Essex Wildlife Trust

WITHAM BACKWATER CHANNEL RESTORATION DESIGN (PHASE III: DETAILED DESIGN)

FINAL REPORT

January 2012

APEM REF: 411874

APEM AQUATIC SCIENTISTS

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PROJECT No:	**411874**
DATE OF ISSUE:	**January 2012**

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This report should be cited as APEM (2012) Witham Backwater Channel Restoration Design: Phase III Detailed Design. Report to Essex Wildlife Trust. APEM Report 411874.

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1 INTRODUCTION

1.1 Background

Following a feasibility study and outline design APEM Ltd was commissioned by the Essex Wildlife Trust (EWT) to undertake the detailed design phase for a proposed project aimed at enhancing the wildlife value of a disused backwater channel of the River Brain at Witham, Essex (TL 821140).

APEM report 411439 (APEM, 2011) included an outline design for the restoration of the existing backwater channel (see Figure 1) and the consideration of flooding, site access, site heritage and public consultation.

Phase III is the detailed design phase, which has been undertaken with our engineering partners, Create Consulting Engineers Ltd (CCE). APEM has overseen this design phase to ensure continuity so that all design considerations do not conflict with the project's ecological objectives.

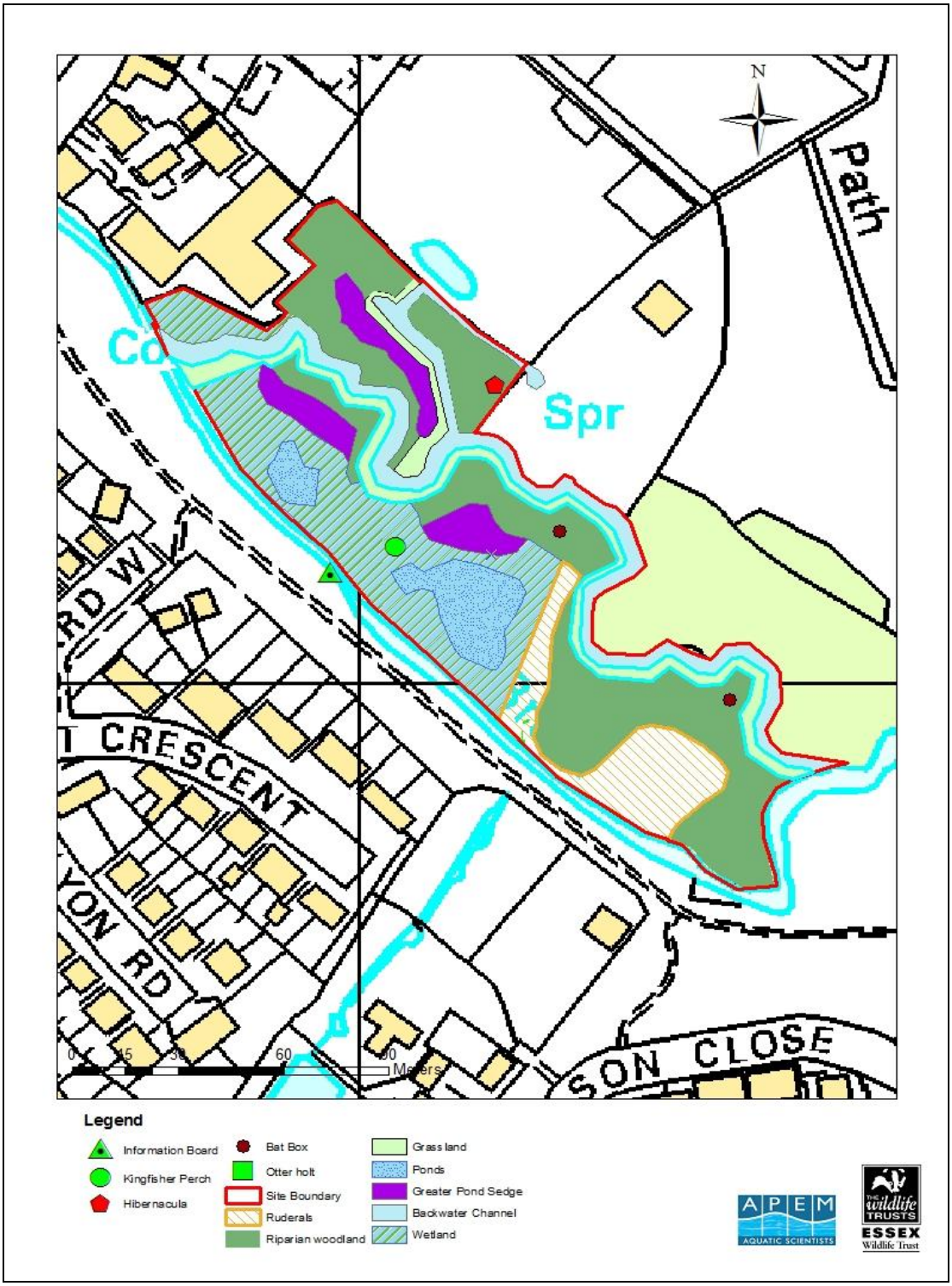

Figure 1 - A map illustrating the proposed restoration design

1.2 Project Appreciation

The main driver for this project is the EC Habitats Directive (92/43/EEC). The aim of the Directive is to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora within the European Community. The Essex Biodiversity Action Plan (BAP) is currently being revised, however there are over fifteen UK BAP species and more than three BAP habitats present within Witham that can be assisted through the delivery of this project.

Additional benefits of the project include benefits to the ecological status of the River Brain under the EU Water Framework Directive 2000/60/EC (WFD). The River Brain is currently at Poor Ecological Potential, with the objective of reaching Good Ecological Potential by 2027. Restoration of the backwater channel will take into consideration the WFD objectives, and where possible provide habitat improvement measures which will not only benefit conservation, but promote improvements to the biological elements and supporting elements within the River Brain.

1.3 Project Objectives

The main ecological objective of the proposed backwater channel restoration is to develop a restoration design for the site which will provide suitable habitat for species of conservation interest, with a particular focus on otter (*Lutra lutra*) and water vole (*Arvicola amphibius*). In addition to this, a wetland area is proposed, further enhancing the biodiversity value of the site.

The objective of Phase III of the project was to provide a robust channel design which can be taken forward to the next phase (construction). The scope of works in the design of the backwater channel involved:

- Detailed topographical survey;
- Calculations and modelling to determine water velocities and floodplain widths;
- Assessment of impact upon existing channel, specifically water flows, sedimentation and scour;
- Specification of the upstream and downstream connections;
- Determination of the magnitude of diverted flow; and
- Specification of cross section and bed levels of restored channel.

2 HYDRAULIC DESIGN

2.1 Model findings

Based upon APEM's outline design in Report 411439 (APEM 2011) CCE have undertaken ISIS modelling to assess water velocities for 1 in 2, 1 in 10 and 1 in 100 year rainfall events, with an allowance made for climate change (20% increase in rainfall).

From analysing various cross sections it appears overbank conditions will occur along most of the length of the backwater channel during a two year event. Following reconnection this will allow periodical saturation of the land between the channels to occur, thereby facilitating the conditions required for a change of plant community (towards hydrophytic vegetation). This may help to prevent growth of scrub and will help to promote a wetland plant assemblage.

In the 10 year and 100 year events, the backwater channel appears to be acting as a flood control measure by storing floodwater, thereby reducing flooding downstream. For a full report of the model findings see Appendix I.

2.2 Channel design

For full details of the channel design see Appendix I. Appendix II details the design of the upstream and downstream backwater connections as well as the backwater channel itself. Details of bank reinforcement have been included for 3m upstream and downstream of the connections, and in an area where scour was noted, but will otherwise not be required. It is assumed the banks will recolonise quickly at such a well-connected site, and thereby not require additional stabilisation.

The bed levels of the restored channel are detailed in Table 4.1 in Appendix I (see also Paragraph 4.13 in Appendix I). The general overall gradient of bed along the channel will be 0.0015.

2.3 Design conclusions

The River Brain backwater channel design has been optimised in order to keep velocities within the range in which both scour and siltation of the channel are avoided. The flows in the main River Brain channel would not be affected significantly following reconnection. Flows in the restored channel will be higher following reconnection, as expected.

The ISIS model analysis appears to indicate that overbank conditions will occur along the length of the restored channel even with just the 2-year return period flood flow event. Overbank conditions will also occur in the main channel, although less so than would occur should the restored channel remain unconnected.

Modelling of the 10 year event showed that the backwater channel and associated flood plain is likely acting as a flood control measure to reduce flooding further downstream by adding capacity for holding water whilst the flood peak is moving through. In the 100 year event velocity is greatly reduced within the main channel due to flow being diverted into the back channel and overbank conditions; this should confer benefits downstream by reducing flooding.

The designs produced here can be refined to accommodate for changing requirements, which might affect the hydrology, ecology or habitat status of the proposals. For example, flow control structures could be used to control flow conditions in the backwater channel more rigorously if required for ecological or habitat purposes, although with a consequential loss in natural appearance. However, flow control structures can also produce localised sedimentation as well as acting as barriers to aquatic organisms trying to move upstream.

3 DISCUSSION

The Witham backchannel restoration project objectives have previously been set as follows:

1. Create suitable habitat on-site to enable Biodiversity Action Plan (BAP) species to occupy, including water vole, otter, bats, white-clawed crayfish, common lizard, GCN.
2. Create suitable habitat for locally notable species. Notable plant species include southern marsh orchid, butterbur, ragged robin, marsh marigold, creeping Jenny, cuckooflower, skullcap; while invertebrate species include glow worm and white-legged damselfly.
3. Increase habitat complexity on-site, including the creation of a mosaic of freshwater, sedge, reedbed, scrape, grassland, and a number of standard trees.
4. Removal of scrub on site to allow sedge and reedbed habitat to become more abundant, whilst providing suitable areas for marsh orchid to re-establish.
5. Increase connectivity between the River Brain and the adjacent land areas to enable movement of species between areas.
6. Promote positive links with the local community and engage them with the habitat enhancement work being undertaken.
7. Create awareness and increase understanding of habitat improvement projects in the local area by erecting an interpretation board along the river walk within the vicinity of the site.
8. Develop a 5 year management plan and monitoring strategy for the site to assure long-term enhancement of the site.
9. Provide perches for Annex I bird species such as the kingfisher.

The design provided by CCE and APEM achieves those objectives which are relevant to the current stage of the project by creating a hydrological regime that is capable of supporting BAP species as mentioned above, creating suitable habitat for the locally notable species mentioned above, increasing habitat complexity on site, and increasing connectivity to the River Brain. The creation of links with the local community has begun (APEM, 2011) and it is essential that this continues in the next phase of the project. It is anticipated that the development of a management plan and monitoring strategy will be created after the construction phase, which would involve assessing requirements for additional habitat creation measures such as the provision of perches for Annex I bird species.

It is assumed that scrub management and other similar tasks will be carried out by EWT alongside its usual management. APEM proposes that the spoil created by the backwater restoration and pond creation is left alongside the restored channel bank on the north bank (side nearest the nearby housing), which will provide further flood

protection to the built-up area and allow for future habitat enhancement features to be created, for example otter holts.

The recommended ponds (see Appendix II) will not be connected to either the main or backwater channels in line with best practice (Williams *et al.*, 2010), as modelling suggests that overbank flow (as well as other hydrological inputs such as rainfall and groundwater springs) will be sufficient to create, at the very least, ephemeral ponds.

The model indicates that approximately two thirds of the flow will remain in the main channel under normal conditions (using a Q95 of 0.154 m^3s^{-1}), with one third diverting into the restored channel. Should this be considered insufficient flow in the main channel, control measures will be proposed at the inlet, which will prevent flow from being diverted under low flow conditions. Further modelling can be undertaken to show the level at which the control measure should be placed, should this be required following consultation with the EA.

3.1 Recommendations

Firstly it is recommended that EA consent is sought as per Section 3.5 of APEM's previous report (2011). Based upon APEM's findings and initial communications with the EA it is likely that they will have no objections to the project.

Throughout the next phases of the project further stakeholder involvement should occur, including a site visit if possible. This will help to achieve the community-based objectives and ensure the smooth running of the project in terms of local stakeholders.

Depending upon EA consent and incorporating stakeholder feedback where possible the project can then be progressed to Phase IV: Construction. The design can then be passed on to a river restoration construction specialist for agreement of methodology and timeframe for construction before construction begins. Interpretation boards are recommended be installed once the backwater channel has been restored.

3.2 Conclusions

The proposed backwater channel design takes into account the primary objectives of the project as well as addressing the initial concerns of the EA.

The re-connection of the old channel will not adversely affect flood risk, and it is anticipated that it will act as flood storage during 10 and 100 year rainfall events, thereby potentially preventing flooding downstream.

Modelling shows that sufficient flow will remain in the main channel in order to prevent problems such as scour or sediment deposition, which is expected to occur more significantly in the restored backwater channel due to its meandering form. Control measures may be put in place at the inlet should it be considered that insufficient flow remains in the main channel under normal or low flow conditions.

Once complete the project is expected to increase the biodiversity of the local area and to help to improve the WFD status of the River Brain.

4 REFERENCES

APEM (2011) Witham Backwater Channel Restoration Design. Report to Essex Wildlife Trust. APEM Report 411439.

Williams P., Biggs J., Whitfield M., Thorne A., Bryant S., Fox G., and Nicolet P. (2010) The Pond Book: A Guide to the Management and Creation of Ponds. 2nd Edition, Pond Conservation, Oxford.

APPENDIX I – MODELLING AND CHANNEL DESIGN

APPENDIX II – CHANNEL DESIGN DRAWING