoring to the old course, where evident, is a reliable way of restoring natural processes where the river has been straightened (and often diverted). This also allows more appropriate cross-sections to be designed where dredging and widening have occurred, allowing the restoration of floodplain connectivity where desired, and the associated benefits of reduced downstream flood risk and sediment delivery. Where the channel may be diverted through existing wet woodland, there will be added benefits.

Introducing ‘pseudo-sinuosity’ within the existing channel where it is more constrained, by re-sculpting the banks and/or bed with an excavator, will create diversity in flow types and velocities, channel form and thus habitat diversity, where this may have been previously absent.

Setting back flood banks as far as possible from the channel will allow a more natural diversity of habitats associated with a more active river-floodplain system, while maintaining the level of flood protection to surrounding areas. Indeed, making more space for the water is likely to impart great flood mitigation benefits on downstream areas like Setchey and King’s Lynn, though the extent of earth moving required and the ‘land take’ involved may make these quite long-term aspirations.

In-stream structures such as flow deflectors and brushwood mattresses are considered less desirable than measures which will reinstate long-term processes more directly and over larger areas, but there will be places where they are the only practical option. In such cases, structures should aim to mimic natural woody debris (i.e. retain dense branches), and be sourced from local trees. In this way, they will both kick-start morphological processes and create new micro-habitats.

Constraints

The strategy recognizes the constraints of flood risk, current land use and recreational use, abstraction, climate change, funding, historical sites and infrastructure, as well as short term negative impacts on the current ecology. Recommendations for the reach-specific options presented in Appendix G are dependent on which of three scenarios is most applicable:

Long-term aspirations are to execute measures to return the river to the most un-impacted state possible, in the scenario that all but the most insurmountable constraints can be eliminated or circumvented, and that money is not limiting.

Pragmatic recommendations propose what might be done in the near future, with reasonable investment, in light of current constraints and in the scenario that perhaps some minor constraints can be mitigated.

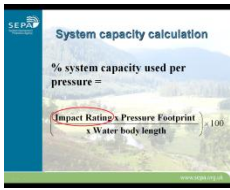
Interim measures are those which represent minimal intervention but which will have significant benefits for the river.

Conclusions

This plan, where implemented, will be a major step toward bringing the SSSI into favourable condition. Together with the wider strategy, it provides guidance such that any opportunities arising in the future may be exploited with the result of creating a resource which is valued even more greatly for its rich wildlife, aesthetics and recreational opportunities, but is also more capable of responding to future pressures such as climate change and population growth in such a way as to retain this value.

The document has been developed with the input of many of those with a vested interest in the River Nar, though if its implementation is to deliver multiple benefits, local engagement should be considered at all stages of its implementation. Indeed, though mechanisms such as Environmental Stewardship and monies dedicated to implementing the Water Framework Directive are identified in this plan, volunteer work and local action groups can achieve significant gains on the ground, and foster new interest in and appreciation of this nationally important river system.

Presentation 2 – Bromley, Chris



For each pressure, the amount of system capacity it uses is calculated for two zones. In rivers these zones are the channel bed and the bank and riparian area, while in lakes they are the shore zone and the open water zone.

System capacity is calculated as follows.

The pressure footprint (its length or area) is multiplied by that pressure's impact rating to produce a pressure footprint that is weighted to the channel's sensitivity. The weighted footprint is then scaled to the water body by dividing by the water body length or area. Finally, this product is multiplied by 100 to express it as a percentage.

For example, on a river water body, the product of impact rating and a section of channel realignment would be divided by water body length. Similarly, in a lake water body, the product of impact rating and a length of bank protection would be divided by the total shore length. Also in a lake water body, the product of impact rating and an area of sediment removal or land claim would be divided by the lake's surface area.

The capacities for each pressure on a water body are then summed for each of the two zones and status is allocated based on the highest of the two zone scores.

It is the impact rating where the expert-judgment nature of the tool resides and this is explained in the next slide.