The Middle Level Internal Drainage Board Biodiversity Manual

Giving Wildlife an Edge

A guide to the management of drainage channels for biodiversity for the Drainage Boards of the Middle Level Biodiversity Action Plan Partnership











Cliff Carson
Environmental Officer for the Middle Level Commissioners and the Drainage Boards of the Middle Level Biodiversity Action Plan Partnership

The Middle Level Internal Drainage Board Biodiversity Manual

All photographs by Cliff Carson, except where indicated.

Appendices

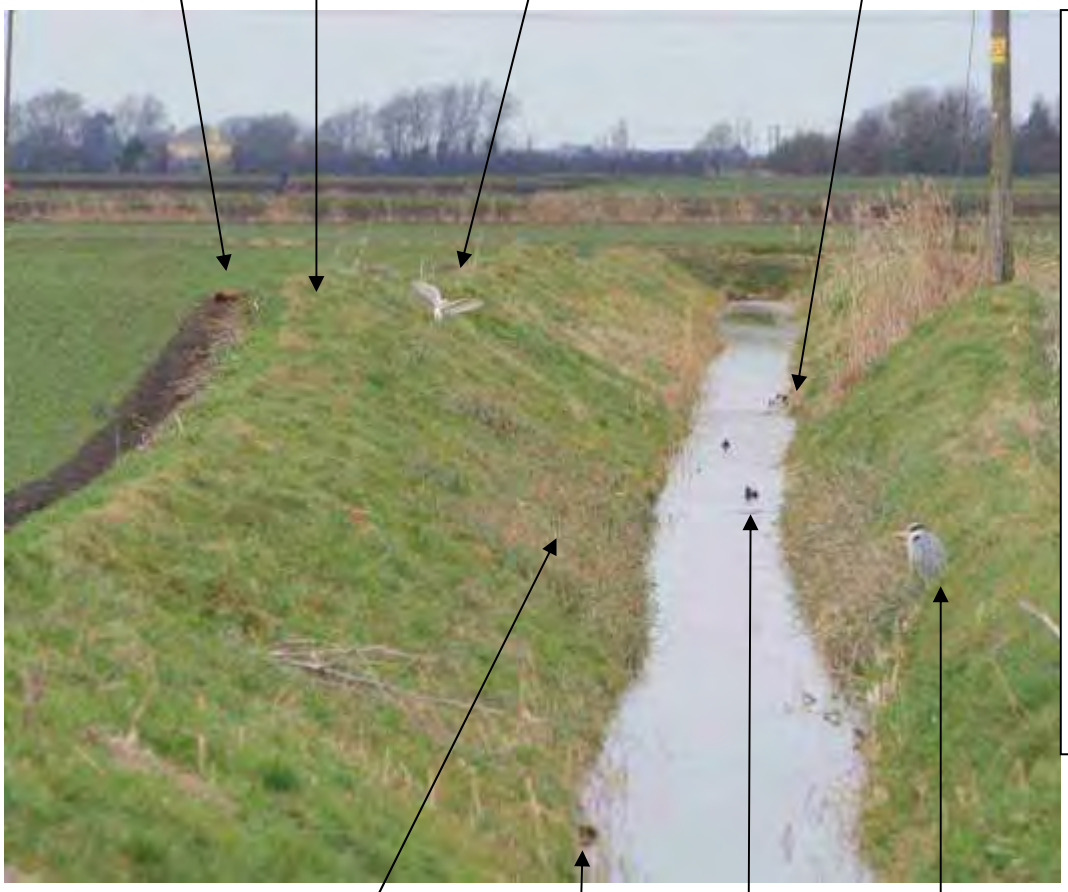
Clues in the landscape. Sometimes an ordinary ditch deserves more than a quick glance.

A male pheasant feeding near the ditch is a reminder that many female pheasants find nest sites in the vegetation along the sides of ditches.

The ridge of high ground shows the route of a roddon. The former creek was full of mineral clay silt that did not shrink as the vegetable peat soils dried out.

A barn owl drops on to a prey item, probably a vole or shrew. The grass of the bank is their favoured feeding area and one reason why the Fens have long been a stronghold for barn owls.

It is the 19th of March so the female of the mallard pair lurking at the ditch edge will be looking for a nest site in a clump of longer bank vegetation.



The grass margins at the right side of this ditch are just out of view but field margins beside ditches and drains are a very valuable resource for the wildlife in the picture and many other species.

The longer dark grey-green vegetation growing on both sides of the ditch is a bank of sedge. It may be a relic of the plant community that lined the banks of the original fenland creeks. This sedge and the reeds behind it are growing where the banks of a roddon (the route of a pre-drainage creek) crosses the modern ditch. Sedge is good at binding the light silty soil of the roddon and preventing bank edge erosion.

Several moorhens feeding in the same ditch indicate that it is rich in natural foods and also that it is unlikely that mink are active in the area.

A heron waits patiently. It is just as likely to be on the lookout for voles or rats on the bank as fish or eels in the ditch.

2 Introduction

2.1 What, Why, When, How, Where and Who

I keep six honest serving-men (They taught me all I knew);
Their names are What and Why and When and How and Where and Who

With appreciation to Rudyard Kipling for advice on establishing the essential details of any matter.

What is this manual about?

This manual is about how IDBs can fulfil their NERC biodiversity duty through implementing their Biodiversity Action Plan, plus other measures. It is a guide for all Internal Drainage Boards (IDBs) and District Drainage Commissioners (DDCs) within the Middle Level geographical area that are part of the Middle Level Biodiversity Partnership, their members, staff and contractors.

The guide promotes management actions that will benefit wildlife diversity without affecting drainage management requirements. It also ensures that IDBs have the information to comply with current legislation that protects wildlife.

Biodiversity Action Plans (BAPs) were adopted in April 2010 by the Drainage Boards in the Middle Level BAP Partnership. Individual BAP summaries were produced as appendices for each of the 35 Boards in the Partnership. Each plan was tailored to the opportunities each District had to offer, but they followed the same broad aims. This manual provides details of how those aims and targets can be achieved.

For the purposes of BAP production, the MLC rivers, drains and their banks were treated as if they were one of the drainage boards in the BAP Partnership. While some of the measures identified in this manual will be appropriate for these larger channels, the management of them has already been covered by another document, the 'Middle Level Operations Manual' so the focus of this guide is on methods appropriate for the smaller IDB drains and ditches.
For ease of writing, when reference is made to IDBs in this manual it can be taken to also include DDCs.

Why is it necessary?

As part of the Internal Drainage Board Review Implementation Plan carried out by DEFRA with ADA, The Environment Agency and Natural England and to fulfill their Natural Environment and Rural Communities Act (NERC) 2006 responsibilities, IDBs were asked to conduct biodiversity audits and produce Biodiversity Action Plans by April 2010.

Since their creation, IDBs have been very effective in preventing flooding in low-lying areas and managing the water in their districts. In doing so, many of the actions necessary have also benefitted wildlife, sometimes unwittingly. The value of the habitat created and the species protected needs to be recognized and other opportunities to benefit wildlife identified. This manual provides guidance on recognizing those opportunities.

When should the actions be carried out?

The Biodiversity Action Plans for the IDBs in the Middle Level Partnership cover the five-year period from April 2010 to March 2015 so the actions can be carried out any time within that period.

How are the actions carried out?

This is essence of what this manual aims to provide. It describes a range of techniques and ideas that will improve the diversity of wildlife in IDB districts. More detail on some of the methods is included in Appendixes five to eight at the end of the manual.

Where are the actions planned for and where will they be recorded?

The location of the actions can be anywhere within the drainage district. Ideally they will be at the adopted board drains or their property so that the IDB is seen to be the provider of the conservation initiative and receives the public credit for the work but if a suitable site is not available on IDB managed land and a private landowner is prepared to provide say, a site for a bat box or plant a black poplar, then that will be considered an action that the IDB has achieved through its contacts and influence. The location of the site and its occupation by a target species will be recorded in the annual IDB BAP report.

The sites of the different actions will be recorded on a Management Plan map. Copies of the map will be made by the Environmental Officer and be available for showing to ditching contractors or other relevant parties. They will also be where the District Officer or other members of the board mark any items of interest for further incorporation into the plan. Once created, the plan will be regularly updated, usually annually.

Who is going to carry out the work?

The actions will be carried out by the combined efforts of the Environmental Officer, the District Officer, Chairman or members of the individual Drainage Boards, other staff or contractors employed by the Boards and any volunteers, specialists or naturalists that are interested in promoting the wildlife interests of the drainage system. The installation of barn owl and bat boxes, drilling kingfisher nest holes, otter holt construction and planting black poplar cuttings will largely be carried out by the Environmental Officer working in conjunction with the District Officer or other board representative.

2.2 Biodiversity and the Internal Drainage Boards of the Middle Level

This manual features actions and targets in the Biodiversity Action Plan for the Middle Level BAP Partners that are particularly appropriate to drainage boards in the Middle Level area. It focuses on elements that can be easily incorporated in management works to maintain and improve biodiversity. Biodiversity is the variety of all living things and refers to the need to maintain that diversity. Like so many ‘new’ ideas, it is not new at all, merely a different way to express a thought that has existed for a long time, an interest in preserving a rich variety of wildlife in the natural world where it comes within our influence and stewardship. This manual puts forward ideas to improve diversity in IDB drains without compromising the essential requirement to keep water moving effectively or losing the advantages of efficient water management.

A significant benefit for biodiversity in the Middle Level is the fact that there are many different boards involved in their management. With over thirty boards covering a rateable

area of over 62,000 hectares and managing over 900 kilometres of adopted drains, diversity of approach avoids the danger of uniformity that could occur if the area was managed by a single organisation to a single plan. With that thought in mind, this manual seeks to provide guidance and ideas for boards to select from, rather than to create a uniformly structured regime throughout the Middle Level districts.

One of the most valuable biodiversity features of the Middle Level is the very significant population of water voles occupying the drains managed by IDBs and the connected privately managed ditches. In 2010 a re-survey of two differently managed drainage districts, Curf Fen and Ransonmoor, found that 73% and 82% respectively of board drains were occupied by water voles. Checks of water vole occupation in other districts in the Middle Level Biodiversity Partnership confirm that water voles are present in similar high levels throughout the area. The Ransonmoor and Curf survey also showed that water voles preferred to occupy recently maintained ditches, confirming the fact that they are thriving because of the rotational ditch management by IDBs, rather than in spite of it. Managing drains sympathetically for water voles by leaving a fringe of vegetation at the sides also produces favourable conditions for a wide range of other wildlife, especially dragonflies and other insects, marginal plants, waterfowl and fish, further enhancing biodiversity.

In the sections that follow I have put a lot of emphasis on the importance of managing the margins of ditch and drains and the sub title of the manual, '*Giving Wildlife the Edge'* reinforces my view that by managing the vegetation we want to grow at the edge of channels we not only create valuable habitat for wildlife, we also get nature working for us by stabilising and protecting the bank itself.

All the IDB districts in the Middle Level area differ to various degrees from each other and no two are exactly the same. They have different characteristics chiefly because of varying soil types and topography. What is appropriate in one district may be unsuitable in a neighbouring one. When considering the options for management included in this manual there may be some that are not appropriate for a given soil type or situation. While recognising that, consideration should be given to options that can be carried out. As can be seen from the pictured examples in the manual, there are many locations where boards are benefitting biodiversity by their actions. In some cases this may be more by accident than design but the illustrations should give examples of the habitat features worth retaining in the course of regular maintenance.

This document is not a comprehensive guide to all the many options available for managing drains and banks. That has been covered very ably and comprehensively by other publications (see appendix 1). The best guide on the subject is the revised edition of 'The Drainage Channel Biodiversity Manual' and should be standard reading for everyone involved in the management of IBDs. The aim of this guide is to complement that manual by giving local examples that focus on carrying out the targets of the Middle Level IDB BAPs.

Under the Natural Environment and Rural Communities Act (NERC) 2006, Government has taken steps to ensure that all public authorities, including IDBs, are pro-active in the implementation of Biodiversity Action Plans (BAPs) to preserve and enhance species and habitats that are at risk in the UK. IDBs' drain management in the Middle Level has ensured water voles are still widely, if thinly distributed throughout the majority of ditches in their districts. Boards have made, and are in a position to make more, relatively small but significant improvements to waterside habitats throughout their Districts. These small changes are significant because they are carried out over a very large area and will improve biodiversity without compromise to channel management priorities.

IDBs have a well-justified reputation for maintaining their systems to high flood protection standards. This manual gives guidance to help achieve and maintain the same high standards in habitat management and the conservation of wildlife, while still retaining the core role of water management and flood protection.

This is a ‘living’ document and the aim is to review it at intervals to keep it up to date and add information that keeps abreast with advances in management techniques, includes new information from Internal Drainage Boards officers, members or staff and to add knowledge from current research, surveys and developments.

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Thanks are also due to Maurice Webber and Becky Barrett of Conservation Constructions for much useful information on making provision for bats and to Peter Wilkinson and Jake Alsop for their advice on the placement of owl boxes and all matters related to barn owls.

Cliff Carson
Environmental Officer
Middle Level Biodiversity Action Plan Partnership

3 Key actions for biodiversity

Sometimes a fully comprehensive manual can provide so many examples it is difficult to work out which of them to focus the limited amount of time one has on. Below is a list of key actions that will deliver important benefits for wildlife in a drainage district.

It may be that many of the items listed are already being carried out, in which case it is important that they are identified on a Management Plan map (item 1) so that the wider world is aware of the work that has been carried out and recognizes the contribution that the drainage boards make towards wildlife conservation.

1. ***Create a Management Plan map that shows key biodiversity features and completed and planned work that benefits wildlife.***

2. ***Manage ditches leaving an un-touched ledge of vegetation at the water margin on at least one side to provide cover for wildlife, especially water voles.***

3. ***Carry out a varied mowing regime, alternating banks annually where possible.***

4. ***Maintain stable, high water levels in spring and summer, consistent with crop and land management.***

5. ***Carry out mink trapping for a period, especially during March and April.***

6. ***Carry out specific projects targeted to benefit key species, e.g.***

    - ***Put up barn owl boxes.***
    - ***Put up bat boxes.***
    - ***Plant native black poplars***
    - ***Create potential sites for kingfishers to nest.***
    - ***Encourage specialists to carry out surveys of watercourses.***
    - ***Help eels and other fish move about the drainage system.***

These key actions are taken from the IDB Biodiversity Action Plan that all boards in the Middle Level Biodiversity Partnership have adopted. The sections that follow are loosely based on the six key actions above. They expand on the issues above under the underlined broad topics –

1. ***Create a Management Plan map - <u>Management Planning Section 4</u>***

2. ***Manage ditches leaving a margin of vegetation - <u>Ditch Management Section 5</u>***
    Varied Ditch Maintenance
    Ditch Maintenance Diversity in Middle Level IDBs
    Creating and maintaining protective ditch edge margins
    Maintenance Dredging
    Water vole friendly dredging
    Spoil Management
    Bank re-profiling
    Channel vegetation management

3. ***Carry out a varied mowing regime - <u>Bank Management Section 6</u>***
    Bank Mowing
    Bush & Tree Management

4. ***Maintain stable, high water levels - <u>Water Level Management Section 7</u>***
   Water management

5. ***Carry out mink trapping - <u>Non-native & Problem Species Management Section 8</u>***
   Mink control
   Invasive non-native water plants

6. ***Carry out specific projects - <u>Species Management Section 9</u>***
   Creating sites for kingfishers.
   Installing bat boxes and creating sites for bats
   Barn owl box installation
   Otter holt construction
   Pollarding willows
   Planting native black poplars
   Eel and fish support actions
   Surveys of key species - plants, dragonflies, otters, water voles, etc.

4 Management Planning

IDB BAP Drainage Ditch actions ref 1.1 Establish and maintain a management plan for routine IDB operations incorporating key biodiversity features.

IDB BAP Drainage Ditch actions ref 2.2 Ensure appropriate management of ditches for priority species.

4.1 The Management Plan Map

The management plan map is the core part of the IDB BAP. The Board's BAP Summary Appendix sets out what the aims and targets are and when the need to be completed by. The Management Plan Map will show where they will be carried out. This manual aims to help with how they are achieved. The Management Plan Map will be a joint production between a Board representative, usually the Chairman or District Officer and the Environmental Officer. They are the people, who, together with volunteers recruited when necessary, will ensure the targets are achieved.

The plan will be based on the district map that is in the board's BAP and will mark features of wildlife or management interest by drawing an arrow to their position on the map. The plan can be very simple initially. It can have additional information added annually and gradually become more detailed. If there are too many features to be added to the map, they could be listed on an accompanying sheet using the ditch identification numbers that all board plans have. A copy of this map can then be given to a ditching or mowing contractor before they carry out the annual maintenance so that features of value can easily be identified, protected and worked around. An example map is included at Appendix 12.

Features that could be marked on the map include :-

- Ditch sections selected for alternate side mowing.
- Ditches selected for longer than usual maintenance returns.
- Ditches that have a good existing margin of sedges or other non-invasive bank edge plants that should be encouraged.
- Ditches where a marginal shelf has been/can be left.
- Ditches prioritised for biodiversity management (e.g. redundant or low maintenance ditches to former pump sites).
- Potential or existing water control structure sites or higher water level ditch sections.
- Ditches or banks that have good wildlife features, e.g. a higher than average diversity of water plants, fish spawning areas, reptile sunning areas, frog or toad spawning areas, high density of water vole signs, kingfisher nest sites, etc.
- The planned or completed locations for barn owl boxes, bat boxes, black poplars, kingfisher nest site drilled holes, trees for pollarding or coppicing, potential sites for conversion as bat roosts, etc.
- Sites to monitor for problem species, e.g. mink control sites, badger burrowing areas, water inlet points to monitor for alien/invasive plants arrivals.

With 35 individual IDBs in the Middle Level area containing over 900 kilometres of adopted ditches, it will take time to produce plans for each district. There may be a board member or local naturalist that is particularly knowledgeable and interested in taking on the job of identifying and recording some of the features on a board map. The Wildlife Trust or a member of a specialist group interested in plants, dragonflies, bats or reptiles and amphibians may be able to provide the name of a local surveyor that could help. An indication of how to prioritise ditches for biodiversity value and enhancement is given in Section 3 of the Defra publication ***Guidelines for managing and prioritising ditch types in arable land for biodiversity*** which can be viewed at this web site, http://randd.Defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=10080

5 Ditch Management

Ensuring effective drainage of land via good passage of water through districts was and always will be the most important role of IDBs. In former times keeping IDB drains uniformly neat and tidy looking was also a primary consideration. Thoughts on land management have gradually moved towards a more natural look and leaving a place for nature in the scheme of things. Legislation to protect and enhance the diversity in our countryside has been introduced and there is more public interest in wildlife conservation. This does not mean a movement away from regular maintenance or good management, only that it is carried out in a way that is sympathetic to wildlife interests and in a varied and diverse manner.

5.1 Ditch Maintenance Diversity in the Middle Level BAP Partnership

Diversity of management will produce biological diversity in the banks and drains being managed. The fact that there are over thirty different IDBs and DDCs within the Middle Level, each with a different Board and differing management, means that diversity already exists throughout the catchment. This diversity can be further improved by each IDB looking at ways to increase variation in management with their district.

5.1.1 Different Ditch Maintenance Regimes

Within the Middle Level Biodiversity Partnership there are many different methods and rotations already used for ditch maintenance. They include –

- Majority of the whole district cleansed lightly every year

Some Boards cleanse up to 80% of their district every year. This potentially is the most rigorous of the rotations in terms of its effects on wildlife. It is very much in the hands of the operator and the type of bucket used as to how beneficial or otherwise it is to biodiversity. With a light approach and an open or basket-type bucket an operator can carry out this maintenance and still allow diverse interest to be maintained. The second and third year after cleansing are often the best years for in channel water plant diversity so with annual cleansing some plants may not get the opportunity to thrive as the would in a longer rotational cycle.

The annually repeated rotation is at its best when it is carried out by the same operator each year. A new operator may be tempted to remove more material than is strictly necessary to ‘show they are doing a good job’ but a regular operator will be more familiar with the district and aware of how little it takes to keep the ditches in good order. The ‘little and often’ approach works for several boards, often with their own machine and operator. In that situation, the operator can use a lot of skill in judging how much material to remove and from where. In leaving small but important areas unmanaged for longer they retain essential plants and structure that harbours much biodiversity interest.

- Regular Light Touch, as required

Boards that have their own machines often are able to utilise this method to good effect. The ditches to be cleansed are identified on an annual basis. It is the most flexible approach and can be quite a wildlife-friendly method, especially if used with a fairly open bucket. Only the sections in need of immediate attention are tackled and then usually lightly and in a way that allows species to recover quickly. It offers opportunities for the operator to leave valuable habitat in place for a year or two because it is easy to return and manage it as required.

- Two Year Rotation

Not widely carried out as a rotation. Many plants and invertebrates reach their optimum condition in their second or third year after management has been carried out. This rotation would inhibit that happening, unless cleansing is carried out lightly.

- Three Year Rotation

This regime can benefit wildlife as it gives two years that are undisturbed for the plants, insects and related wildlife. It is best when the bank mowing regime follows the same rotation. If rigidly followed, a three-year rotation can result in some sections being dredged unnecessarily frequently. This rotation is best when allowance is made for that and some sections are skipped if the annual review indicates they will 'last another year'. Modern machines have much faster tracking speeds than previously so tracking to a location out of sequence is not the problem it once was.

- Four year rotation

A good rotation period and one that produces a useful balance between recently cleared ditches and more mature ones without letting many ditches become over mature and monocultures of single dominant species. Usually bank mowing follows the same rotation in this regime with it being carried out on both sides of the ditches to be cleansed in the fourth year. This gives three years of undisturbed growth for vegetation to the benefit of the related insects and their dependant breeding birds, bats and fish. If there is a large growth of vegetation in a channel before the fourth year, usually as a result of an inflow of nutrient runoff following a heavy rainfall period, clearance may be required in a localised area out of sequence. This would add to the diversity of management in the system and variety in age structure of the vegetation community.

- Only when required.

This approach can produce some mature ditch and bank vegetation that is attractive to wildlife. However, as the channel vegetation grows older the ditch becomes less attractive to wildlife, or at least to the greater variety of wildlife that a more regularly maintained ditch has. One disadvantage of leaving ditches as long as possible between maintenance action is that when cleansing is eventually carried out the major disruption involved in removal of a lot of material can set back some species that would survive less rigorous but more frequent treatment. On the positive side, there are some plant species that respond to this type of management and only germinate when a major cleansing is carried out.

Summary

Other variations on the above rotations are carried out. No ditching regime is completely right or wrong. However, a system that is designed to be flexible and accommodate diversity reflects the thought that has been given to the process by the IDB concerned.

Broadly speaking, the greater variety of dredging frequencies within a District, the greater the diversity of species and age diversity that will be supported. If a section of a ditch planned for cleansing does not require dredging, consider not cleaning it just for the sake of completeness. If it is left untouched it will be a valuable source for invertebrates and other species to re-colonise the newly cleansed sections of ditch.

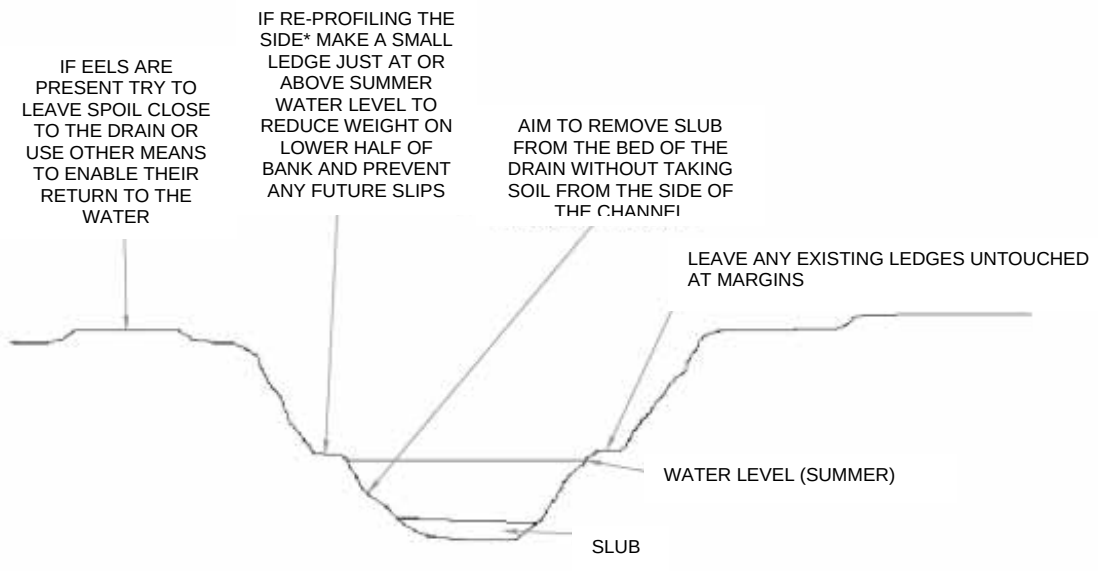
5.2 Maintenance Dredging

IDB BAP Drainage Ditch Action Plan ref 1. Manage ditches for biodiversity as well as drainage

The core role of a Drainage Board is to carry out the management of drains for the mutual benefit of landowners in the District to enable the effective removal of water entering the system. That role has been carried out by Internal Drainage Boards in a very cost-effective way since their creation. This manual puts forward measures that promote biodiversity interests without compromising the primary drainage role. In some cases, such as the maintenance of sedge margins, the biodiversity element is also a positive benefit to the management of the drain.

Other resources sensitive to change or loss through excavations for ditch management include archaeological remains. If widening works are to be undertaken it is worth contacting the Historic Environment Teams of the relevant local authorities (see contacts list, Appendix 2) to let them know in advance where these works are to occur so that they can run a check on the Historic Environment Record to see if any statutorily protected sites or significant non-designated are likely to be affected. Avoiding these sensitive areas should be the priority.

Within the channels the practice of leaving a fringe of emergent vegetation on either side performs an important role. It protects the bank toe against wave action and prevents erosion by flotsam by providing a buffering margin. The width of the margin will have to be judged in relation to the over-all width of the drain. Typically it would be half a metre wide but on narrow ditches 30 centimetres or even less may be all there is room for.



DRAIN DIAGRAM, CROSS SECTION

* IF THE DRAIN SIDES ARE BEING RE-PROFILED (SIDE TRIMMING) AND WATER VOLES ARE PRESENT (80% LIKELYHOOD IN MIDDLE LEVEL DRAINS) DRAIN SIDES MUST NOT BE REMOVED WITHOUT PRIOR (ONE WEEK AT LEAST) REMOVAL OF VEGETATION BY VERY SHORT FLAIL MOWING

Where possible, material should only be removed from the middle of the ditch to encourage the establishment of marginal ledges on either side and to prevent bank damage and erosion. Ensure the machine operator is aware of any ditches for which specific management practices are required, such as leaving existing marginal ledges, in order to preserve features of particular interest or rarity. The district management plan map with its indications of where those features are located will be an important resource for this.

These methods are examples where nature is being employed to help us achieve our ends. Hard engineering will always have its place but the aim of these practices is to prevent erosion and reduce the occasions when expensive steel, stone or timber bank reinforcement is required. The fact that an important habitat for wildlife is sustained by this practice doubles its value and is an indication to the wider world that the IDB is fulfilling its obligations to make a place for nature while carrying out its water management functions.

5.2.1 Timing

IDB BAP Reedbed Action Plan ref 3.2 Where reeds are present, commence mowing or cleansing work outside the bird breeding season, 7th April to 15th July.

Maintenance dredging should normally take place between September and March. This avoids the fish spawning season and the period when low dissolved oxygen levels present a potential problem of fish kills. It also avoids the main bird breeding season from April to August. Outside those dates one still gets early nesting species like mallards and kingfishers and late nesters like reed warblers on their second brood, so care needs to be exercised where they may be present.

If, in very exceptional circumstances, dredging (or weed cutting/removal) is necessary for flood defense purposes during the nesting season (7th April to 15th July) a survey to check for the presence of nesting birds must be carried out by an experienced breeding bird surveyor. This is time-consuming so management during the breeding season should only be carried out in an emergency situation. The survey should identify and mark areas where nesting birds are present and where sections need to temporarily left undisturbed. The machine operators should still be watchful for any flushed birds and avoid interference with any birds' possible nests in the reed margins or where spoil is placed at the back (non-river side) of the banks.

Species to look out for in particular include little grebes, coots and moorhens nesting on vegetation at the waters edge, reed warblers with nests in the bank-side reeds. Also be alert for signs of mallards, pheasants and other birds nesting on bank sides where spoil water may spill or areas on bank tops where spoil may be spread. If a bird is flushed from a likely nest site, avoid the area by leaving the spoil as far away from the probable nest location as possible.

5.2.2 Creating and Maintaining Ditch Margins

IDB BAP Drainage Ditch Action Plan ref 1.2 Look for opportunities to provide natural erosion protection such as marginal plant ledges when re-profiling ditches & 1.3 Provide natural erosion protection as in 1.2 if opportunities available

IDB BAP Water Vole Action Plan ref 2.1 Look for opportunities to add a marginal shelf when re-profiling banks.


Left. A good margin of greater pond sedge protects one side of the Fenton Lode, Warboys, Somersham & Pidley IDB. Right. A mixture of emergent plants protects a Manea & Welney DDC ditch margin.

5.2.2.1 Marginal Plant Ledges

The water margin is arguably the most important part of a ditch for biological interest. If the management of it is carried out with care, a wide range of species benefit. Emergent water plants provide habitat for very many invertebrates, especially dragonflies and water beetles and water bugs. They also benefit channel management by providing an important protection from erosion at this vulnerable zone. Reed warblers, reed buntings, little grebes and other water birds are provided with nest sites and many other species find food in the mixture of plants that grow. Water voles and water shrews benefit from the cover.

If the channel is wide and deep enough for fish, the marginal vegetation gives them important refuge, shade and spawning habitat. Ditch and drains are very valuable habitats for species like the spined loach, a Bern Convention listed species and eels, a UK BAP species.

The aim is to encourage plants that provide cover at the edge but do not expand rapidly into the channel. Most valuable of these non-invading plants are the sedges, especially greater pond sedge, *Carex riperia* and lesser pond sedge, *Carex acutiformis.* They should not be planted together as they tend to hybridise, producing a sterile plant. Lesser pond sedge plugs are more readily available as it is an easier plant to germinate.


Left, a band of sedge protects the margin of a March Third DDC ditch and right, on the same ditch the sedge has been retained as a stabilizing ledge and a valuable habitat for water voles and other wildlife when the bank was re-profiled.

Other plants that tend not spread into the deeper part of a channel include yellow flag, false fox-sedge and soft rush. Common reed*, Phragmites australis*, and sweet reedgrass, *Glyceria maxima*, are invasive into channels so giving an early start to non-invasive species like

sedges will encourage the plants that assist ditch management and discourage the species that require frequent management.

Left, Sedge plugs planted on a ledge at the margin of the Forty Foot River near Chatteris in April 2010. Above, the growth of the sedge plugs 12 months later in April 2011.

5.2.2.2 Planting Sedge Plugs

A good time to create a ledge is when a ditch requires re-profiling (also referred to as battering back or side trimming) because it has been undercut by erosion or been subject to slips due to the presence of light silt or sandy soil. Sedge plugs are easily and quickly planted in the ledge in a staggered double line at about five pair metre using a long-handled dibber. Planting when the berm is being created in low water level conditions is an efficient means of establishing the plugs.

Ben Wales planting sedge plugs at the margin of a Hundred of Wisbech IDB drain.

Sedge plugs and a wide variety of other native plants are available from British Wild Flower Plants, see contacts list, Appendix 2.

Making a ledge about 300mm wide just above the summer water level will encourage good emergent plant growth at the water margin, produce good habitat for water voles and other species. More importantly, a protective zone of vegetation is established that will help to prevent further slips by creating a network of roots at the banks most vulnerable area. Creating the flat ledge is important because it provides a good base for the plants to become established on and adds depth to the protective structure of emergent vegetation that develops on it.

This stabilizing membrane develops into a naturally regenerating revetment for the bank toe. As the stands of sedge grow more mature their leaves bend down in winter and provide further protection to the wet edge of the bank at the water level. Sedge in particular does this by its roots stabilising the bank at the key point where it needs stability the most and its leaves help by creating the curtain that screens the softest part of the bank edge from the small but continuous erosion by water movement and wave action.

Sedge plugs planted at the toe of a newly profiled drain bank in March & Whittlesey IDB that will form a protective margin in due course.

A mature border of sedges protects a ditch margin in winter. Manea & Welney DDC.

If a bank is very prone to slips because of poor soil type, sedge at the margin also helps to minimise their effect. A mature marginal band of vegetation such as sedge helps catch the soil from a slip point and prevents it disappearing straight into the ditch. It helps hold it on the bank, limiting the damage and further loss of soil caused by a slip.

Where a ditch is sufficiently deep to prevent reed from spreading into the channel a band can be left on the margins to give protection from erosion at the toe and as good habitat for many insects and birds. March & Whittlesey IDB.

5.2.3 Water Vole-Friendly Ditch Management

IDB BAP Water Vole Action Plan ref 1.1 Assume water voles are present when carrying out works and follow the ADA Water Vole Mitigation Guide

Why

Water voles are a UK Biodiversity Action Plan Species because their population fell to less than 10% of its former distribution in the UK. The Wildlife and Countryside Act 1981 (as amended) legislation that protects water voles carries significant penalties. A £5,000 fine and/or a six months imprisonment and confiscation of any machine or vehicle involved in the damage are all penalties available to the courts for anyone convicted of damaging water vole habitat or the animal itself.

In the Middle Level ditches water voles remain widespread, and in many locations they are numerous. This is because of the way boards have regularly maintained the extensive network of ditches over many years. Never the less, IDBs need to be particularly careful to avoid damaging, or appearing to be damaging, water vole habitat. Work needs to be carried out so that boards are not open to claims that their activity is damaging water voles or their burrows. The claims may well be misguided but if the bank side at water vole burrow level (a zone typically between 500mm above and 500mm below the normal summer water level) is significantly scraped, an RSPCA Inspector, Wildlife Crime Officer or magistrate is unlikely to give the board the benefit of the doubt. If the water vole burrow zone has not been scraped, there is no case to answer. The best way to avoid that is by not touching the opposite side of the ditch with the bucket on the way in or scraping the near side on the way out.

Even in narrow ditches it is possible to avoid scraping the sides. Needham, Burial & Birdbeck DDC.

Ideal water vole habitat. A small ledge at the water's edge with a vertical bank behind it to burrow into, a good variety of plants for food and cover and easy access to a clean ditch.

How

The traditional ditch cleansing method often included a scrape up the working side of the ditch with the bucket to 'make a tidy job'. That method is no longer appropriate, particularly where water voles are present. It leaves a raw soil margin that is vulnerable to erosion and removes vegetation and roots that protect the bank toe. It is unlikely that water voles themselves were harmed by the method because their tunnels are usually longer than one metre, typically much longer. The removal of vegetation will however cause a disruption to their food supplies and the loss of the cover it provides will make them more vulnerable to predation. If the side of the ditch is left at a shallow angle it also makes it less attractive for water voles to burrow into as they prefer a more vertical face to make their initial entry.

Not scraping the sides does mean that the bucket edge does not do as good a job at cutting the longer stems of vegetation at the ditch edge as it would do if the bank edge was scraped. This can result in a slightly less tidy look to the finished job than many operators or district officers will have traditionally been used to. The very neat finish of former times may have been pleasing to the eye immediately after the work was completed but it is a very transitory effect. A few weeks afterwards the tidy look has gone but the ditch edge is a little more vulnerable to erosion because vegetation is no longer there to protect it at its most vulnerable point. Leaving the edges un-scraped gives a practical long-term benefit over a perceived temporary one.

The minimum requirement for water vole-friendly ditching is to leave one side of the ditch untouched during cleansing. Leaving both sides untouched is the best practice. As well as ensuring no possibility of prosecution under the protective legislation, it allows the vegetation on both sides of the ditch to provide a natural protective revetment to the ditch margins.

In Appendix 4 there is a copy of the ADA guidance on Mitigation Measures for Water Voles (currently being reviewed and updated) which sets out the method of mitigating the effect of dredging by only managing one side of the a ditch, leaving the non-working side untouched. While adherence to that method may be used to defend a claim of damage in court, it does leave the operator open to the accusation that water voles sites have been damaged. The only way one can be certain of compliance with the letter of the law is by not scraping either side of the ditch.

A definitive indication of water vole presence is finding the remains of vegetation cut at 45 degree angles. These are a result of the consistent way that water voles hold plants with their front paws when eating them.

Some boards are able to lower water levels sufficiently when dredging work is being carried out so that the operator is working well below the water vole burrow level. While keeping water levels as high and as stable as possible is generally best practice in spring and summer, both for bank stability and ditch wildlife, dredging at temporary low water levels during winter allows the operator to see the slub and make a quicker and more efficient job. One benefit of this method for wildlife can be the areas of exposed mud which sometimes are used for feeding by snipe and green sandpipers.

Left. Working below the water vole burrow level in a drained-down White Fen DDC ditch. Right. Tiny holes in the margin of a drained-down Benwick IDB ditch show where a snipe has taken the opportunity to probe for invertebrates.

Lowering water levels in this way runs the risk of de-oxygenation if fish are present and the weather is warm so should not be carried out during summer or early autumn. The period of

low water levels should kept as short as possible to minimise the possibility of bank slip, de-oxygenation and disruption to the ditch species.

5.2.3.1 Coir Roll Revetment Installation

IDB BAP Water Vole Action Plan ref 2.2 Consider using coir roll to stabilise banks and provide marginal vegetation.

When bank slips occur or erosion undermines a bank, bank toe revetment using hard materials such as stone with timber or steel piles has been the usual requirement. These materials are becoming increasingly expensive and they are not at all water vole friendly. Since 2009 the MLC have carried out a number of trials on their main drains using 1,000 metres of coir rolls as an alternative to hard revetment materials. The three-metre long rolls come pre-established with wetland plants including sedges. When they are installed at the water margin the coir (coconut husk material) provides an immediate protection to the bank toe while the plants grow their roots through it into the bank and establish a self-perpetuating natural revetment.

There are situations where bank damage is so severe that only hard revetment materials are appropriate but coir rolls are very effective in providing ‘a stitch in time’ solution to prevent a small slip becoming a large one. Sometimes a slip may ‘self heal’ but unless the bank edge is stabilized it is more likely to get worse, requiring hard revetment. In this situation coir rolls can provide a cost-effect solution.

On comparable lengths, coir rolls cost less and are quicker than hard revetment to install. They add another option to the methods that can be employed to protect and maintain vulnerable banks. The location of any coir roll installations should be added to the Management Plan Map to identify their position to maintenance contractors. To ensure the sedges and other plants are able to perform their water margin protection function, they should not be mown very short during maintenance activities.

April 2009. Coir rolls on the Sixteen Foot River near Bedlam Bridge after installation in January 2009.

The coir roll is contained in a net of mesh that plant roots and water voles can get through. Yellow flag iris and lesser pond sedge are the plants showing good growth in the foreground.

The same site in September 2009.

Purple loosestrife plants have flowered and provided a bright source of nectar for many butterflies and other insects.

In the background burr reed plants are starting to get established in front of the coir rolls on the river side.

The site in August 2011. Burr reed has now naturally established itself in front of the whole coir roll site, consolidating the protection of the bank toe. The roots and vegetation of the plant community will continue to provide a living defense against erosion even after the coir has eventually decomposed in about 10 years and been incorporated into the bank edge soil.

5.2.3.2 Ditch Corner Shallow Water Habitat Creation

IDB BAP Open Water Action Plan ref. 2 Look for opportunities to create open water habitat when managing ditches.

One of the scarcer but most valuable features in IDB drains are shallow water areas. Drains tend to be deeper than most emergent plants can thrive in and while that is important for the movement of water from A to B, there are some situations where a corner can be given for wildlife without compromising water movement. Where a drain sweeps around a corner in a wide arc the furthest corner can be a bit of a stretch for the excavators arm to reach to. In these situations a deep main channel can be maintained while leaving the corner apex as a shallow area for emergent water plants to grow. These shallow, undisturbed areas are particularly valuable as fish spawning sites, as are the following two methods.

Where this Manea and Welney DDC drain turns a corner the extra width allows emergent water plants to grow in the corner in the foreground. The extra width of the channel at this point ensures the vegetation does not inhibit water passage.

5.2.3.3 Pool Creation at Ditch Junctions

IDB BAP Open Water Action Plan ref. 2 Look for opportunities to create open water habitat when managing ditches.

IDB BAP Open Water Action Plan ref. 2.2 Create a pool at an appropriate ditch junction when re-profiling

The extra width of channels at ditch junctions offers opportunities to create pools where water plants can be allowed to grow more freely.

As with the example above, ditch junctions offer the opportunity to allow water plants to grow in an area they can occupy without inhibiting the passage of water which moves through via a deeper channel route. The position of areas indentified as shallow pool areas should be identified on the BAP Management

map and shown to ditching contractors when they commence maintenance works.

5.2.3.4 Cul-de-sac Conservation Areas

IDB BAP Open Water Action Plan ref. 2 Look for opportunities to create open water habitat when managing ditches.

Leaving dead-end drains or head water ditches as conservation areas is a very positive biodiversity action. When an old diesel pump on the Manea & Welney DDC drain pictured above was retired from service, the channel became a cul-de-sac on a spur off the main routes. By adopting a less frequent maintenance regime it became a very attractive conservation area where water violets and a good variety of other water plants thrived.

If drain priorities change in a district, opportunities may present themselves to designate sections for less frequent cleansing. They will still require occasional maintenance but costs will be reduced and valuable sites for biodiversity created. The position of channels indentified as conservation areas should be identified on the BAP Management map.

5.2.4 Maintenance Cleansing Depth

When carrying out maintenance ditching it is important that only ‘slub’, the soft mud material that has been laid down on the bed of the channel, is removed and not virgin soil from the bed itself. If virgin soil is coming up with each bucket then the channel is being deepened. It may not appear much but if it occurs each time the channel is dredged the effect will be to make it deeper in relation to its width. This will inevitably result in steeper sides to the drain and the eventual need to re-profile the sides back to a shallower batter, with the consequent costs and loss of land and ditch margin habitat. By ensuring only deposited material that has dropped out of suspension is removed and that the original ditch base is followed, the costs of re-profiling can be avoided and a stable bank side maintained for a long period.

5.2.5 Spoil Management

Spoil from dredging activities is normally spread thinly behind the ditching machine and allowed to dry. Where fish are present, especially eels, efforts should be made to provide them with the opportunity to get back to the water by the placement of the spoil. During the drying period the spoil forms a much overlooked but important temporary habitat. Initially herons are the first to benefit briefly from the easy pickings presented to them. A great many insects are attracted to the spoil during the drying time and they in turn attract species such as pied wagtails, yellow wagtails, red-legged partridge, grey partridge and pheasants. At a dryer stage spoil can provide valuable dusting bowl sites for game birds.

Left, a pair of grey partridge and right, a yellow wagtail takes advantage of spoil areas as feeding sites. Insects are attracted to the wider variety of plants growing on ditch spoil banks while they remain available.

The ploughing-in of ditching spoil is usually carried out by the relevant land owner in IDB situations and in most cases the board will have no control over how soon that happens, however these examples are included to highlight the value of spoil areas to wildlife during the period that they remain available.

5.3 Bank Re-profiling/ Side Trimming

IDB BAP Drainage Ditch Action Plan ref 1.2 Look for opportunities to provide natural erosion protection such as marginal plant ledges when re-profiling ditches

IDB BAP Drainage Ditch Action Plan ref.1.3 Provide natural erosion protection as in 1.2 if opportunities available.

IDB BAP Water Vole Action Plan ref 2.1 Look for opportunities to provide a marginal shelf when re-profiling banks.

What is re-profiling

When a ditch or drain side becomes too steep or starts slipping either because it has gradually become undercut by erosion at the water margin or pressure from machinery close to the top edge has pushed soil out creating a bulge, it becomes necessary to re-profile the bank to a shallower angle, also described as ‘side trimming’. The underlying problem is usually a poor soil type leading to erosion at the water margin and resulting in bank instability.

Procedures where water voles are present

When re-profiling is necessary, it is essential that a survey for water vole presence is carried out by the Environmental Officer so that the appropriate mitigation measures can be carried out to allow the process to proceed without infringing the significant legislation that protects this species. Water voles are present in 60% to 90% of Middle Level IDB drains so it is very likely that these Best Practise measures will be required.

The various measures set out in the ADA guidance for the management of channels where water voles are present (Appendix 5) should be followed. **The vegetation on the side of the ditch to be re-profiled should be flail mown very short down to water level two to seven days before the re-profiling is due to be carried out.** This is to encourage water voles to move away from the side to be re-profiled**. A key requirement is that the opposite side of the ditch is left untouched and un-mown for the voles to move to.**

This procedure is the correct one where only one side of a ditch is being re-profiled**. It is not recommended that both sides of a ditch are re-profiled at the same time because it does not leave a nearby area for water voles to move to.** If both sides are to be re-profiled at the same time, the maximum length that can be carried out is 100 metres. For lengths longer than 100 metres trapping and re-location of water voles is required. This is a very time consuming process so it is worthwhile ensuring that double-sided re-profiling lengths are avoid or are planned to be less than 100 metres. The process should be organised so as long as possible is left before the opposite side of the ditch is re-profiled, if required, to give time for water vole habitat to re-establish on the original side. **The timing of this procedure is also important. It has to be carried out either before water voles start breeding, between March and mid April or after their breeding season but before they enter their period of torpor, between mid September and the end of October.**

A re-profiled bank in March & Whittlesey IDB. The opposite bank was left un-mown for water voles to move to. A shelf was created at the toe and planted with sedge plugs.

The re-profiled design should incorporate a ledge at the toe of the bank to allow a sedge margin to grow, as described earlier in section 5.2.3. This will (a) help mitigate for the temporary loss of water vole habitat (b) create a stabilizing root structure and vegetation barrier for the continuing protection of the new bank's toe. If sedge plugs are planted at the time of ledge creation the re-establishment of a stable and protected toe to the bank can be speeded up.
With good forward planning the presence of water voles need not affect the essential management works to be carried out by IDBs. By ensuring drain margins are protected and not under-cut during maintenance cleansing, the necessity for re-profiling will be greatly reduced.

5.4 Channel Vegetation Management

5.4.1 Weed Cutting and Removal

In the Middle Level weed cutting with a 360 degree ditching machine and a weed bucket is not widely carried out as a routine, separate action from ditch de-silting (slubbing). Weed cutting is usually combined with ditch slubbing unless a waterway has become choked with water plants. The presence of filamentous algae or exceptional growths of hornwort occasionally require specific operations where they occur in very dense monocultures.

Left. A little grebe presents an insect to her young in a Wimblington Combined IDB ditch. Right. A reed warbler hunts for insect food in an Upwell IDB ditch.

If a weed-cutting bucket is used it is important that any valuable plant communities at the margins that are not invasive to channels and protect the edges from erosion are not removed. The temptation to 'tidy up' the bank vegetation at the water edge should be resisted if sedge beds are present because they are non-invasive. As indicated above, sedge margins are an important element of a ditch both in biodiversity terms and as a bank protection and stabilisation factor.

Weed cutting can cause de-oxygenation and consequential fish kills if cut material is left in the water or even if cutting is carried out in hot or thundery weather and the drain bottom is disturbed. If there are any signs of fish in distress near the surface work should be stopped immediately. The Environmental Officer should be contacted who will check the dissolved oxygen levels as soon as possible. If it is not possible to contact the Environmental officer, the Environment Agency should be contacted via their hotline, 0800 80 70 60, a free phone 24 hour service. In severe cases they may have to add hydrogen peroxide to immediately restore oxygen levels.

5.4.2 Aquatic Herbicides

At the time of writing there is some speculation that the licence to use glyphosate in aquatic situations may not be renewed as the re-licensing cost is high in relation to the market use of it at or near water. Below is information supplied by Monsanto that indicates it will be re-licensed for use near water.

Glyphosate Registration

- Glyphosate will need to be re-registered under Regulation 1107/2009/EC, known as A1R ,(Annex 1 renewal) following the initial approval for 10 years at European level under the Plant Protection Products Regulation 91/414EC in 2002.
- This was originally expected by June 2012, but there is currently a backlog and the commission expect to renew before 31st December 2015.
- Until renewal the current products and recommendations for use will remain in place (unless there is any specific revocation by the UK CRD).
- There has been some concern that many pesticides will be excluded from renewal under 1107/2009/EC because of failure to meet the tough new hazard-based criteria based on toxicity- e.g. endocrine disruptors, carcinogens etc. Glyphosate is a non-toxic active and does not meet any of the criteria announced to date which would trigger non-inclusion.
- The dossiers are currently being prepared for submission at EU level. These dossiers will cover a representative use in some crops, but not the minor uses of which aquatic is one.
- Once renewal for the active glyphosate is confirmed, each member state will approve products containing glyphosate and will include specific country recommendations. Monsanto intend to apply for continued approval for use of hazard-free formulations in aquatic areas at this stage.

Reed growth into channels in some conditions can threaten to make mechanical removal necessary at frequent intervals if it were not for the practice of controlling it by glyphosate spraying. In some IDB drains in the Middle Level glyphosate is sprayed on dense monocultures of common reeds, Phragmites australis, as a means of keeping the channel open and to lengthen the period before weed cutting or dredging is required. Because it is targeted on dense reed stands which then open up by the removal of the reed monoculture, it can be less damaging and more beneficial by creating a more diverse vegetation community.

The use of herbicides near water bodies requires particular care and preventing spray drift on to non-target species or open water is very important. While the initial assumption by some might be that mechanical control is always to be preferred over herbicide use, there are some situations where targeted use of glyphosate creates less disturbance and damage to the ditch ecology than the mechanical alternative. Overall the diversity of species present does seem to compare favourably to the alternative of system of weed cutting using buckets fitted with reciprocating cutting blades, especially as the frequency of disturbance is two three times less. Research needs to be carried out on how *Phragmites*-dependant invertebrates cope with each of the two management methods but subjective impressions are that breeding reed warblers find more sites in glyphosate treated drains than mechanically managed ones.

Herbicides are one tool in a range of management methods. Selecting the correct management tool for the task, chemical or mechanical, will depend on many factors including the proximity of sensitive or non-target species, the disturbance caused by the activity and especially, the prevailing weather conditions. The use of an aquatic herbicide should be considered in comparison with alternative non-chemical options. have been considered and

shown to be less appropriate for the task in hand. While glyphosate alone is not considered to be of major concern as a water contaminant, some of the surfactants and adjuvant chemicals included in branded products have been found to be damaging to amphibians, especially tadpoles, and aquatic invertebrates and fish.

The success in avoiding damage to scarce or interesting water plants depends on the skill and experience of the operators in ensuring the herbicide is applied to only in monoculture situations and drift of spray to non-target species is prevented. Herbicide spraying is limited by the number of days when wind conditions are too strong and create spray drift.

The Middle Level Commissioner engineers experimentally adapted a type of brush weed-wiper to fit on a tractor flail arm for the application of glyphosate to reeds that are encroaching up banks. The wiper has the potential to provide a safe and effective means of applying herbicide without the danger of spray drift onto non-target vegetation, but the possible withdrawal of glyphosate for use near water and the non-licencing of this application method may make this targeted application technique redundant.

Left. Reed growth on Well Creek that can extend up the bank and become a traffic hazard. Right. A brush type weed-wiper that has been adapted to replace a flail mower head as a potential method to provide more targeted delivery of herbicide close to water.

5.4.2 Reed spraying prior to dredging.

Where dense reed is present glyphosate has been applied to it prior to maintenance dredging in many Middle Level IDBs with the aim of preventing early re-growth of the reed after dredging. To achieve the best effect at least three weeks was required for the systemic herbicide to reach and kill the rhizome system of the reed before dredging takes place.

The retention of a band of emergent vegetation at the ditch edge is important to protect it from erosion so herbicide application should be carried out with that aim in mind. The long-term target is to allow the emergent plants at the margin to develop from a common reed monoculture into a non channel invading community of plants such as sedges.

All herbicide treatments should be carried out by NPTC Certified Operators in accordance with current Control of Pesticides Regulations.

5.4.3 Biological Control

5.4.3.1 Barley Straw

In the past, attempts have been made to control the production of filamentous algae on certain channels using barley straw. The beneficial effect was found to be limited and the subsequent handling and disposal of the exhausted straw bales proved difficult. In addition

the polythene baler twine used was a hazard to navigation and wildlife. Until an economically viable product is developed for wide-scale use, the general use of barley straw as an algaecide has been discontinued in MLC waterways. Localised use for specific areas may still be appropriate and trials of new products based on the active agent will be considered.

5.4.3.2 Azolla Weevils

IDB BAP Drainage Ditch Action Plan ref 4.1 Control Non-native Invasive Species

At the time of writing (December 2011) biological control of the non-native invasive plant Water Fern, *Azolla filiculoides* by a specific weevil has been successfully trialled at Hundred of Wisbech IDB. The method has also been used successfully in other parts of the country to control this float plant that covers waterways completely, excluding light. More details of the method are located at the Non-native Species Management section, 8.0

6 Water Level Management

6.1 Water Management

Modern pumps, especially electric ones, allow more effective and efficient control of water levels than previously. Large variations in water levels cause problems not only for the wildlife of the system but also negatively affect bank stability. Where soils with iron oxides are present, low water levels that expose them to the air causes the release of ochre flushes that stain and choke the ditch system. The aim should be to maintain high water levels, as far as are consistent with the demands on the system, with 'little and often' draw-downs rather than major drops in water levels.

Structures for water level control are valuable in managing different water levels within a district and providing flexibility in water management. Maintaining high water levels in parts of a district's system while lowering others for maintenance is a very useful facility. It provides a greater diversity of water levels which in turn offers a wider range of conditions for different species. A more stable water level in the structure-controlled sections is also beneficial compared with systems that are dependant on one single level.

Water has been retained on a slope on this private ditch in Warboys, Pidley and Somersham District by creating a series of simple weirs (installed by Kelvin German). This produces a range of water depths that will aid diversity in the ditch and should attract water voles where they were absent due to the lack of water.

Many private field-side ditches that dry out during the summer can be improved in their benefit to wildlife by the provision of shallow overspill dams that retain 20 to 30cm of water. These could be as simple as a length of scaffold board retained by two posts or two sand bags tied to lengths of rope to facilitate their removal if necessary.

A twin-wall polyethylene pipe and turnable right-angled bend being used to control water levels in privately managed ditches of the Hundred Foot Washes IDB (the Ouse Washes).

Provided the levels are still below field drain out-falls, the benefits of this slight increase in retained water level are very significant because it has a benefit over a large area. On IDB drains, District Officers know the characteristics of their systems and could give thought to how they can get better water level management control over different sections by installing control sluices. More sophisticated controls are available including tilting weirs that retain water to a given level but allow a fast flow through when high rainfall requires it.

Water control structures. Top left, March Third DDC, top right Drysides IDB, bottom left, Whittlesey IDB, bottom right, a tilting weir at Hundred of Wisbech IDB.

7 Bank Management

ML IDB BAP ref. Drainage Ditch Actions BAP Target 1.1 Establish and maintain a management plan for routine IDB operations incorporating key biodiversity features.

IDB BAP Water Vole Action Plan ref 1.1 Assume water voles are present when carrying out works and follow the ADA Water Vole Mitigation Guide

Carrying out a varied mowing regime.

7.1 Bank Mowing

Mowing is an important part of the bank maintenance regime. It produces a dense, strongly rooted sward which protects the bank from erosion and reduces the likelihood of slips. The aim of this bank mowing guidance is to produce a diversity of sward heights that will both fulfil flood management requirements and provide a range of vegetation throughout the year that will support a wide range of wildlife. Where finer grass species such as the fescues and bents have been established, a bi-annual (every two years) mowing rotation will prevent the loss of these species. A mowing plan based on cutting alternate sides of a ditch annually to produce a bi-annual rotation is a good compromise between economy, diversity and maintenance.

7.1.1 Mowing timing

IDB BAP Reedbed Action Plan ref 3.2 Where reeds are present, commence mowing or cleansing work outside the bird breeding season, 7th April to 15th July.

The timing of when different IDB banks are mown will be to some extent dependant on the availability of the mowing contractor. Banks running past domestic premises or other amenity areas that are traditionally kept short should have the mowing commence before 7th April and maintained as a short sward during the nesting season. In the great majority of cases Middle Level IDBs do not mow their banks more than once a year, some much less frequently than that. In the few cases where mowing early in the season is required, the following 'Best Practise' should be adopted.

All wild birds and their nests are protected under the Wildlife and Countryside Act and subsequent legislation. Starting mowing during the nesting season, defined here as from 7th April to 15th July, is liable to destroy nests on banks. To avoid that, areas where vegetation needs to be kept short should be cut before 7th April and then cut at regular intervals (of typically about a month) to prevent it becoming long enough to attract nesting birds. Some birds, such as little grebes, which do nest in IDB drains, do start nesting before the 7th of April and can have eggs laid in March. They will however be protected by the adoption of a policy of leaving an uncut fringe at the bottom of the bank, see below.

Mallards are often early nesters and machine operators should keep an eye out for ducks that are flushed off a possible nest. A cutting gap of about five metres (16 feet) should be left around the site to provide cover and protect the nest. In most cases however, mallards will select a patch of nettles or other fast-growing plants for a nest site in a location that is unlikely to be cut.

7.1.2 Leaving a protective fringe

ML IDB BAP ref. Drainage Ditch Actions BAP Target 1.1 Establish and maintain a management plan for routine IDB operations incorporating key biodiversity features.

IDB BAP Water Vole Action Plan ref 2.1 Look for opportunities to provide a marginal shelf when re-profiling banks.

In the past it was traditional to mow down to the waters edge. While this does leave a neat looking edge it often is at the price of removing or suppressing vegetation that has a positive role in protecting and stabilising the bank toe. Leaving a small fringe of vegetation 300 to 500mm (12 to 20 inches) wide at the waters edge is not only one of the most valuable contributions to ditch biodiversity; it also prevents the small but insidious erosion and undercutting of banks that eventually requires re-profiling. When this narrow strip is left as a natural protection to the vulnerable soil/water margin it also leaves sites for invertebrates to overwinter in that are important in their own right and to a wide range of birds and other wildlife.

Drains with marginal fringes, top left Benwick IDB, top right Ramsey, Upwood & Great Raveley IDB, bottom left Hundred of Wisbech IDB, bottom right Forty Foot River.

Of course this feature is not appropriate for narrow ditches with a total width of less than about three metres (10 feet) where the whole of its bottom may need to be clear to provide an unobstructed channel for the water to move through. It is appropriate for drains that are three metres and more wide. They will still have a clear channel of 2.5 metres (eight feet) down the centre when fringes of up to 500mm (20 inches) are present. In many cases these drains will have been widened by re-profiling to reduce bank steepness as a result of toe erosion in the past and may be wider than their original maximum designed capacity as a result. In such cases, leaving a fringe does not affect water management but does contribute to the prevention of further erosion.

Grass does not provide a good stabilising root structure right at the waters edge because it does not cope with the changing water levels; emergent water plants are best suited to this task. Sedge is one of the most important plants to encourage in this zone. Its dark green V-shaped leaves make it readily identifiable and in winter they form a protective curtain for the ditch margin. If sedge tussocks are regularly cut very short they can eventually be suppressed and replaced by less useful vegetation.

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A fringe left on a Warboys, Pidley & Somersham drain and right, a moorhen's nest in rushes at the margin of a ditch at Westwood Farm.

This fringe of vegetation also has a valuable role in preventing cut material sliding into the ditch where it could create blockages at culverts or de-oxygenation problems. In a flood event when water rises out of the normal channel, the fringe, especially the wider versions, will act as a comb, retaining the cut vegetation which would otherwise be swept into the channel. That ability to hold material that would otherwise add to the burden of material to be dealt with at culverts and pumping station grids is an under-rated benefit compared to over-rated benefit of keeping the channel sides completely clear of vegetation.

Exposed margins can lead to erosion and consequent bank edge undermining, especially where soils are poor. This marginal fringe can be cut when the drain requires maintenance to give the machine operator a view of the channel. Eventually a more stable plant community including sedges will succeed from the pioneering reed and this should be encouraged by not mowing it excessively short.

In some cases, leaving the bank top uncut is preferred, especially when game birds are being encouraged to nest. A regularly mown corridor is still a desirable feature here to provide the short vegetation next to cover that young partridge and pheasant chicks require for feeding and safety.

To provide increased vegetation age diversity, some bank sides should be cut on alternate years, leaving the other side un-mown. On many Middle Level IDBs this is now established practice and is carried out where late lifted crops such as sugar beet and potatoes prevent access when the contractor's machine is available to carry out the maintenance programme. In districts where MLC Operations Engineers are providing maintenance services, any fields with crops not lifted by 1st November will be left un-mown till the following year. It is more economical than transporting the machine back for a second time and the usual crop rotation means that the section can be accessed and mown in the subsequent year. Where two root crops are grown consecutively, the aim would be to ensure the bank is mown as normal during the second late summer/autumn. Reeds that are allowed to remain standing into a second spring and summer are significantly more valuable as a food source for species that eat invertebrates because the larvae that over-winter in the stems are available to species like reed warblers.

A moth larva over-wintering inside a reed stem. When reeds are cut on a two-year cycle this valuable food source is made available to many species that are dependent on invertebrates, such as warblers, bats and other small mammals.

Mowing is an opportunity to encourage the plants at the water margin that one wants to see thrive and discourage to channel invading ones like common reed that one does not. Ideally when sedge occurs naturally at the side of a drain it should not be mown short but left with its 'crown' intact. Common reed on the other hand can be mown short to inhibit its expansion. There are some situations when reed might be managed and left as a bank protection structure. Some boards have a very large differential between their maintained summer water level and their winter water level. The high summer level may be as a result of holding high levels for irrigation requirements but the seasonal difference results in a wide zone of soft bank margin being exposed to erosion from wind and wave action during the winter period. In these cases, it is worth managing the drain to allow reed to grow on a shelf created halfway between the summer and winter levels. It is one of the few plants that can cope with a wide seasonal range of water levels and a stand of reed can provide significant protection to soft fen soils both via its barrier of stems and in binding the soil with its rhizomes.

7.1.3 Mowing height

A District Officer may have a favoured mowing height based on his knowledge of his district's banks, the weather conditions at the time of cutting and the soil moisture deficit, or he may prefer to leave it to the contractor to use the cutting height they favour. Bank mowing maintains a dense, strongly rooted sward for bank protection. In some conditions a cutting height can be set so low that the sward and roots are damaged by scuffing to the soil. In hot summers, very short swards that expose bank soil to sunlight can contribute to soil cracking and slips. A slightly longer grass sward helps protect soil from direct sunlight and helps retain dew and existing moisture. In dry conditions consideration should be given to setting minimum cutting heights at 75mm to 100mm (3" to 4") the higher height being preferred in drier conditions. Special care should be taken on bank crests and toes and on light soils to ensure the mowing head does not scuff through the sward, opening it up for possible erosion.

A well maintained sward retains bank stability. Wimblington Combined IDB.

7.1.4 Health & Safety Cuts

Where leaving bank top vegetation uncut until mid July would present a safety problem to mower operators by hiding hazards it has been necessary to start bank top (and one swath down the side where necessary) cuts prior to the breeding season on MLC banks. This has not proved necessary on IDB banks where the bank vegetation does not grow sufficiently tall by mid July to require it. If it proves necessary the cut-off date for when these first cuts must have been started is 7th April. The time between H&S cuts will be judged to keep the vegetation sufficiently short to prevent it becoming long enough for birds to seek to nest in it. This would typically be at monthly intervals but could be longer or shorter because of seasonal variation in growing conditions. Operators should still be vigilant during H&S cuts and leave uncut any area where they suspect birds may be nesting.

7.1.5 The Main Cut

The main cut of the bank slopes usually starts after harvest from mid July onwards. Cutting prior to this date leaves the possibility of mowing the nests of birds with eggs or young. If boards wish to retain a short sward on bank sides throughout the summer the cutting programme must be commenced prior to 7th April and the sward kept short by regular mowing to avoid the possibility of mowing nests.

This main cut extends from the bank top to near the waters edge, leaving an uncut marginal fringe that is typically 0.30 to 0.50 of a metre (12” to 20”) wide. If bank mowing is being carried out before 7th September, leaving this fringe ensures that the nests of reed warblers that are likely to have young present until early September will not be destroyed,
infringing the Wildlife and Countryside Act that protects all nesting birds. Reed warblers usually have two broods per year and can still be feeding young in early September. As they typically site their nests above water, leaving a fringe of uncut vegetation at the bank bottom ensures that any nests are undamaged.

A reed warbler's nest, left, and a harvest mouse's nest, right. Both species build nests attached to tall vegetation. Reed warblers are nearly always in reeds over water at ditch edges, harvest mouse in long vegetation generally.

7.1.6 Mowing where ragwort is present

Common ragwort is a weed that grows where soil has been disturbed. It is one of five weeds covered by the Weeds Act 1959, legislation that is directed at plants that can threaten agricultural production. As a predominantly arable area, there are not many locations where IDBs may be mowing banks where stock have access but operators should be aware of the dangers ragwort present when cut. It is poisonous to grazing animals but it has a bitter taste so they do not eat it as a growing plant (unless starving when no other vegetation is available). It only becomes a problem to grazing stock if it is cut or sprayed. As a dead plant, it looses the bitter taste that deters animals from eating it but it still retains the poison that destroys the animals' livers. Horses, cattle or sheep will eat the dead cut or sprayed material as if it was hay. If enough material is consumed, damage to the liver is inevitable and the affected animal will suffer a slow and painful death.

It is essential therefore to take particular care when cutting or spraying ragwort to ensure grazing stock are not present or will not gain access to the area at a later date. Although it may look completely unattractive to stock, parts of ragwort plants can still be eaten by them up to eight weeks after cutting or spraying. The best policy is not to cut or spray ragwort unless there is a specific requirement to do so and then to take special precautions to ensure grazing stock do not have access to that land for the rest of the growing season. The best way to avoid problems with Ragwort is through the maintenance of a dense grass sward and to ensure that the sward is not damaged by mowing or grazing too short, especially in late summer. Further information from DEFRA is available at http://www.Defra.gov.uk/farm/wildlife/weeds/weedscontrol.htm

7.1.7 Diversity of Mowing Regime

Three different vegetation lengths as a result of a varied mowing regime. Well Creek.

A 'one size fits all' approach to mowing that produces a highly uniform result is the opposite of what is necessary to achieve biodiversity. On the banks of the main waterways the MLC have established a cutting regime that works well for practical, legal obligation and biodiversity reasons. The top and one swath down the side are cut early, before 7th April, as a 'health & safety cut', to maintain short vegetation that will give the machine operators a clear view of the bank edge when the main cut is carried out in late summer.

This is mown as often as required to maintain a short sward as required to avoid birds starting nesting in it where they might have their nests mown. The main cut on the side slope is carried out after 15th July when the nesting season for most birds has finished. The main cut stops short of the water margin leaving a fringe of vegetation at the waters edge. This fringe is only cut when the ditch is due to be slubbed out (de-silted) to allow the operator to see the channel.

Barn owls benefit from short to medium length grass swards, the length favoured by their main prey, voles and shrews

On the Middle Level river banks this cutting regime produces bio-diversity throughout the system because of the three different ages and structures of vegetation. The tops have short vegetation which is attractive to voles and shrews that in turn attract barn owls, kestrels and herons that prey on them. The sides are left untouched for most of the breeding season providing good cover for nesting ducks or game birds and habitat for insect life. The uncut margins at the bank toe provide more permanent conditions for many species including water voles, emerging dragonfly larvae, and a varied marginal plant community.

Bank mowing diversity. The un-mown side provides cover for moorhens and food for many other species via the invertebrates that over-winter in the reed stems.

The mown side allows herons and barn owls to hunt their prey.

Most IDBs only have one bank cut per year, usually in late summer after harvest. Increasingly, Boards are looking for opportunities to reduce costs and benefit biodiversity by cutting the sides of drains in alternate years.

Alternate side mowing examples, clockwise from top left, Ramsey Hollow IDB, Manea & Welney DDC, Euximoor IDB and March East IDB.

7.2 Bush and Tree Management

7.2.1 Bush Management

IDB BAP Otter Action Plan ref 1.1 Identify and maintain existing key bushes and trees near watercourses likely to be important for otters

Hawthorns and other bushes are used by a wide variety of wildlife, especially where they grow low and compact. They provide cover for game birds, roost sites for moorhens, food for blackbirds, fieldfares and redwings, nest sites for wrens, blackbirds and doves as well as a

habitat and food source for many insects. Kingfishers sometimes nest in the bank sides below their roots. With a small amount of work adding a structure at their base they will provide lying-up cover and even breeding sites for otters. Where brambles grow around their base the wildlife value is doubled.

As far as possible, the aim should be to manage scrub to allow it to be worked around to meet engineering and maintenance needs. By trimming the tops and sides of bushes on a rotational basis they can be kept to manageable size and be improved for wildlife value in the process. Flail mowing arms can be lifted over bushes that are less than three metres (10 feet) high so that is a good height to maintain bank side bushes at. Compact, low bushes provide better nest sites and cover than tall, leggy scrub and never become high enough to become top-heavy and a potential channel hazard. Where appropriate, cuttings and brashings from maintenance cuts can be used to maintain thick cover at the base of existing bushes to provide temporary lying-up sites for otters.

Bramble bushes are small islands of food and cover for a great variety of wildlife. If they are maintained as a habitat feature by occasional cutting to keep them compact and in control they will remain a very valuable feature for many years.

A linnet sings for its perch on top of a bramble bush. As well as providing well protected nest sites, brambles are a rich source of insect food for many species. A harvest mouse also found a site for its nest at the base of this bush.

With appropriate cutting equipment (reciprocating cutting heads leave a cleaner cut and better finish than flail mowing heads) scrub can be efficiently managed to contribute to the diversity within the District, as well as retaining attractive landscape and amenity value in the ditch side scene. In certain cases, where a line of bushes has grown that makes it impossible to access drains for maintenance, bushes will have to be removed to create access gaps for machinery but opportunities should be sought to replace trees or bushes elsewhere in more suitable locations.

7.2.2 Tree Management

IDB BAP Otter Action Plan ref 1.1 Identify and maintain existing key bushes and trees near watercourses likely to be important for otters.

IDB BAP Kingfisher Action Plan ref 1.2 Leave kingfisher fishing perches where possible (e.g. occasional branch).

Waterside trees are an important habitat for many species. They are also an attractive feature of the fenland landscape. With the open views of the fens, the few trees we have add a sense of scale to the big sky vistas. While IDBs have the power to order the removal trees in their bylaws, they also have the power to consent the planting or retention of them.

When the public become aware of tree cutting in progress there can be an adverse reaction because they see it as a loss to wildlife and the scenic attraction of the area. A policy of pollarding or coppicing instead of removal is one that will be positively received by the public when they are aware that the pollarding is being carried out to benefit wildlife and extend the life of the trees.

7.2.3 Pollarding

IDB BAP Bats Action Plan ref 1.2 Pollard suitable trees to provide bat roosts

Pollarding trees, especially willows, by cutting them off at about three metres (10 feet) high and allowing them to produce a crown of young branches, it transforms them into a very valuable habitat and a landscape feature. When pollarding is repeated at five to ten year intervals it ensures the trees do not become top heavy and gives them a greatly extended life. Pollarded willows were historically a typical element of the Fenland scene as they provided a renewable source of valuable materials including thatching pegs, hurdles and fuel.

A mature pollarded willow on the Hundred Foot Washes IDB. It will have been pollarded many times over the decades since it and others were first planted to mark the route across the flooded wash road.

Where standard trees are growing close to a waterway, they can be coppiced or pollarded in a way that allows management activities to be worked around them. Riverside pollarded and coppiced trees are particularly valuable as otter habitat as well as providing nest sites for ducks, owls and many other species. The aim should be to carry out rotational cutting at intervals of between five and 10 years to extend their lives without impacting on flood management.

Further details on pollarding are included in section 9.5 and a leaflet on willows and pollarding is included in Appendix 8.

7.2.4 Coppicing

IDB BAP Kingfisher Action Plan ref 1.2 Leave kingfisher fishing perches where possible (e.g. occasional branch).

Coppicing is the same activity as pollarding but carried out near ground level. It creates less habitat for wildlife than pollarding because the resulting coppiced stool is close to the ground and prone to disturbance. Coppicing is at its most valuable carried out within a woodland but in a fenland situation it can be used where one does not want a leaning tree to extend over a waterway but wish to retain it as a wildlife benefit. Because they can be managed at ground level coppiced stools are easy to manage and harvest for fuel.

Left. A recently coppiced willow near Benwick and right, a line of older coppiced trees on Well Creek near Nordelph.

8 Non-native and Problem Species Management

8.1 Non-Native Species

IDB BAP Drainage Ditch Action Plan ref 4.1 Report any sightings of non-native invasive species immediately to the Environmental Officer and control as appropriate.

8.1.1 Non-native Invasive Plants

Most invasive plants of waterways are non-native species that have been introduced and expanded their population to the detriment of other plant and animal species and the waterways they occupy. Seven of the most persistent species are listed here.

Aquatic Plants	Status in Middle Level waterways
Australian swamp stonecrop *Crassula helmsii*	Not currently present
Floating pennywort *Hydrocotyle ranunculoides*	Not currently present
Water fern *Azolla filiculoides*.	Present
Parrot's feather *Myriophyllum aquaticum*	Not currently present
Bankside Plants	
Giant hogweed *Heracleum mantegazzianum*	Present
Japanese knotweed *Fallopia spp*	Present
Himalayan balsam *Impatiens glandulifera*	Present

GB Non Native Species Secretariat (NNSS) identification sheets illustrating these seven species are included in Appendix 9 at the back of this manual. Early recognition of the arrival of these weeds will limit the amount of control required so District Officers and Board members should familiarise themselves with what to look for and remain vigilant.

Floating pennywort is probably the most likely species to appear in Middle Level drains. It is present in the catchment of the Cam and is the South Level. Early intervention is very important to control this plant, as it is with all invasive species. Report any suspect plants to the Environmental Officer as soon as possible.

Floating pennywort, *Hydrocotyle ranunculoides.*

A very damaging species to water management, angling, navigation and wildlife interests.

Photos: GB Non Native Species Secretariat

8.1.1.1 Azolla Control

Fortunately the Middle Level drains and ditches do not suffer from any of the above species to any great extent, apart from Water Fern*, Azolla filiculoides*. This floating North American water plant has a remarkable reproduction capacity and is able to expand exponentially until it completely blankets channels, cutting out light completely. It has been confined to a handful of locations until recently but 2011 proved to be a bad year for it late in the summer season, not just in this catchment but in many other locations.

It is very hard to control by mechanical methods or by herbicide but fortunately there is a host-specific weevil, *Stenopelmus rufinasus,* that eats it, and only it. It is possible to purchase batches of the weevil and release them on it as a control agent. The weevil also expands its population exponentially but it takes time to get the upper hand, two to three months, so it needs to be introduced as soon as possible in the season.

Left. Water Fern, Azolla filiculoides, covering a drain. Initially it looks green and can be mistaken for duck weed.

A closer view, right, shows the distinctive structure of the plant and its tendency to turn pinkish red.

Trials of Azolla control were started with the weevil in Hundred of Wisbech in 2011. Initial results look promising but conditions appear to have been vary favourable for Azolla growth in late summer so further distribution of the weevil may be required in other Districts in future if the conditions persist.

The weevils that control Azolla, Stenopelmus rufinasus, are tiny, just 2mm long, but have a great appetite for the plant. If the supply of Azolla runs out, they die. They are not able to survive cold UK winters.

8.1.2 American Mink

IDB BAP Drainage Ditch Action Plan ref 4.1 Report any sightings of non-native invasive species immediately to the Environmental Officer and control as appropriate.

IDB BAP Water Vole Action Plan ref 4.2 Carry out mink control as part of the Middle Level scheme and report all sightings to the Environmental Officer.

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As an alien species that escaped and was released into the British countryside, American mink caused a huge crash in the native water vole population. Unlike native weasels and stoats that the voles could escape from into the water, mink had an advantage for which their prey had no defence. They were just as at home in the water as the voles and a female mink could follow them through their burrows into the water. The Fens are a stronghold for water voles, compared to other areas of the UK. The extensive ditch and drain networks hold an important population but often in low density. In the past, when their numbers grew to a high level, mink found the concentrations and reduced them to a few individuals. Recent checks of water vole sites indicate that densities at 'hot spots' are increasing and the number of hot spots is also on the increase. The populations still remain vulnerable to fragmentation if mink numbers are allowed to expand.

To prevent mink from locating the water vole hot spots in IDB drains they need to be controlled. Mink are probably too well established over much of the country to ever eradicate them completely, but we can buy time for water voles that will allow them to evolve strategies that will ensure their survival. As a Biodiversity Action Plan species with a stronghold in the Middle Level drainage districts, water voles are one of the key animals IDBs can make a important contribution to by limiting the influence of its primary, non-native predator.

Fortunately mink are relatively easy to trap. The Middle Level Mink Control Scheme has been set up as part of the ML Water Vole Support Project. Traps and indicator/trap rafts are made available for landowners in a position to set and monitor them. Reducing mink numbers in late winter and early spring brings benefits not only to water voles but also all nesting water and game birds as well as poultry and fish stocks.

Details of the Middle Level Mink Control Scheme are at Appendix 5. Contact the Environmental Officer for the loan of traps and rafts or advice on trapping generally.

American mink, left, are non-native predators that our native water voles have not had time to evolve effective defences against. Controlling mink buys time for water voles to evolve effective defence strategies against them and to rebuild populations.

8.1.3 Other Non-native Species

8.1.3.1 Mitten Crabs and American Signal Crayfish

American red-clawed signal crayfish and Chinese mitten crab are both species that have been reported in main waterways around the Middle Level system. GB Non Native Species Secretariat (NNSS) identification sheets illustrating these species are available and included in appendix 9 at the back of this manual.

Signal Crayfish
Within the Middle Level system American signal crayfish have currently only been reported in small numbers from the Whittlesey area of Whittlesey Dike. This introduced species carries crayfish plague that decimates the native white-clawed crayfish where it occurs. They also out-compete the native crayfish by breeding earlier. The native crayfish species has not been recorded within the Middle Level system. American signal crayfish can cause significant damage to banks by burrowing and will eat fish eggs and the food they depend on. Great care in drying or disinfecting traps before moving to another trapping site is important to avoid spreading crayfish eggs or plague. Some types of crayfish traps have also been found to drown water voles. A licence to trap crayfish is required from the Environment Agency. Any sightings of crayfish should be reported to the Environmental Officer.

Chinese Mitten Crabs
As their name indicates, this invasive species originated in Asia but has spread rapidly and is now widespread in the rivers that flow to the east coast of the UK. In the Middle Level they have entered the system via Well Creek and have been recorded in IDB districts that take water from it such as Upwell IDB and Ladus DDC. Recently they have been reported from Whittlesey Dike, Ramsey High Lode and New Dyke so are likely to reach much of the Middle Level system eventually. In other catchments mitten crabs have proved very difficult to control. Potential problems include their ability to burrow into banks and undermine them and their effect on the ecology of waterways by competing with and preying on native species. At present there is not a national strategy for their control, probably because the task is economically untenable.

Catching mitten crabs for food has been promoted on several television celebrity chef programmes but some of the traps used have been found to drown otters. Crayfish trapping can only be carried out with a licence obtained from the Environment Agency. It is a legal requirement to have an otter guard fitted to traps with a net funnel entrance to prevent otter deaths. As the crabs can feed in quite polluted conditions, tests were carried out on the meat of mitten crabs from the River Thames in 2009. While the levels of organochlorines (PCBs, dioxins and dibenzofurans) in the meat of the crab were relatively high it was considered that it was unlikely that any individual would eat enough crabs to be a risk to health. The Food Standards Agency however advice is that girls and women up to child-bearing age should not eat excessive amounts of mitten crab.

This mitten crab was found in the weed screen of Cock Fen Pumping Station, Upwell IDB, in 2010.

Photo: Carl Nunn

Although the crabs spend most of their life in freshwater they return to the sea to breed. Anglers are usually the first to be aware of their presence when their baits are chewed off. Any sightings from new locations in the Middle Level should be passed to the Environmental Officer.

The web site http://mittencrabs.org.uk/ gives more information, a distribution map and the facility to report sightings directly.

8.2 Native Species Problems

8.2.1 Rats

Most rat problems near IDB banks are the due to the presence of a food source on the adjacent land and are therefore the responsibility of the land owner to control. Brown rats are easily confused with water voles and anyone considering control should be aware of the risks to this Biodiversity Action Plan species from rat baiting activities. A change in water vole legislation has made the killing of water voles illegal, either intentionally or accidentally.

A collection of freshwater mussel shells with rat droppings. Rats appear to have learned to dive for mussels, especially in winter when other food sources are limited along waterways. These shell piles are often seen at bridges and other locations favoured by rats.

Placing scatter-packs of rat bait, traps or bait boxes near water vole burrows or runs could lead to prosecution.

There are safe methods to control rats when water voles are present. The following recommendations are, with minor additions, from the Water Vole Conservation Handbook, Second Edition. They should enable IDB members or land owners who wish to carry out rat control to do so without fear of contravening water vole protection legislation.

- Always check for signs of water voles before controlling rats along watercourses, ditches, lakes, ponds or reservoirs. Rat holes often have a splay of soil at the entrance that is absent or minimal at water vole burrows. Seek advice if unsure of correct identification.
- Live-capture traps checked twice a day are the only safe option. Site in the open rather than in dense vegetation and not at the waters edge.
- Avoid the use of break-back/ snap traps. If used, place at least five metres from water, under cover and in a raised location.
- Avoid the use of poison baits to control rats where water voles are known to occur. Do not place poison in burrows. It is illegal to block or obstruct water vole burrows.
- Where no alternative is feasible, poison should be covered or enclosed in a bait box and placed at least 5 metres from a waterway. Avoid the use of poison grains or pellets. Use wax or soap blocks instead. If possible site the bait off the ground, as rats are more likely to climb than water voles. If a small gap is included that a rat will jump it will make it doubly safe as water voles rarely jump if they can avoid it. Poison bait is best dispensed around buildings where rats are more likely to be seeking food sources than near burrows in banks.
- Regularly inspect and monitor the control site, clearing away poisoned corpses. If any dead water voles are found, cease the control method in use immediately.

Carried out carefully, rat control may be beneficial to the local water vole population. They sometimes prey on young water voles, often evict adult water voles from their burrows if there is a local abundance of potato or sugar beet waste present and may also be a vector of disease.

The tail of a rat in the process of enlarging a water vole's burrow for its own occupation. The adjacent field had the residue of a sugar beet harvest on it, always attractive to rats. A sign of rat occupation is often a splay of soil outside a hole. Water voles dispose of soil via holes below the water level.

8.2.2 Rabbits

Any persons that are trained in rabbit and mole control methods by the use of approved gassing chemicals will be aware of the safety and environmental considerations involved. The precautions as set out above for rat control where water voles may be present equally apply for rabbit and mole control. Before using these 'Very toxic' compounds consideration must first be given to other methods of control which present a lower risk.

Particular care must be taken when undertaking rabbit control to avoid killing non-target species. For example, in the Middle Level area otters have been found using former rabbit burrows. As a consequence, all proposed rabbit gassing sites need to be checked for the possible presence of otters or other protected species by the Environmental Officer prior to the work being carried out.

Where rabbits have extensive burrows in light, silty soils it is easy to miss where badgers have come in and taken up residence in the holes. A ditching machine operator very nearly fell foul of badger protection legislation recently when he covered a rabbit hole at one end of a warren that had been taken over by badgers at the other end.

A badger tunnel that looked like a rabbit hole. This rabbit hole had been taken over by badgers. The usual arched shape to the entrance that indicates a badger tunnel was only visible further inside the hole and the usual badger bedding at the entrance was absent.

Shelducks are large coastal and estuary ducks that come inland to nest in the Fens. They are burrow nesters and usually seek gaps in straw stacks but their natural nest sites are empty rabbit burrows.

A female shelduck with young.

Operators must therefore be vigilant for any indications of interest in target sites by this large, white and chestnut brown duck with a red bill. They nest from early April to late July and the male remains in the general area. The presence of a shelduck in the vicinity of rabbit burrows will make it unsafe to carry out rabbit control measures there in the April to July period.

The optimum period for rabbit control is from mid October to mid March. Rabbit control should only be carried out during that period. No rabbit control should be carried out during the 1st April to July 31st period. Foxes and badgers can take over rabbit holes. It is illegal to control foxes by gassing and badgers are of course a protected species.

8.2.3 Moles

Mole control may be necessary if their activities present an actual threat to the stability or sealing of a raised flood bank. This is rarely the case as the clay core in most banks limits the extent of their digging. As some banks are Public Rights of Way or used as footpaths and dog-walking, very serious consideration must be given to the risks associated with the use of gassing chemicals. There is no antidote to Phostoxin (aluminium phosphide) one of the most widely used gassing chemicals and operatives must be trained and certificated in its use. The danger of domestic animals, farm livestock, non-target wildlife, children, anglers or other members of the public digging or exposing the location of the compound in the 48 hours it remains active must be considered. A Risk Assessment should be carried out and if any doubts remain the precautionary principle of non-chemical control should be adopted.

8.2.4 Badgers

As a protected species, with severe penalties for infringements, badgers can to be managed under licence if they cause significant problems at drainage ditches. Although measures to cull badgers as a means to try to limit the transmission of TB in cattle are being considered in dairy farming parts of the country, it is illegal to kill badgers in a effort to limit their activity at drainage ditches. Badgers are changing their habits from being a woodland species and are now routinely occupying open country sites in the Fens. They occasionally make burrows in the side of drains, usually in silt hills where the digging is easy.

Their activities can appear to threaten to create blockages on water courses by excavation of soil. Badger activity is at its peak in the spring and at that time it can appear certain that they will fill the ditch with soil by their regular excavation. This often turns out not to be the case when one returns later in the season. Badgers have a knack of perching the soil at the top of the bank and their burrowing activity greatly reduces later in the summer.

While badgers can excavate a large amount of soil they often manage to perch it on the side of drains without blocking them.

8.2.4.1 Sett Disturbance Defined

Management work that disturbs badger setts or holes must be carried out under licence from Natural England (NE). NE issued a clarification note in June 2009 on what constituted 'disturbance' in this case. If a working machine is passing over a badger sett, for instance a flail mower or a ditching machine, this is not judged to be disturbance and a licence is not required. Likewise if vegetation removal is being carried out, for instance cutting bushes or strimming grass near a badger sett, this is also judged not to be a permanent disturbance and no licence is necessary. It is only where the entrance to a sett is blocked, for example when re-profiling of the bank side is carried out, that a licence is required. Blanket licences from Natural England for this activity that cover all of the IDBs in the Middle Level BAP Partnership are held by the Environmental Officer and the Assistant Operations Engineer at the Middle Level Commissioners.

8.2.4.2Temporary Sett Entrance Blocking

When re-profiling a bank where badgers are active under licence using the temporary blocking method, a bag of straw with a rope attached is put in each sett mouth by the licensed person. The machine comes and re-profiles the bank and the bag is removed immediately afterwards. A report of each time and location where this has been carried out is submitted to EA annually. When re-profiling a bank, it makes sense to leave a small ledge below the holes so that when the badgers resume their activity, the soil they bring out does not immediately run down a straight slope to the ditch water margin but remains perched on the side. If a smooth slope is left it is more likely that any new soil excavated by the badgers will run down the face and start to block the ditch. While leaving a ledge may not look as neat it is a practical method of living with badger activity and preventing drain blockages. Increasingly, boards are not intervening where badgers do not threaten ditch blockage or bank stability and are only taking action where strictly necessary.

8.2.4.3 Badger Exclusion and Sett Collapse

If badger activity does present a significant threat to flood defence, licences can be applied for to Natural England to move them away from a site by fitting one-way excluder doors and collapsing the sett tunnels after there has been no sign of badger use of the site for 21 days. The period when this can be carried out is from 1st July to 30th November ensuring that the action is carried out outside the badger breeding season when small young are likely to be present in burrows.

Checks of the gates are required every two to three days to establish if there are still badgers inside the sett. (Tell-tale threads are stretched across the doors to indicate if they have been used). Only after all the gates have been unused for a continuous 21 day period can the burrows be collapsed. This process is a time consuming one. A specific licence for the site has to be applied for, there is no 'blanket' licence given in this case. If badgers prove determined to get back into their sett and burrow new holes, this process can take several weeks longer. Link mesh wire often has to be put around the doors to prevent badgers digging past them. Given that the badgers could set up home again in a new hole dug further along the bank, requiring the process to be repeated, the alternative of temporarily blocking the burrow mouth with a straw bag while the bank is re-profiled becomes a more attractive solution. This method has therefore only been carried out in the Middle Level where badgers have burrowed into a flood defence bank and thereby presented a danger of flooding.

A non-return door fitted to a badger sett entrance. Note the string across the bottom edge of the door. There is a similar string across the inside of the door. If the string is broken, indicating the door has been used, the count of 21 days of non-use starts again. Link mesh fencing has been added to prevent badgers digging in again.

Collapsing a badger tunnel under licence at Monks Lode. A clay core to the bank had confined their digging to the non-river side.
Their tunnels extended for 35 meters along the bank. After collapsing the sett, the badgers did not return.

To prevent badgers returning to the site, chain link fencing is pinned to a newly re-constructed bank on the Black Ham following sett collapse under licence. It will be covered by a thin layer of soil.

9. Species Management Projects

IDB BAP Action - Carry out specific actions for particular species, e.g. barn owls, bats, black poplars, kingfishers, otters, water voles and record the results.

IDBs have been quietly getting on with the job of managing water and keeping people's feet dry for centuries. The general public are largely unaware of this important but unsung activity. IDBs need to become more proactive in communicating what they do and why. The contribution they have made and will continue to make to biodiversity and conservation is a very positive message and needs to be presented clearly and with confidence. The vital day to day work that IDBs carry out and the benefits derived for biodiversity as a consequence goes largely unrecognised. In the following section examples of conservation projects are given that are relatively easy and inexpensive to carry out. Many of them, such as bat boxes, barn owl boxes and black poplar planting, not only create habitat for key species but the visible provision of it also is a message to the world at large that IDBs are 'doing their bit and more' for wildlife. The wildlife conservation element of IDBs' work is an aspect that will catch the public's attention and give them an insight into the important works generally that Boards carry out on their behalf.

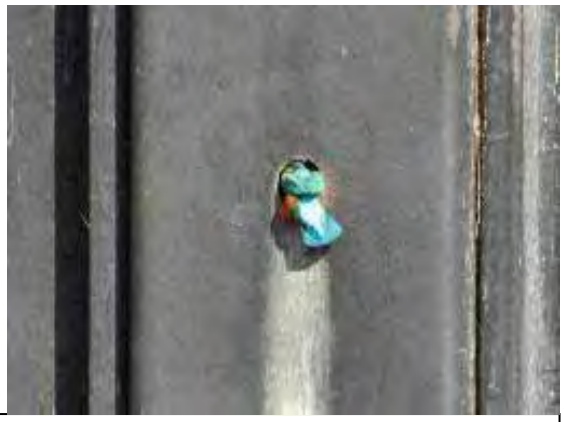
9.1.1 Create a kingfisher nest site.

IDB BAP Kingfisher Action Plan ref 1.1 Provide potential nest holes in sheet piles as per BAP Targets

IDB BAP Otter Action Plan ref 1.2 Leave kingfisher perches where possible

The kingfisher is a favourite bird for people to catch a glimpse of. Like the otter, it has difficulty in finding breeding sites in the modern fenland landscape. What kingfishers need is a miniature cliff with a vertical side that is at least two metres high and with water directly below it. It needs to have soil they can excavate to create a tunnel at least a metre long.

The article in Appendix 6 describes how a nesting opportunity can be created in sheet piling at a pumping station, often a favourite fishing site for kingfishers. Alternatively, a purpose built site can be created on a ditch side using wooden piles with holes at the correct height. In either case, advice and assistance is available from the Environmental Officer.



A 50mm hole drilled into sheet piles at the right height with a magnetic attaching drill can provide a kingfisher nest site if there is suitable soil behind it.

9.1.2 Stand-alone and Combination Kingfisher Site Creation

Where kingfisher sites are in danger of being lost or disturbed by unavoidable works, one of the mitigations that have been pioneered in the Middle Level has been the provision of stand-alone nesting opportunity sites. Sheet pile piers incorporating appropriately drilled holes with soil behind them have been constructed on drain margins. The piers do not extend into the channel or obstruct flow. They can also incorporate an otter holt.
Advice on the design, cost and construction of these 'combo' sites is available from the Environmental Officer.

A stand-alone kingfisher nesting site in the process of construction at Ramsey First (Hollow) IDB as part of pump replacement mitigation works. Fine silt is used as fill for tunneling in the area behind the 50mm holes in the sheet piles on the drain side. This design also incorporates an otter holt below the kingfisher nesting level.

9.1.3 Other kingfisher nesting sites

Kingfishers will seek out sites where ever they can find them in the Fens. The vertical

A kingfisher perches near its nest site on a Ransonmoor DDC drain. They look for vertical banks with water at the bottom and these sometimes occur below trees or bushes on fenland waterways.

waterside bank that they require is a rarity on fenland waterways. If at suitable site occurs it is worth trying to preserve it although the exposed soil is, by its nature, an impermanent feature.

On rare occasions kingfishers will use an existing tunnel or pipe, see below. The pipe that the kingfishers found in this case was larger than the usual 50mm diameter, closer to 100mm and not sloping upwards as is usual when they dig their own.

A pair of kingfishers found a drainage pipe underneath this busy A142 bridge over a Sutton & Mepal IDB drain and successfully raised two broods from it in 2011.

This bridge is has since been strengthened and changed but alternative nest site opportunities for kingfisher were provided in mitigation.

9.2.1 Bats and Bat Boxes

IDB BAP Bat Action Plan ref 1.1 Put up bat boxes at appropriate sites as per BAP Target

Some of the best feeding areas for bats are IDB drains. They are frequently bordered by reeds which are breeding sites for substantial populations of moths, bats' primary food.
Bat species most commonly associated with fenland are the noctule, the three pipistrelle species and Daubenton's bats. These species all forage for invertebrates associated with aquatic habitats. The town of March is known for its well studied colony of noctule bats. One of the largest bat species, it feeds on correspondingly larger prey which includes, the wainscot moth. This moth has part of its lifecycle associated with common reed. Radio tracking has shown that they travel regular routes to feed on particularly favoured drains.

Daubenton's, or the water bat, is a common species in the fens but its population size is probably limited by the lack of roosting sites. It will utilise trees, bridges and other structures but is rarely found in dwellings, other than churches. This bat is recognised by its ability to take insects off the surface of water, which it scoops up with its large tail membrane, transferring its prey to its mouth before flying to a feeding perch.

Natural roosts for bats include mature trees like willow and horse chestnut; species that undergo heart wood rot quite early in their lifecycle and are therefore attractive to bats and birds. Where possible, standing deadwood should be retained, but where this is not possible artificial roosting opportunities can be provided with bat boxes, either mounted to buildings or on a pole.

Taking advice from experienced bat experts, the boxes selected for installation as IDB BAP actions are panel boxes with roosting areas and entrance routes of varying size that offer sites for several different species of bat. The box is 700mm by 420mm, (27.5" x 16.5") and strongly made from sustainably sourced larch. No preservatives can be used on a bat box so the wood has to be good quality and thick to ensure the box last for many years. The box incorporates a section of slate that acts as a heat sink and provides a source of heat on cooler days. A bulk order price has been agreed with the suppliers, Conservation Constructions, and boxes are available via the Environmental Officer.

What is often lacking for bats are suitable breeding sites close to the abundant food supply along drains and ditches. Most boards are being asked to install bat boxes at suitable sites near their drains. The bat boxes could be attached to the outside of a pumping station or on a pole (not an existing electricity pole) in the same way as a barn owl box would be. All bat species are protected in the UK so some people are wary of providing opportunities for them to roost in case their presence hampers maintenance or repair activity. The bat boxes recommended for installation would be used as summer roosts only. They are not insulated enough to be used in winter. There will not be an issue if maintenance to the building is necessary that requires their temporary removal as it could be carried out during the winter when the boxes were empty.

Providing bat boxes is similar to installing barn owl nest boxes that also have specific legislation protecting them from disturbance. Farmers have been installing barn owl boxes very successfully for years without problems regarding the legislation that protects them so there is no reason why the same will not be true for bat boxes. If an unforeseen situation arises that would require the removal of the box during the breeding season in an emergency, arrangements can be made via the Environmental Officer with a licensed bat expert to deal with the issue.

Site selection is important if bats are to find the panel box in a location attractive for use. The site requirements include -

- A southerly facing aspect (southwest to southeast) that gets the sun for most of the day.
- Positioned as high as possible on the building, just below the eves.
- No lights on the side of the building.
- Ideally a concrete surface below the box to make it easy to check for the small bat droppings that indicate the box is in use.

A bat box sited high on the gable end of Mepal Pumping Station, Sutton & Mepal IDB

Ideally the box should be on or near an IDB drain. Not only is it close to the food source, it is also a permanent sign to the public that the IDB is making a practical contribution to conservation in its District.

This bat box is sited on a new stock building in Warboys, Pidley & Somersham IDB District

If a suitable site cannot be found for a box near a board drain, a member of the board may be in a position to offer a site on their property. It will still be considered as the board's box and count towards their BAP target, as long as it can be checked annually for occupation and reported on the Board's BAP actions report.

9.2.2 Providing natural sites for bats

IDB BAP Bats Action Plan action ref 1.2 Pollard suitable trees to provide bat roosts

A mature tree, especially a willow or black poplar is an excellent habitat for bats to roost in because they present many fissures, cracks and holes as potential sites for them. See the section on pollarding willows for more details.

This pollarded willow at the Hundred Foot Washes IDB provides not only potential roost sites for bats but also nest sites for ducks on the crown

9.2.3 Providing all-year roost sites

IDB BAP Bats Action Plan action ref 1.3 Identify potential sites for a bat hibernaculum

Bats need sites that they can use during the winter as well as the summer, called hibernaculum. Hibernation sites are difficult to create because the requirements for them are stable temperature, humidity and light levels but also ideally a range of those levels within the site. Some IDBs may however have potential sites where there is a disused culvert or inlet pipe present in the district. Converting one of these to a bat roost site requires a combination of specialist advice, practical application and enthusiasm.

If there is a potential site in an IDB District, the opportunity can be discussed with the Environmental Officer. Converting a site need not be a costly exercise, especially if local materials are available. Within the site, roosting opportunities can be created by attaching bricks converted to create the sites bats require.

An old inlet chamber could provide a potential hibernation site for bats such as this one at Pidley Pumping Station, suggested by Bob Wilmer, District Officer, Warboys, Somersham and Pidley IDB.

A Kingston house brick converted for use as a bat roost. Draft sealing strip around three sides forms a seal between the brick and the wall. Bats enter at the bottom where the end has been chipped off. A roofing nail acts as a hanger. Up to 10 Natter's bats have been found roosting in a single one of these bricks.

Photo: Conservation Constructions

9.3 Barn Owl Boxes

IDB BAP Barn Owl Action Plan action ref 1.1 Put up barn owl nest boxes in suitable locations

IDB BAP Barn Owl Action Plan action ref 2.1 Monitor nest boxes for use. Have occupied nest boxes checked for success by licensed barn owl ringers.

IDB BAP Barn Owl Action Plan action ref 2.2 Pass barn owl nest box information to local Environmental Records Centre via Environmental Officer

A barn owl hunting the margins of a Manea and Welney DDC drain.

Barn owls have a stronghold in the fens and most journeys after dark will eventually be rewarded with a glimpse of them hunting along the margins of roads and drains. Their continued presence in good numbers is due to fenland farmers putting up nest boxes for

them in very many sites and the availability of very many grass margin hunting territories along the sides of fields and drains.

Although barn owls are not a national biodiversity action plan species they are an iconic bird of farmland and still remain vulnerable in hard winters or in summers when their favoured prey, the short-tailed vole, has a bad breeding year. Putting up a barn owl box on a building is another means of indicating that the provider is active in contributing to wildlife conservation. In their BAP each drainage board has a target to put up one or more boxes. The Environmental Officer can assist in siting and erecting the boxes and has located a supply of well-made exterior and interior boxes that are good value for money. A supply of both type of box is held by the Environmental Officer and the installation of them at a suitable site in the district can be arranged with him.

External boxes are visible to the public view and owls use them without requiring access inside a building. A position where the entrance hole is not facing the prevailing south-west wind is preferred.

Internal boxes have the advantage that they last much longer than boxes that are exposed to the elements. IDBs do not tend to have barn-like buildings with open fronts but older pumping stations that formerly had diesel engines installed often have air bricks high in their walls. These can be converted easily for barn owl use by opening them up and fitting a box directly behind on the inside. When this is done it is important to ensure the box is sited low on the inside so that there is a ledge up to the exit hole. This ensures that young barn owls that are too young to fly do not make their way too easily to the outside and get nudged off onto the ground in the sibling rush when prey is brought in.

An air brick was opened up to give access for an internal nest box in Pidley Pumping Station at Warboys, Pidley & Somersham IDB.

An advantage of an internal box with direct access from the outside is that the site is very secure and there is no mess or droppings inside the building.

An external barn owl box sited on a former pumping station building at Glenhouse in Manea and Welney DDC District.

A well sheltered location under a redundant water tank proved a good site for this external box at Mepal Pumping Station.

If a site for a box is not available in or on a building, a tree site could be selected. Tree sites give more shelter than pole sites which tend to be exposed and are more often occupied by other species.

Photo: Peter Wilkinson

Barn owl boxes are sometimes positioned higher than they need be. In secluded sites three meters is high enough. A pair of barn owls very quickly adopted this box in Warboys, Pidley & Somersham IDB District.

A nest box design with 3 compartments – offering nesting opportunities for barn owls, kestrels and stock doves. As the entrance is low, a tray will be fitted on the bracket extensions at the front to prevent any young owls from falling from the box opening. This box sited at Haddenham IDB.

When putting up nest boxes they should be attached strongly and in a way that ensures it is safe to access them by ladder. Checks of barn owl boxes are important to monitor the success of broods and to further research projects and population studies. As barn owls a specially protected species, this must be carried out by experienced field workers and ringers licenced by Natural England and the BTO. Peter Wilkinson and Jake Alsop have the necessary licences and carry out these checks for the ML IDB Partnership barn owl boxes. If you have occupied boxes please contact the Environmental Officer or them direct so that the successes of the nest box provision can be recorded. Contact details are in the appendix.

9.4 Building an otter holt.

IDB BAP Otter Action Plan ref 1.1 Identify and maintain existing key bushes and trees near watercourses likely to be important for otters

IDB BAP Otter Action Plan ref 1.3 Provide otter holts as per BAP Target

Otters are slowly coming back to many parts of the country from a huge population crash in the 1950s and 1960s. In 2005 they were still largely absent from the middle of the Fens as breeding animals. The Middle Level Otter Recovery Project, funded mainly by a SITA Landfill Tax grant, has created over 60 otter holts (underground dens) and habitats (small clumps of scrub with a lying-up site in the middle) within the catchment. Many of these have been located on the rivers and large drains but some of the most valuable sites that may attract breeding females to raise young will be off the main rivers and in quiet, less disturbed drains. Over thirty of the holts have been installed in IDB Districts.

The underground holts are not visible when completed and they are designed to last 20 years or more. Many incorporate an infra-red video camera that allows periodic monitoring of the inside of the holt. The conservation of this charismatic animal is important and there may be further sites where an otter holt or lying-up site could be placed in a board's district. Advice and support on the positioning and construction of an otter holt is available from the Environmental Officer. A description of how to construct an underground otter holt is included at appendix 7.

Two types of otter holt in construction. Left, an underground one built into the side of a drain that will be covered and restored to its original profile and right, an above ground one that is being covered by logs from the adjacent coppiced willow.

9.5 Creating and Managing Pollarded Trees

IDB BAP Bats Action Plan action ref 1.2 Pollard suitable trees to provide bat roosts.

IDB BAP Barn Owl Action Plan action ref 1.2 Pollard suitable trees to provide natural nest sites.

Pollarding is the cutting of trees above head height to create a supply of younger branches from a crown that is above the reach of browsing livestock. It prevents the tree from becoming top-heavy and greatly prolongs its life. For the best conservation benefit, trees should be re-pollarded at six to ten year intervals. This allows the branches of the crown to grow large enough to provide the crevices between them that are particularly valuable to wildlife.

When pollarding for conservation benefit it is best to leave a little length on the stumps of the cut branches, rather than cutting them close to the crown. This helps to create the nest sites and cavities that are its valuable feature. It can also make access for subsequent pollarding easier. An example of leaving them very long on the left, a more typical example on the right.

Allowing the tree to grow longer than ten or 12 years without pollarding runs the risk of branches breaking away from the crown under their own weight. This can cause damage to the tree by bark stripping or splitting the trunk vertically.

In waterside locations trees may have been viewed as obstructions to access or as problems to be dealt with in the past, and in some cases that may have been the case. Trees can obstruct access for machinery when they grow in the wrong place but the occasional tree

growing in a planned location, at a site that does not impede access significantly, is worthy of conserving. In the Projects section of this manual the planting and management of black poplars is dealt with. Back poplars are our rarest native hardwood tree and in need of conservation and support.

Pollarding trees can improve access for channel management while at the same time as improving their wildlife value and life-span.

A mature pollarded willow is immensely valuable to a wide range of wildlife. Barn owls and little owls find nest sites inside its cavities, bats have roost sites in its cracks and hollows, mallard nest safely in its crown, and over 150 different plants have been recorded in pollarded trees in Cambridgeshire. They are a characteristic but vanishing part of the fenland landscape. Managed well, they grow to a great age, provide a source of firewood and are a symbol of mans ability to live and work with nature. A leaflet on willows and pollarding is in Appendix 8.

9.6 Planting Native Black Poplars

IDB BAP Drainage Ditch Action Plan action ref 5.1 Identify suitable sites and plant young black poplars as per BAP Targets

The black poplar is Britain's rarest native timber species. It is thought there are only about 7000 left in England and Wales. A recent survey found them at only 102 locations in Cambridgeshire. They favour sites along the edge of river banks and other low-lying areas. The tree is in decline and nationally rare.

Usually drainage boards seek to prevent trees becoming established at the side of their drains and will have a clause to that effect in their byelaws. Obstacles such as fences, gates, culverts, signs or water controls do however occur on drains and we manage to work around them. Finding two sites for black poplars somewhere on a large system should be possible without significant inconvenience to operations. An exception can be made in this case because as well as making an important contribution to the conservation of this species, they will become visible symbols of the board's contribution to local biodiversity and to conservation in general.

Many of the drainage boards in the Middle Level have the planting of two or more black poplars as actions in their Biodiversity Action Plans. It is important that the black poplars that are planted are truly native and not a hybrid. In other parts of the country black poplars have been hybrid-tested and DNA fingerprinted to establish their clone type before planting schemes have been established. This will be required for the Middle Level scheme and the

Environmental Officer will be in contact with the relevant boards when appropriate sources of stock are established.

9.7 Eel and Fish Support Actions

IDB BAP Eel Action Plan action ref 1.1 Install an elver pass at St Germans Pumping Station.

IDB BAP Eel Action Plan action ref 1.2 Identify barrier points where there is a need for an elver pass and consider opportunities for installation.

IDB BAP Eel Action Plan action ref 2.1 Devise and operate eel-friendly slow start-up methods at St Germans Pumping Station to allow safe passage of silver eels on return migration.

IDB BAP Procedural Action Plan action ref 2.1 Consult with the Environmental Officer when planning and undertaking capital works and choose the best possible mitigation solutions for biodiversity, e.g. fish-friendly pumps.

Eels are probably the most endangered biodiversity action plan species within the Middle Level IDB BAP Partnership's area because not only has their population declined to less than 5% of its former numbers, all the indications are that numbers are continuing to go down, not only in the UK, but throughout Europe. The reason for the decline is not clear, it could be one of several possibilities or a combination. Possible reasons include a parasite worm that affects their swim bladder, a change in the ocean currents that bring the young back from the Sargasso Sea, over-fishing of the glass eels and young elvers or the returning silver eels or the barriers man has constructed across their routes along waterways.

An elver being monitored on its way up a fenland river, having made its way across the Atlantic on ocean currents

Passage of eels and fish at barriers such as pumping stations and sluices are issues all Boards will have to address in due course as part of the Water Framework Directive and The Eels (England & Wales) Regulations 2009. The effect on fish passage of each barrier will have to be evaluated individually. The evaluations are beyond the scope of this manual and separate guidance will be available in due course. There are several documents on the subject on the ADA web site under the Downloads menu and the Technical Documents heading, see this link. http://www.ada.org.uk/downloads_guidance

9.7.1 Recording Eels

IDB BAP Drainage Ditch actions ref 1.1 Establish and maintain a management plan for routine IDB operations incorporating key biodiversity features.

IDB BAP Eel Action Plan action ref 1.2 Work with the Environment Agency to collect information on the status of eels.

There are actions that IDBs can undertake to benefit eels and fish in the course of their usual maintenance operations however. A basic action, given how scarce eels have become, is

simply recording in which drains they are present. All that is required is for ditching machine operators to make a note of ditches where they see eels coming out with the slub. These records should be passed to the Environmental Officer and will be added to the district's BAP Plan map as a record of the importance of the system for eels.

9.7.2 Conserving Eels

If a drain proves to have more than the odd eel in it and they are being brought out regularly with the slub, it is worthwhile making an effort to ensure as many as possible get back to the water. Nearly everyone will remember when eels were so numerous that the were regarded as the 'weeds' of the angling world, present everywhere and not very desirable. Now every effort should be made to conserve the stocks we have.

Some drains still hold eels of considerable size and age. If they are being brought out with the slubbings in any numbers, efforts should be made to ensure they are able to easily find their way back to the water. This might mean placing the slubbings closer to the drain in a position that allowed the water to run back towards it. Eels usually follow the flow so if they are able to follow it back quickly the period when they are open to easy predation by gulls or herons is reduced.

A pike found in the dredged slub of a Warboys, Pidley & Somersham drain being returned to the water by District Officer Bob Wilmer.

Some machine operators are able to return large eels or other fish to the water using their bucket skilfully and if they are prepared to carry out that action with their machine it should be encouraged where possible.

Ditch and drain maintenance can cause de-oxygenation and consequential fish kills even if the machine operator is aware of the danger. Conditions that can lead to it include where cut material is left in the water or if the maintenance is being carried out in hot or thundery weather and the drain bottom is disturbed.

If there are any signs of fish in distress near the surface work should be stopped immediately. The Environmental Officer should be contacted who will check the dissolved oxygen levels as soon as possible. If it is not possible to contact the Environmental officer, the Environment Agency should be contacted via their hotline, 0800 80 70 60, a free phone 24 hour service. In severe cases they may have to add hydrogen peroxide to immediately restore oxygen levels.

9.7.3 Other Protected Fish Species

9.7.3.1 Spined Loach

The spined loach is an important species of the rivers and drains in the Middle Level and other fenland areas. Spined loach is listed under Appendix 3 of the Bern Convention and is included under Annex II of the EC Directive on the conservation of natural habitats and flora and fauna. This nocturnal species spends much of its time at the very bottom of rivers and drains. The spined loach is a separate species from the more common stone loach and only occurs in rivers and waterways in eastern England, which were once connected to the Rhine. The Great Ouse, Witham and Trent once joined the Rhine and together drained down a vast valley that is now the Channel, reaching the sea somewhere west of the Isle of Wight. The spined loach's presence in both the Rhine and these English rivers is evidence that the North Sea was once dry land and part of a single giant river basin.

The fish has never spread beyond its original habitat and is absent elsewhere in Britain. It is found in Europe, North Africa and Asia and is being studied to find out whether these fragmented populations have evolved into sub-species, and what else their distribution and genetic make-up tells us about the distant past.

The spined loach is a rare protected species but locally it can be very abundant. Hundreds of specimens were found in one 25-metre stretch of the river Ouse in Bedfordshire, but the populations tend to be isolated because of lack of suitable habitat. The fish only lives three to four years, so rapid breeding is required for survival.

The spined loach is an attractively patterned fish, less than 10cms (4ins) long. Bottom dwelling and nocturnal, it is not often seen. It has a two-pronged spine in a pocket at the rear of each eye.

The spined loach thrives where there is a river or lake bottom of fine, organic rich sediment. During the day it half buries itself for protection and at night sieves the sediment, catching and eating small creatures and ejecting the sand and mud through its gills. Like all fish, the loach likes oxygen rich waters, but some slow-flowing rivers, canals, streams and ditches can be low on oxygen. The spined loach solves this problem by a special adaptation. It swims to the surface and takes a gulp of air, its gut being capable of absorbing oxygen into its bloodstream. Once the fish has removed the oxygen the depleted air is expelled as waste and the process is repeated, enabling the fish to breathe through its stomach.

A special licence and skill is required to catch these fish which elude anglers and most fish surveys because they are hard to net. Exact population sizes and their extent are not yet fully known, but despite its patchy distribution experts believe that against all the odds the spined loach population seems to be healthy, particularly in the Middle Level system and adjacent waterways.

A custom built dredge used by the Environment Agency to survey the bottom silt of waterways for spined loach under license.

Because they are hard to locate their distribution is probably under recorded in the Middle Level drains and ditches.

9.7.4 Fish Spawning Site Provision

Emergent and floating water plants growing in shallow water sites in drains and ditches are valuable courtship and spawning sites for many fish. See sections 5.2.3.2 to 5.2.3.4 for examples of shallow water site creation that will benefit fish productivity.

9.7.3 Illegal Eel Traps

Eel trapping may be attempted illegally without permission on IDB drains. All eel trapping must be licensed by the Environment Agency and carried out with the permission of the adjacent riparian land owner. Fyke nets are long tubular nets with funnel traps at either end, usually with a vertical guide net joining them into a series and set at the edge of drains or other waterways. They present a particularly lethal hazard to otters if otter excluder grids are not fitted. Excluder grids are a frame of black plastic with a cross in the middle that makes four squares each no larger than 90mm. This prevents otters entering the trap without restricting eels entering.

If eel nets are encountered in the course of operations and permission has not been obtained for their siting, their location should be reported to the MLC Environmental Officer immediately. If possible, check for otter excluder grids at the entrance to nets and for Environment Agency licence tags, a coloured disc that must be attached to every licensed net. If contact with the Environmental Officer or the EA is not possible, make a note of the exact location (put a marker stick in the bank if necessary) and leave the nets where they are. Report their location to the Environmental Officer as soon as contact is possible.

9.7.4 Illegal Fish Nets and Fish Removal

Because coarse fish, especially carp, have become increasing valuable the illegal netting of them has become more prevalent, even in small water bodies. The use of mesh nets for catching freshwater fish is illegal unless authorised by the Environment Agency. Any suspected incidents should be reported to them on their Incident Hotline number 0800 807060. Even if it is only evidence of a suspected offence that has taken place and the offenders are not known, it is important to inform the EA Fisheries Department at Brampton

so that the incident and its location can be logged and taken account of in future monitoring or actions planning. The Environmental Officer should also be informed.

9.7.5 Non-licensed Crayfish Traps

Crayfish traps that resemble a small fyke net are become more prevalent but have proved particularly lethal to otters in Cambridgeshire with six being drowned in them during 2007. They require permission from EA for their use and must be fitted with otter guards which are available from EA. Any sign of their use illegally should be reported to the MLC Environmental Officer as soon as possible.

9.7.6 De-oxygenation Signs

Any incidences of dead fish or fish in distress (gasping for air at the surface) should be reported to the Environmental Officer by mobile phone immediately. An oxygen meter for testing dissolved oxygen levels is held by the Environmental Officer. If these signs are related to management being undertaken such as weed cutting or pumping water to a low level the activity should be stopped immediately until levels can be checked. De-oxygenation is most likely to occur during hot conditions or during periods of thunderous weather. The latter weather conditions can produce an effect known as inversion, or water turnover, even when no management work is being carried out.

During thundery weather the weather can be warm and then cool down quickly resulting in the air temperature becoming lower than the water temperature. This can then cause the upper water level in the drain to become cooler than the water in the bed. As the warmth from the bottom of the drain rises, it can take organic matter from the bed with it. The fine organic matter suspended in the water decomposes causing oxygen levels to drop and fish to suffocate. In cases like this the steady introduction of oxygen-rich water to the area is the desirable action if it can be arranged. Early recognition of de-oxygenation problems by reporting fish showing signs of stress as soon as possible can allow action to be taken before the situation develops into a major fish kill. In severe cases the Environment Agency can use hydrogen peroxide to quickly restore oxygen levels.

9.8 Surveys of Key Species

IDB BAP Drainage Ditch Action Plan action ref 1.1 Establish and maintain a management plan for routine IDB operations incorporating key biodiversity features.

IDB BAP Water Vole Action Plan action ref 3.1 Set up a survey programme to monitor water vole populations.

IDB BAP Water Vole Action Plan action ref 3.2 Provide data on water voles to the local Environmental Records Centre.

IDB BAP Bat Action Plan action ref 2.1 Monitor bat boxes & ref. 2.2 Pass bat box information to the local Environmental Records Centre.

IDB BAP Kingfisher Action Plan action ref 2.1 Note sightings of potential breeding kingfishers and pass information to the local Environmental Records Centre.

IDB BAP Barn Owl Action Plan action ref 2.2 Pass barn owl nest box information to the local Environmental Records Centre.

IDB BAP Eel Action Plan action ref 1.2 Work with the Environment Agency to collect information on the status of eels.

The adopted drains and waterways managed by the IDBs in the Middle Level BAP Partnership extend to over 700 miles. We know that as well as performing a vital role in flood defence and water management, they also form important habitats for a range of wildlife. The distribution of some of this wildlife is better recorded than others. The water vole is a good example of a species that has thrived in many districts because the sympathetic maintenance regimes insured its continued presence. They are a success story for Middle Level IDBs (in spite of the predatory activities of introduced mink) but there are many other species living in the system's waterways that remain unrecorded.

The scale of the area to be surveyed is clearly too large for one individual to take on, even if they had the necessary expertise to identify all the different birds, mammals, plants, reptiles, amphibians, invertebrates and other wildlife that are likely to be present. Fortunately there are individuals and organisations with specific interests that may be prepared to carry out surveys of selected areas within districts to further the knowledge in their particular area of interest. This is likely to happen gradually with some areas receiving more attention than others but gradually the map for each IDB BAP will have information added to it that will indicate the importance of IDBs for wildlife.

Boards need have no fear that if some interesting or rare species is located it will mean their management for drainage purposes will be inhibited. Whatever the species is, it will be there because of the management regime that has been practised by the board for decades. Its continued success will depend on that same management being maintained. Knowledge of the importance of drains and ditches for wildlife will benefit both drainage and wildlife interests.

It will largely be the Environmental Officer's responsibility to find suitably experienced surveyors to look at key species in IDB districts but it may be that board members are aware of someone with a special interest locally that might be prepared to carry out an informal survey of their particular interest group. We need to be safety aware, especially if the surveyor is working alone, so a Risk Assessment will need to be carried out and relevant landowners contacted beforehand, to advise them of the activity as a matter of courtesy.

The local Wildlife Trust is a good resource for locating experienced surveyors or just people with particular species interest. The various organisations that represent particular wildlife interests will also have knowledge of experienced field workers in their sphere. A list of them is included in the Useful Contacts List, Appendix 2.

As part of the support for the Middle Level IDB BAP Partnership, a series of locally organised courses on the identification of the animals, plants, dragonflies and other wildlife of fenland ditches and drains are being considered for IDB members and other interested individuals, if there is sufficient interest.

Right to left, Alice Ward-Francis, Yuping Chen and Sampsa Leather carrying out a water vole survey by canoe in Ransonmoor DDC District in 2010.

Dedication

Sampsa, (Sam) Leather died suddenly on 23rd December 2010 aged 37. During the brief time I knew him it was clear his enthusiasm for wildlife and its conservation, his kindness and his positive attitude to life was an inspiration to everyone who met him. This guide is dedicated to his memory.

Cliff Carson