5 Wetlands habitat action plan

5.1 Wetland habitats

5.1.1 Summary

The term 'wetland' covers a diverse range of habitats. Within Hertfordshire alone this includes rivers, streams, springs, water-cress beds, ponds, lakes, reservoirs, sewage works, marshes, fens, swamps, wet grassland and carr woodland. These wetlands are hugely important for both wildlife and people. Many of the wetlands of Hertfordshire, especially open waters, have been created by human activity. In fact, all wetlands within the county have been influenced by human activities to some degree. In many cases this is due to the range of benefits they have provided. Over the centuries wetlands have supplied food, drinking water, power, transport and leisure opportunities as well as their natural purifying and flow regulating functions.

All wetlands are characterised by the presence of water; static or flowing. Differences are based on the degree of wetness, flow rates, the underlying geology, water chemistry and historical management. This first section describes the main forms of wetland habitat. However, it should be recognised that there are considerable overlaps as one habitat grades into another. For example, a floodplain wetland may include river, open water, marginal swamp, fen and carr, all in close proximity. A floodplain grassland may simply be described as wet grassland or it may merge into fen or neutral grassland habitats. The close association of these habitat types will be evident within this plan.

5.1.2 Wetland ecology

Rivers, streams and springs

Rivers and the corridors of land through which they flow are a major wildlife resource of critical importance to wetland habitats. Most of the county's wetlands lie within these river corridors. Rivers are not only important for the wildlife they directly support within the channel but also for the influence they exert, from spring source to floodplain, on the plants and animals of adjacent habitats. Unconstrained rivers spill onto floodplains and inundate habitats on a regular basis, allowing the development of wet grassland, marsh, swamp, fen and carr woodland. These natural functions of river systems bring huge benefits to human society.

However, few rivers have not been physically altered by human activities. Engineering works with the aim of reducing problem flooding or improving land drainage can also have serious adverse environmental effects, leading to degradation both of the main channel and adjacent habitats. Such works tend to hydrologically isolate the river from its floodplain habitats. Rivers relatively unaffected by these activities are a particularly valuable wildlife resource.

The key characteristic of river and stream habitats is that they have flowing water, transferring minerals and nutrients from the source to the depositional site. River habitats can be remarkably diverse and include such wide-ranging features as springs, seepages, brooks, bournes, meanders and ox-bows. When relatively unmanaged they are dynamic systems and have a diverse and continually changing physical structure with pools, riffles, eroding banks, secondary channels, backwaters and fringing marsh. River channels in their natural condition vary widely in form from straight to meandering and braided (multi-channel). Several factors control the physical processes within rivers and hence their structure. These include volume of water, flow rate, amount and type of sediment and the bedrock. Channel size and form is determined partly by flood peak flows, which affect erosion and channel-shaping sediment transport. Rivers have been described as belonging to one of three zones in terms of these processes. The upper or *source* area is the main sediment production zone, characterised by valley slopes impinging directly on to the river channel. In the middle or *transfer* zone the river redistributes

sediment from upstream. Here the river typically has a wide floodplain. Estuaries form the lower or *depositional* zone. The range of substrates found within the upper two zones, together with the hydrology and water chemistry, determine the habitat characteristics of the river.

The mosaic of features found in rivers and streams supports a diverse range of plants and animals. In-channel riffles are spawning areas for fish while gravel bars are important for specialised invertebrates such as some beetles and spiders. Eroding banks provide nesting sites for birds such as Kingfishers. Backwaters are important for fish, birds, invertebrates and amphibians as well as plants. Rivers and streams often provide a wildlife corridor link between fragmented habitats in an intensively farmed landscape.

Rivers may also be classified on the basis of their plant communities. In Hertfordshire all are typically lowland rivers with low altitudinal sources, low gradients and fine/rich substrate. These lowland rivers are subdivided, with both chalk and clay river types being present in Hertfordshire.

Chalk rivers have a characteristic plant community, often dominated in mid-channel by Water-crowfoot and Water Starwort. They have low banks which support a range of water-loving plants. All chalk rivers are fed from groundwater aquifers, producing clear waters and a generally stable flow and temperature regime. Most have 'winterbourne' stretches in their headwaters. These often run dry in late summer because of a lack of rainfall recharge to the aquifer, in some cases exacerbated by over-abstraction. There are approximately 35 chalk rivers in the UK, ranging from 20 to 90 km in length. The majority of the European resource of chalk rivers is found in southern England (Biodiversity: the UK Steering Group Report).

Clay rivers are more prone to fluctuating water levels and typically have deep silty sediments. Characteristic plants include Arrowhead and Yellow Water-lily.

Open water

Open waters include all freshwater systems comprising standing water or waters lacking any dominant flow. The immediate associated wetland habitat is also included and there is much cross-reference to the sections on swamp, marsh and fen, wet grassland and carr woodland.

The range of open water habitats in the UK includes lakes, ponds and ephemeral pools with a wide range of both natural and human origin, as well as gravel pits, reservoirs, sewage treatment lagoons and floodplain wetlands such as backwaters and temporary flood pools. Natural open waters are relatively common in the uplands but scarce in lowland England, where the majority of such habitats are of human origin.

The wide range of open waters makes a significant contribution to national biodiversity and reflects their various origins, functions and management. Open waters can be remarkably rich in plant and animal life. However, many sites fail to reach their natural potential due to such factors as pollution, lack of water and poor management. Some open waters are important for human use, for example, water supply, power generation and recreational activities such as angling and sailing. Those open waters that fulfil their biodiversity potential may well perform such functions better and more economically than habitats which have been degraded.

Certain open water habitats have suffered large losses or reductions in biodiversity. Floodplain wetlands have particularly suffered due to the impoundment of rivers, severing their hydrological links with the floodplain – vital to the open waters dependant on such a water supply. Smaller open waters have also suffered; between 1880 and 1993 the number of ponds in Britain declined by 75% from an estimated 1.3 million to 375,000. By contrast, some open waters of a different kind have been created, notably reservoirs, gravel pits and garden ponds. Although this will not compensate for the losses, if managed sympathetically such waters can make a significant contribution to biodiversity.

Fen, marsh and swamp

Fens, marshes and swamps consist of a range of similar habitats, all largely transitional between open water and dry land. Fens develop where water-logged conditions with a low oxygen concentration persist throughout the year, promoting the accumulation of organic matter and the formation of peat. Water level

management, to ensure occasional flooding, and water quality are important in determining their conservation value. Fens tend to be base-rich and have moderate to high levels of nutrients. They are particularly characteristic of areas with chalk or chalky boulder clay.

Swamp is characterised by the water table at or above ground level for most of the year and has a relatively poor floral diversity often dominated by a single species of tall fen vegetation, such as Common Reed, sedges or Greater Reedmace. Swamps characteristically have wet peaty sub-soils, composed of decaying plant remains.

Marshes form on a mineral substrate where water levels are at, or close, to the soil surface in summer and rise above ground level in winter. The term 'fen' is frequently used generically to cover all these related habitats.

All fens inevitably change as the decaying remains of the vegetation build up and the land dries, allowing a more terrestrial community to develop. They are usually maintained at this successional stage by grazing or cutting and in the past were important in the agricultural scene.

Swamps, marshes and fens are widely distributed throughout the UK but the majority of sites are small. An estimate of the total area of all fens is not currently available. However, reedswamp dominated by Common Reed is a scarce habitat in the UK. A recent survey estimated the national total to be around 5,000 hectares. It is estimated that between 1979 and 1993 reedswamp in the UK has declined by 5-10%.

The National Vegetation Classification (NVC) recognises a large number of associated swamp, marsh and fen communities. In Hertfordshire at least 15 different community types are likely to be represented (see Appendix 3).

Wet grassland

Wet grasslands are to be found where groundwater levels are close to, but not permanently at, the surface and where the grassland is affected by seasonal flooding. They form the typically flat permanent grasslands and fen meadows of river valley floodplains, often with a network of water filled ditches containing standing water. Such sites are typically flooded during winter and spring but can dry out considerably during the summer. Wet grasslands have been created by people as part of a traditional livestock farming system, with grazing by cattle creating and maintaining a habitat rich in plants and invertebrates. Wet grasslands provide breeding habitat for wading birds such as Snipe and Redshank while winter floods can attract huge numbers of wildfowl.

The flora will depend on the exact degree of wetness and the management history. Such grasslands will often be comprised of mosaics of several neutral grassland communities grading to swamp communities on sites with higher all year water levels. The richer sites include some of our finest traditional hay meadows. With this range of possible plant communities there is considerable overlap between wet grasslands and other habitats. Thus the botanically rich habitats are described under the neutral grasslands action plan (see Chapter 7), those botanically poorer grasslands most associated with flood inundation are dealt with in this action plan.

The extent of wet grasslands in the UK is unknown although damp pastures dominated by Yorkshire Fog Grass, rushes and Tufted Hair Grass are widespread. Only around 2000 hectares of the more unusual Creeping Bent Grass and Marsh Foxtail dominated pasture are thought to exist. Although some wet grasslands are widespread, few areas are managed optimally and in general there has been substantial decline in the associated plants and animals.

Carr woodland

If natural succession in swamp, marshes or fens is allowed to continue, colonisation by shrubs and trees will occur to form a variety of woodland types. Where the key environmental factor remains the over-riding wetness of the ground they are dominated by Alder or willow trees and as a group they are often termed 'carr' woodlands. The floristic composition is determined by the degree of wetness, the nutrient status, the base-richness of the soils and past management. They often develop from swamp, fen, or marsh, but in time, such woodlands will themselves inevitably succeed to drier communities.

There is no estimate of the extent of carr woodland nationally although they are scattered or locally distributed with the best examples of species-rich communities found in East Anglia. Seven types of carr woodland are recognised nationally, four are present in Hertfordshire.

Scope of this Action Plan

With reference to *Biodiversity: The UK Steering Group Report*, this action plan covers five of the listed broad habitat types, namely: Rivers and Streams; Canals; Standing Open Water; Grazing Marsh; and Fens, Carr, Marsh, Swamp and Reedbed. The priorities for habitat conservation in Hertfordshire are evaluated in an earlier section of this document and are reflected within the Vision and Targets section of this plan.

5.2 History of Hertfordshire's wetlands

There can be little doubt that Hertfordshire is now drier than it has ever been. The lower stretches of most rivers, notably the Lee and Colne, would have supported extensive wetlands in the past. Areas of wild marshland, natural swamp and riverine forest were slowly reclaimed to damp floodplain pasture, hay and fen meadows, mainly by felling and grazing, but also by mowing, drainage, sedge cutting and other activities. Even until the last century most of the river valleys remained as seasonal grazing marshes (frequently flooding in winter), hay meadows, or wet woodland. The richness of these areas in plant and animal life can only be imagined.

Archaeological evidence shows that river valleys have been extensively used by humans. Widespread settlement along river valleys is known to have occurred back into prehistory. Early peoples obtained water and food from the river and used it as a route for communication and transport. Early attempts to control rivers are shown by millstreams, fishponds and initial attempts at canalisation. All the county's small rivers and streams had flourishing mills by the Middle Ages. Larger rivers such as the Lee provided a trade route into London. The importance of this trade route was such that the Lee Navigation Act was passed in 1739 and subsequently the canalisation of the lower Lea changed its character forever.

Watercress beds were established along many of the chalk streams, particularly on spring sources. Many were within a day's cart travel of London. The flooding of the river valleys was a desirable feature for many years, with winter flooding bringing fertilising silt to valley grasslands. These hay meadows were highly valued, providing winter feed for animals. It was only after the design of improved grass strains and artificial feeds that the system lost its economic value and a large decline in hay meadow habitat occurred as they were ploughed, re-seeded or lost to the developing aggregate industry. In some valleys, notably the Lee, Colne and Gade, this winter flooding was part of a carefully managed water meadow system. Some plants are characteristic of such systems.

Hertfordshire's rivers have undergone many changes over the years, the majority of which are seen as detrimental to their ecology, These changes still continue today. Past river 'improvements' for agricultural drainage and urban flood alleviation have led to a massive destruction of wetland habitats. Increased run-off of nutrients and silt can also occur when fields are ploughed to the river edge, and many rivers have been physically altered by straightening, deepening, widening or diverting. Long sections of the major rivers have been impounded for navigation. This includes the Lee and Stort navigations. In addition the Grand Union Canal passes down the west side of the county following the valleys of the Bulbourne, Gade and Colne from Tring to Rickmansworth. More recently, low flows in rivers during the summer months, widely suspected to be due to over-abstraction of water (and proved in some cases) has had serious effects. All these works have acted to severely reduce habitat diversity and more importantly to isolate rivers from their floodplains and associated wetlands.

The formerly extensive Boulder Clay marshes and fen meadows, rich in wild flowers and reminiscent of East Anglian Fens, are now restricted to a few sites, all

struggling to maintain their integrity. Improved drainage, over-abstraction of water, urban development and, most significantly, conversion to arable farmland have all reduced these wetland areas. The effect of all these has been a lowered ground water table over the last 100 years or so. It has resulted in a massive loss of wetlands, especially in central and southern Hertfordshire.

Carr woodland would have been managed in the past for its renewable resources of willow for baskets, alder for charcoal, water resistant poles and bark for tanning leather. Many were managed, often intensively, as osier or withy beds with carefully controlled water levels. The associated crafts such as basket making flourished in several areas. Today the equivalent is the cricket bat willow plantation, sadly often being the reason for the retention of the last remnants of more extensive wetlands but at the same time steadily drying it out.

Thus extensive wetlands are now a thing of the past. A study in the parish of Ashwell records wetland habitats as suffering more than any other, with no less than 41% of the wetland plants recorded in the parish now extinct. In this small part of Hertfordshire wetlands are now reduced to a few ponds and springs, some ditches and badly degraded streams (T James 1992).

Large areas of natural open water by and large vanished many years ago, lingering on in the form of seasonal flooding in river valleys. Ponds, long part of the agricultural scene, began a steady decline to less than 50% of the former total due to changes in agricultural practice. Early in the 20th century open water in Hertfordshire must have been at its lowest ebb.

All this paints a rather depressing picture but there are glimmers of hope. During the latter half of the 20th century there has been a steady increase in water-filled gravel pits and such pits are now a common feature of our larger river valleys. These pits have brought many wildlife benefits, largely by chance. The early stages of gravel winning with open habitats, muddy edges and gravel islands allowed many plants and animals of disturbed ground conditions to flourish. Such species may well have formerly been much more widespread when river systems were far more unpredictable. Birds such as Little Ringed Plover and Sand Martin may be the more obvious beneficiaries but a whole range of specialised invertebrates and plants have also benefited. The expansion of mineral workings has allowed an increase in marsh and swamp habitats in certain areas. Reedswamp is probably at its greatest extent for several centuries. Such sites also provide opportunities for leisure and recreation. Here then is a great opportunity to redress some of the balance and create new wetlands for both wildlife and people. However, with most major sites already worked for gravel and restored, any such opportunities will need to be grasped soon.

5.3 Wetlands – current status, trends and threats

5.3.1 Current status

Rivers and streams

The major river systems in Hertfordshire originate as chalk streams emerging along the foot of the dip slope of the Chilterns and flow south to feed into the lowland clay river systems of the Colne and Lee. To the north of the Chilterns a few small rivers drain into the Ouse system. A total of 1258 km of watercourse are marked on the latest ordnance survey map. However, the Hertfordshire Habitat Survey 1994-97 found that only 730 km had held water in the recent past.

Quantitative data on Hertfordshire's rivers are fragmentary, with the 1978 Nature Conservancy Council survey providing some information. Of the 240 kilometres of main river only about 20 are of good habitat quality. In addition, at least 70% of the total length of watercourse in the county was considered to be heavily degraded.

Chalk rivers are listed as a key habitat within ‘Biodiversity: The UK Steering Group Report’ and also support species, such as White-clawed Crayfish, which are listed on Annex II of the EC Habitats Directive. Few of Hertfordshire's rivers now retain their chalk stream characteristics. The combined effects of over-

abstraction, road and agricultural run-off and sewage effluent discharge has resulted in most rivers now suffering from low flows and over-enrichment from nutrients and pollution. A few stretches of relatively unpolluted chalk river do exist and are of high conservation importance. The characteristic species of our chalk rivers include the Stream Water Crowfoot and Water Starwort. The severely threatened White-clawed Crayfish hangs on in a few locations. Better areas are as follows:

The Mimram is one of the most natural rivers in the county, being least affected by abstraction and discharges. It is fed by chalk springs and flows mostly through agricultural land. Its middle and lower reaches (7 km) flow through several important wetland habitat complexes such as at Digswell, Tewinbury, Archers Green, Panshanger and Hertingfordbury. Another stretch between Kimpton Mill and Fulling Mill is also valuable (4 km).

The Chess has considerable wildlife value throughout its length (8 km), with clean water supporting an abundance of aquatic vegetation. Several good damp meadows, such as at Frogmore and Sarratt Bottom, can be found along the river.

The small chalk rivers flowing north through Hitchin are in general much degraded due to over-abstraction and urban development but the few remaining associated wetlands are of great importance. **The Purwell** perhaps remains least affected and has particularly valuable river corridor habitats through Hitchin (2 km). **The Oughton** still retains a characteristic flora where it flows through Oughtonhead Common (1 km).

In addition sections of the rivers **Ver** and **Gade**, although degraded to some extent, still have important wetland habitats within the river corridor.

Of the more typical stretches of lowland clay rivers few of Hertfordshire's rivers now show anything like natural features. The better reaches are as follows.

The water chemistry of the **River Lee** is heavily influenced by discharge of treated sewage effluent from Luton and Rye Meads. However, some stretches retain reasonable structure and associated flora, these are at Wheathampstead-Water End (3 km), Lemsford-Stanborough (3 km), Water Hall-Hertford (3 km) and Ware-Stanstead Abbots (2 km).

The Beane retains valuable features only in its lower reaches between Waterford and Hertford (4 km).

The Stort The canalised main river is now severely degraded but the backwaters retain much of value, with the Pishiobury loop of special significance. However, the river corridor remains a key wetland complex with many important individual sites, notably Hunsdon Mead, Sawbridgeworth Marsh, Thorley Flood Pound and Tednambury Marsh. These wetlands depend on water supply from the Stort and thus the entire stretch of river between Bishops Stortford and the confluence with the Lee (15 km) is important.

On most rivers artificial features such as weirs, millstreams and millraces have been constructed in the past. These are in general damaging to the river's natural character, alter the gradient of the river and may prevent movement of species. However, to a limited extent they may also add diversity to the river in a county which tends to lack similar natural features. Most Grey Wagtails in Hertfordshire nest on or by such features and ferns are also well represented in such situations.

Seasonal streams and swallow-holes

Seasonal streams and clay-based brooks are a feature of south-eastern Hertfordshire in particular. These small watercourses generally exhibit diverse channel structure with pools, riffles, banks and meanders. They are normally dry in summer but are frequently in spates during winter and spring. The best examples flow through the Broxbourne and Northaw woods complexes. Others are to be found scattered throughout the county, for example The Old Bourne near Ardeley. A particular feature of note is the development of swallow-holes, caused by water percolating through gravels to reach the chalk beneath. Notable examples (both SSSI's) exist at **Northaw Great Wood** and **South Mimms**, the waters of the latter reputedly rising at Chadwell Springs near Ware.

Springs

Springs in Hertfordshire derive from two basic origins. Chalk springs have a high pH, low suspended solids, low nutrient status and a stable low temperature. Such springs frequently form the beginnings of chalk streams. Some have multiple sources, forming a mosaic of stream and fen habitats. The best examples occur at Purwell Ninesprings, Oughtonhead and Tewinbury. Some chalk springs provide habitat for specialised coldwater invertebrates:

Ashwell Springs and Ashwell Quarry Springs These sites are important for flatworms, caddis-flies and stoneflies typical of cold waters and generally scarce in southern England.

Flush-line springs arise from the junction of impervious clay and overlying permeable substrates. They are most frequent in the east and south of the county in association with Boulder Clay or London Clay. Such springs often support a rich fen flora. Unfortunately few examples with the associated habitats remain intact. Those that do are of great importance. The best examples are at **Patmore Heath**, **Blagrove Common, Ridlin's Mire, Sandon Moor, Biggin Moor and Moorhall Meadows.**

Three sites show tufaceous deposits at the spring source, such sites are important for their moss community and can support an unusual floral community. Tufa springs are listed as a priority habitat in the EC Habitats Directive.

Hebing End Tufa Spring Ash woodland over calcareous tufa spring with Tussock Sedge and Opposite-leaved Golden-saxifrage.

Foulwells Calcareous spring with some tufa formation in grazed marshy grassland supporting scarce sedges and spike-rushes.

Trenchern Hills Spring sources within woodland.

Watercress beds

Watercress beds are a result of human activities and were frequently excavated in the area of chalk spring sources. Formerly quite extensive, active beds now survive only at Sarratt Bottom, Kimpton and Whitwell. Former watercress beds now managed to retain and enhance their characteristic wildlife importance are as follows. Both examples demonstrate community involvement in their management.

Lemsford Springs Long-established nature reserve with spring-fed lagoon management and a rich diversity of wetland species. Notable for wetland birds, especially important for Green Sandpipers.

Cassiobury Park Two sites, both under conservation management. An older area now succeeding to wet woodland and a more recently worked area of open lagoons.

Open water

In Hertfordshire it is estimated that there are currently 623 hectares of open water greater than 0.3 hectares in extent. All large areas are man-made. The range of open water habitats in Hertfordshire includes lakes, ponds, mill pools, gravel pits, reservoirs, sewage treatment lagoons and floodplain wetlands such as backwaters and temporary flood pools.

Ornamental lakes

The oldest man-made waters in the County are those associated with landscaped country estates, large old houses or agriculture. Broadwaters, where rivers flowing through estates have been widened to form a large water feature are frequent. These broadwaters resemble lakes more than rivers in their ecology. Examples occur at **Brocket Park**, **Woodhall Park**, **Panshanger Park** and **Hatfield Park**. Most are very poor ecologically, being heavily silted as a result of the slowing of the river flow and the margins frequently over-managed for sporting or other recreational purposes. Ornamental lakes are also scattered across the county but are particularly frequent in southern Hertfordshire. Good examples are found at **Bonningtons** and **St Paul's Waldenbury**. A number of ornamental lakes have been unmanaged for many years and are now heavily silted and/or over-shaded. They are in danger of being lost as they dry out.

Reservoirs

Although few in number, the eight water storage reservoirs in the county form a major percentage of the area total.

Tring Reservoirs (80 ha) A complex of four reservoirs built in the early 19th century to supply the Grand Union Canal. The reservoirs are designated as a SSSI on account of the breeding and migrant waterbirds, such as Grey Heron and Shoveler, aquatic flora and invertebrates. A wetland complex of open water with associated swamp, fen and carr habitats of great importance. The reservoirs are used for angling and shooting and attract high numbers of visitors.

Hilfield Park Reservoir (45 ha) Constructed in the early 1950s, Hilfield is fed with water from the chalk aquifer and thus supports abundant aquatic weed, including Stoneworts. A key site for migrant waterbirds with significant numbers of wintering and moulting duck such as Pochard and Gadwall. Designated a Local Nature Reserve, Hilfield is notable in that it remains undisturbed although pressure to permit leisure activities is mounting.

Aldenham Reservoir A redundant water supply reservoir now extensively silted and used for leisure activities, resulting in a very much degraded, although still important, nature conservation importance. It supports a rich aquatic flora and adjacent wet willow woodland.

Cheshunt Reservoirs Two small reservoirs, also now redundant, were built in association with the New River. Support wildlife of only minor importance.

There are also numerous farm reservoirs, many are poor in ecology but have potential for improvement.

Gravel pits

By far the largest number of open waters are the many water-filled gravel pits along the Colne and Lee Valleys. These extensive areas of gravel workings now support many of our larger wetland complexes. These areas consist of a matrix of open water, remnants of old marsh, fen and carr with new areas developing alongside.

Lee Valley

Cheshunt GP A complex of eight pits excavated between 1930 and 1970 now supporting a rich mosaic of open water, swamp and carr habitats. The open water is notable for aquatic weeds and waterbirds.

Amwell GP A 20 year old pit now managed as a nature reserve. Attracts significant wintering and breeding waterbird populations and is important for amphibians and Grass Snakes with huge numbers of Toads.

Other pits in the Lee Valley include **Broxbourne GP**, **Stanstead Abbots GP** and **Ware GP**.

Colne Valley

Stocker's Lake Nature Reserve An older lake dating back to the 1930s with many wooded islands and sub-surface gravel bars. A key wetland refuge for waterbirds in the lower Colne valley.

Tyttenhanger GP This complex of lakes is still currently being excavated but the open muddy margins attract many breeding waders.

Old Parkbury An old pit complex now largely infilled and suffering from drought and lack of management. However the small remaining lakes, willow carr and old meadow complex are of high value for invertebrates.

Other sites with some wildlife value include **Troy Mill GP, West Hyde GP, Pynesfield Lakes** and **Broad Colney Lakes**.

Other extraction lakes not in these valleys include the Cornwood Sanctuary at Westland Green, lakes at Bourne End in the Gade Valley, Pitstone Quarry and Kings Langley lake. Some of these sites are important because of highly calcareous waters.

Ponds

There is a distinct correlation between the distribution of ponds in Hertfordshire and the underlying geology. Not unexpectedly the greatest concentration of ponds occur on the impermeable Boulder Clays of the north-east and London Clay in the south rather than on the free-draining chalky soils of the west. In the past these

ponds contributed a variety of essential services to the rural economy, from a watering place for stock to fish-rearing ponds.

A map study in 1986 revealed that in just under one hundred years the total number of ponds in the county almost halved, from 7,007 in 1882 to 3,595 in 1978 (Herts County Council, 1987). Many were lost during the period 1955-85 as agricultural practices changed, particularly the change from pasture to arable. Currently 3086 ponds are shown on the Ordnance Survey maps while the Hertfordshire Habitat Survey 1994-96 found 2608 ponds. The condition of ponds is also declining. The 1986 survey (based on a sample of 730 ponds) revealed that 80% were in a poor condition. Only 3% supported a reasonable flora and fauna. The need for active pond management was one of the key recommendations to emerge from the study. Top ranking ponds included those at **Tykeswater Lake**, **Park Street GP**, **Bayford**, **Meesdon Green**, **Lamsden Common**, **Fishers Farm at Colliers End** and the **Cokenach Estate**.

In 1993 The Wildlife Trust re-surveyed 50 of the ponds identified in 1986 as being of the highest quality in order to try to assess any trends. Of these 50 ponds only two (4%) were found to be well managed, while, alarmingly, five (10%) had been destroyed. The remainder (86%) were either poorly or un-managed.

Ephemeral pools are a specialised but often neglected habitat. They support a characteristic plant and invertebrate community. Many species are scarce.

There are also an unknown number of ponds in suburban gardens, increasing in both number and conservation importance, especially for their amphibian populations. These are discussed under urban habitats (Chapter 10).

Other open waters

Finally, there are a number of miscellaneous man-made open waters including treatment lagoons.

Rye Meads sewage treatment lagoons A series of 17 shallow lagoons forming tertiary treatment of effluent. These highly nutrient-rich waters are highly significant for breeding and wintering waterbirds. They form an integral part of the large and rich complex of wetland habitat at Rye Meads SSSI.

Fen and marsh

About 114 hectares of fen or marsh habitats remain in Hertfordshire. The dividing line between these habitats and neutral/wet grasslands is often indistinct. Some of the best examples, but by no means all, are listed below. Calcareous fens are listed in the EC Habitats Directive, some sites in Hertfordshire may fall within this definition.

Rushy Meadow Unimproved fen meadow by Tring Reservoirs supporting several rare species.

Redbournbury Meadows Marshy grassland communities by the River Ver.

Oughtonhead Common/ Ickleford Common/ Purwell Meadows/ Purwell Ninesprings Examples of diverse fen meadow and marshy grassland habitats by the rivers Oughton, Purwell and Hiz.

Beane Marsh Rich fen and marsh communities by the River Beane.

Rye Meads/Silvermead Fen/mire communities in the River Lee floodplain.

Moorhall Meadow/Blagrove Common Examples of unimproved marshy grassland and fen meadow on poorly drained Boulder Clay.

Sarratt Bottom/Frogmore Meadows Good examples of alluvial meadows by the River Chess.

Water End Meadows Marshy grassland communities by the River Gade.

Ridlins Mire A small dome of peat and associated fen vegetation.

Blackfan Fen A remnant fen meadow on the outskirts of Welwyn Garden City.

Tewinbury/Singlers Marsh Marshy meadows by the River Mimram.

Standon Lordship/Braughing Meads Remnant fen habitats in the Rib Valley.

Thorley Flood Pound/Sawbridgeworth Marsh/Hollingson Meads Sites with diverse fen meadow, mire and marsh in the Stort Valley.

Swamp

Narrow bands of fringing swamp are found along most of our larger rivers and around many open waters and the total extent of this is unknown. However larger stands of swamp are rare in the County.

Reedswamp

Reedswamp is listed as a key habitat in *Biodiversity: The UK Steering Group Report*. In the early part of this century extensive reedswamp in Hertfordshire was known only at Tring Reservoirs. Since then the creation of gravel pits and the dereliction of grazed fen has allowed an expansion in certain areas. The total area of reedswamp (excluding narrow fringes) is estimated at no more than 12 ha. Key areas are as follows:

Tring Reservoirs Extensive reedswamp exists at Wilstone and Marsworth Reservoirs between the open water and carr woodland communities (3 ha).

Rye Meads Reedswamp derived from dereliction of grazing management in wet fen meadow. Also newly developed areas with associated carr around water-filled gravel pits (4 Ha). Also about 0.5 ha at the adjacent Rye House Marsh

Stanborough Reedmarsh Reedswamp derived from old cress beds adjacent to River Lee (2 ha). A remnant of a formerly more extensive reedmarsh and meadow system across land now occupied by Stanborough Lakes.

Purwell Ninesprings Reed and sedge swamp derived from increasingly wet fen meadow (0.5 ha)

Tewinbury Mixed reed and glyceria swamp with associated carr developed in old cressbed lagoon by the River Mimram (0.5 ha).

Cheshunt gravel pits Fringing reedswamp around several gravel pits but also some more extensive areas, notably North Met, Seventy Acres and Bowyers, much succeeding to drier communities (total 1 ha).

Smaller patches exist at **Sawbridgeworth Marsh, Silvermead, Broxbourne GP, Amwell GP, Burymead Springs, Oughtenhead Common** and **Bonningtons Lake**.

The expansion of mineral working along the river valleys this century has allowed an increase in reedswamp habitat to probably its greatest extent for several centuries. This is reflected in the current status of Bittern in Hertfordshire. This nationally threatened species (only 15 breeding pairs) is now a commoner winter visitor in the County (up to five) than at any time in recorded history. The current total area of reedswamp may now remain stable as new quarries continue to open. However, without extensive management and creation of new sites the long-term trend is for decline as succession to carr inevitably occurs and new gravel pit sites reduce.

Other single-species swamp

Extensive areas of single species swamp are, in general, scarce. However, good examples of sedge swamp occur at **Rye Meads**, **Thorley Flood Pound** and **Tednambury Marsh** while extensive areas of Reed Sweet-grass swamp exist at the **Withy Beds, Rickmansworth** and **Rye House Marsh**.

Wet grassland

The best remaining examples of wet grassland occur along the broader valleys of the Stort and Lee. There is much overlap between wet grasslands and fens or marshes. In general the wet grasslands dealt with here retain the characteristic landscape of seasonally inundated flat permanent grassland with intact ditch systems.

The major trend is of reduced incidence of flooding, so much so that few areas of wet grassland now exist. Although many grasslands remain within the river floodplains the vast majority are protected from flooding by artificially raised banks. These grasslands do not exhibit the typical flora or fauna of wet grasslands but do have the potential to be restored.

Where flooding does occur water is drained quickly from the land and none of the traditional wildlife of this habitat has more than a fleeting moment to exploit it. The habitat is at such a low ebb that the situation can only improve if positive conservation management to increase water levels is undertaken. The better intact sites are as follows.

Kingsmead (96 ha) A series of grazed flood meadows intersected by ditches. Although much degraded, the site still floods and a long list of scarce plants still exist.

Parndon Meads (10 ha) Regularly flooding pasture and ditch system but with negligible botanical value remaining.

A number of other floodplain sites continue to flood but are better described elsewhere. These include Rye Meads, Redbourn Meadows, Thorley Flood Pound (all fen and marsh) and Hunsdon Mead (neutral grasslands – hay meadows).

Carr woodlands

Carr woodlands are thinly scattered throughout Hertfordshire along the river valleys. Many of the richer examples have developed from fens of long-standing but the majority of carr is probably associated with margins of gravel workings in the lower Lee and Colne valleys. Excluding the stands of Alder associated with more extensive woodland (see Chapter 4 – Woodlands), the total extent of river valley carr is probably around 30 ha.

In Hertfordshire the Alder/Stinging Nettle and Willow/Marsh Bedstraw types (see Appendix 3) of carr woodlands are the most frequently encountered forms due to the high nutrient status and levels of disturbance over most of the county. However few, if any, sites are typical, reflecting human activity over the years. Where the influence of the chalk is stronger, mainly in the north of the county, sites might be expected to show a leaning towards the richer Alder/Tussock Sedge and Willow/Birch woodlands but never quite matching the richness of the typical sites. The more typical Alder/Stinging Nettle carrs are especially prevalent in the lower river valleys around gravel extraction sites.

The remaining areas of carr are largely unmanaged but not greatly threatened by destruction. However, a minority of sites are managed for their timber, a process that destroys the typical carr structure. In addition, some gravel pit sites are being managed with a misguided tidiness. The main trend is a steady change in community composition caused by increasing nutrient enrichment. This may originate as run-off from adjacent farmland or more directly from enriched river water flowing through the site. With our history of wetland destruction and over-abstraction of water combined with continuing enrichment, carr woodland sites will continue to be impoverished unless remedial action is taken.

Several key sites are associated with the chalk rivers of the north of the County.

Oughtonhead Mixed carr derived from fen habitats.

Purwell Ninesprings Wet alder wood showing little sign of over-enrichment. However past management has altered the stand composition and resulted in the loss of many characteristic species. Recent increases in water level have allowed spread of swamp species.

Folly Alder Swamp The narrow valley of the Ippollyts Brook south of Hitchin with associated spring sources supports one of the richest alder carrs in the county. Probably the best example of Alder/Tussock Sedge carr remaining, with as yet little sign of enrichment.

Ivel Springs An area of Almond Willow carr.

The River Mimram also has several areas of associated alder carr.

Tewinbury (1 ha) Alder carr with rich ground flora.

Panshanger (3 ha) Good stands of alder carr with associated flora and fauna, some damage from woodland management.

Hertingfordbury – Rich Alder woodland with long history of Alder and Osier management. Understorey rich in swamp species including frequent Tussock Sedge. Enrichment from run-off from adjacent housing plus general lowering of water levels has promoted changes to a more species-poor community.

The Lee Valley has isolated examples of carr down to Hertford but then considerable amounts below Ware associated with old gravel workings. The best examples are as follows.

Hertingfordbury (2 ha) Alder carr with moderate ground flora.

Stanborough (1 ha) Old willow carr in association with reedswamp.

Equally the Colne Valley has most carr associated with old gravel workings but some old osier beds do survive such as at the **Withy Beds** near Rickmansworth.

Stocker's Lake Nature Reserve (2 ha) Alder and willow carr around old gravel pit, supporting the largest heronry in the county and the rare Large Bittercress.

Other sites in the Colne Valley include **Pynesfield GP** and **Old Parkbury GP**.

Key species

With such a wide range of wetland habitat types it follows that the list of associated key species is extensive. The following list does not attempt to be comprehensive but merely highlights some examples relevant to Hertfordshire. It is drawn from species lists within the UK Biodiversity Steering Group Report with a selection of other species considered to be locally important by the Wildlife Trust.

Water Vole *Arvicola terrestris.* Typical of lowland wetlands, the Water Vole has undergone a significant decline in recent years (see Chapter 11).

Otter *Luta lutra.* Formerly widespread throughout the UK, Otters declined rapidly from the 1950s to the 1970s. A partial recovery is now underway. Became extinct in Hertfordshire in the 1970s and subsequently re-introduced (see Chapter 14).

Water Shrew *Neomys fodiens*. Thought to be widespread in wetlands, its precise distribution and abundance is unclear, but some local sites have large populations.

Pipistrelle Bat *Pipistrellus pipistrellus.* Although it remains the most abundant bat in the UK, it has undergone a significant decline in numbers. Recent evidence has split Pipistrelles into two distinct species, one is thought to frequent wetlands.

Bittern *Botaurus stellaris.* A nationally rare inhabitant of reedbeds. A significant population winters in Hertfordshire, notably the Lee Valley (see Chapter 16).

Shoveler *Anas clypeata.* Typical of larger open waters in Hertfordshire, several sites hold populations of national significance.

Snipe *Gallinago gallinago.* Formerly widespread in damp river valleys in Hertfordshire, the Snipe is now on the verge of extinction as a breeding bird locally.

Bullhead *Cottus gobio.* A typical inhabitant of chalk rivers.

Great Crested Newt *Triturus cristatus.* Although still quite widespread, the UK population is amongst the largest in Europe. Evidence of steady decline (see Chapter 19).

White-clawed Crayfish *Austropotamobius pallipes.* Typical of clean chalk and limestone rivers, the White-clawed Crayfish has undergone a significant decline. The UK is highly significant in a European context (see Chapter 23).

Desmoulin's Whorl Snail *Vertigo moulinsiana.* Restricted to long-established calcareous wetlands, this snail is known from a series of sites in a band from Dorset to Norfolk.

River Water-dropwort *Oenanthe fluviatilis.* A nationally scarce plant of clean, flowing rivers. Significant populations in Hertfordshire (see Chapter 26).

Stream Water-crowfoot *Ranunculus penicillatus.* The characteristic crowfoot of Hertfordshire's chalk rivers retaining reasonable in-channel habitat structure.

Southern Marsh Orchid *Dactylorhiza praetermissa.* A typical plant of wet meadows and marshes but now restricted to a handfull of sites locally. Suffering from loss of habitat and low water levels generally.

5.3.2 Trends and threats

The key issues on wetlands generally relate to either hydrology or management. Wetlands are now much reduced, fragmented and overall, drier. In the past drainage and direct destruction were the main problems. Nowadays water levels are still falling but the concern is with over-abstraction of water. Wetlands have always been popular areas for human leisure and recreational activities. These pressures continue to increase and now form a real threat to the biological integrity of many sites. The following issues are most relevant to Hertfordshire's wetlands today.

Low water levels

Low water levels are the primary threat to all forms of wetland and there is a widespread feeling that all wetlands, from rivers to ponds, have never before been so short of water. Any long-term lowering of water levels in any wetland, or reduced incidence or duration of flooding, can cause severe losses in biodiversity and changes in community composition. The main causes are over-abstraction of surface or groundwater, drainage and the continued impoundment of rivers, mainly for flood defence. Such problems are exacerbated during times of drought.

Groundwater abstraction has reduced the upper reaches of several rivers to a trickle in some summers, with the Beane, Bulbourne, Gade, Chess and Colne particularly affected. Winterbournes, which depend on high groundwater levels, flow even less regularly and springs become less vigorous. Recent remedial work on the Ver, when abstraction from a pumping station was sharply reduced, has amply demonstrated the beneficial effects.

Flood defence works have acted to separate the hydrological links between rivers and their floodplains. The reduced incidence of flooding in floodplain wetlands such as wet grasslands, fens and marshes is now a frequent problem. Recharge of groundwater from rainfall is also reduced. The general loss of wetlands and the concreting over of urban areas reduces the land's ability to soak up rainfall (see Chapter 10 – Urban).

Natural succession

There is an inevitable process of natural succession to scrub and woodland as wetlands accumulate organic matter and dry out. This results in an overall loss of species, especially if early successional stages are not regularly being re-created in compensation. **Carr development on fens and marshes is now commonplace where active management is absent and will cause a shift in wildlife value with the loss of species of earlier successional phases.** On fens in particular this is accelerated by cessation of traditional management practices. Natural succession is also evident around the county's open waters. Many ponds are now overshaded and dry. Many gravel pits in the Lee and Colne Valleys are now overshaded and almost engulfed by woodland in as little as 25 years after extraction. Vegetational changes during this period will be considerable; open waters surrounded by marsh and swamp will have changed to lakes with heavily shaded, eroded and bare banks. Although some species will benefit, many will not.

Lack of management

Wetlands such as fens are dynamic semi-natural systems which in general require management to maintain the typical communities and their associated species-richness. Without appropriate management (grazing, mowing, reedcutting, scrub clearance) natural succession will continue. However, unmanaged, derelict fen and swamp is important for several species (before they inevitably succeed to new habitats). In wet grasslands and fens the cessation of traditional ditch management has both reduced water availability and biodiversity. Riverside willow pollards that are not managed on a regular cycle will become top heavy and collapse (although this is a natural growth pattern of some species).

Poor management

Poor or inappropriate land and water management can lead to the degradation of habitats. Operations such as ditching, river straightening and dredging can all be damaging if carried out unsympathetically. Poor management includes over-cutting of fens or open water margins, suppressing aquatic flora. Pond management can frequently be well intentioned but ultimately damaging. By aiming for 'classical' but often

over drastic management – varying bank profiles, removal of shade and complete de-silting, the valuable and differing features of ponds can be destroyed. Ponds are frequently used as a dumping ground for all kinds of rubbish.

In carr woodlands planting of non-appropriate tree species and woodland management that prevents the natural woodland structure (the jumble of fallen, rotting and growing willows and Alders), reduce the value of the site. Tree planting, for example poplars or cricket bat willow plantations, on fen or wet grassland habitats inevitably leads to a degradation of a scarce resource. In other areas the general 'tidying' of carr woodlands is simply misguided.

Cultural eutrophication

Most wetlands in Hertfordshire are naturally eutrophic (nutrient-rich). **However, eutrophication beyond the natural process, usually as a result of human activities (cultural eutrophication), leads to a sequence of ecological change and is a major problem in Hertfordshire's wetlands today.** In open waters a progressive increase in nutrient tolerant plants is followed by the dominance of algae, with resultant turbidity, at the expense of aquatic plants. Water quality decreases and scarce plants and associated animals decline. It may lead to blooms of toxic blue-green algae.

Excessive nutrient enrichment arising from point sources (eg phosphates in sewage) and diffuse sources (run-off of nitrogen-rich agricultural fertilisers) is a major problem in open waters and rivers. There are clear ecological differences in terms of water clarity and aquatic plant abundance between gravel pits isolated from river systems and those connected to it. Recent studies on Hunsdon Mead have highlighted the problem of excessive levels of nutrients in the river system with increase in grass growth and reduction in herb diversity. The efforts of conservationists to increase flooding of wetlands brings a catch-22 situation in that the nutrient-rich river waters may be detrimental to the ecology.

Over-stocked angling waters pose clear threats to conservation interests. Problems include increasing turbidity of waters through pollution by organic matter and silts and the release of nutrients held within them. These problems are most associated with unnaturally high densities of bottom-feeding fish, such as Bream and Carp.

Nutrient enrichment is one of the key factors determining community type in carr woodlands with few examples of the less-enriched Alder/Tussock Sedge woodland remain.

Acidification

Predominantly caused by atmospheric sources via the soil. A known problem in open waters where biodiversity and biomass are shown to be reduced. Mainly associated with UK uplands but there is evidence of effects in some lowland areas.

Pollution

Pollution of wetlands from a variety of sources (industrial discharge, road or urban run-off) and bio-accumulation of chemicals (eg organochlorines) can be a problem. Although pollution incidents may be declining residues of past contamination remain locked in the bottom silts of many water courses. Ponds can become polluted as a result of dumping.

Drainage

Although drainage for agriculture remains a national problem it is marginal in Hertfordshire.

Development and land-use change

The development of sites may lead directly to the loss of habitats or species. This may include housing, industrial or recreational developments. Development of, or changes in, adjacent land may also pose a threat as wetlands are linked to and influenced by the land surrounding them. Changes which alter the water table, increase the pollution load or degrade adjacent habitat will adversely affect wetland biodiversity.

Conflicts with recreational and leisure activities

The potential conflict between recreational activities and wildlife is a key area for concern. Although the effects of recreational activities upon wildlife are wide-ranging, it is the potential conflicts on open water habitats that are the most critical.

The effects of water-based leisure activities on wildlife

The recorded effects of angling on wildlife include: bankside disturbance; habitat change through trampling; littering; competition with waterbirds for food resulting from overstocking of fish. The removal of the angling close season on still waters, although not compulsory, may represent a threat to breeding birds, fish and other wildlife on some waters. Angling policies are generally biased towards stocked fisheries rather than natural fish communities; this may pose a threat to fish conservation. Watersports such as sailing, boardsailing and water-skiing have all been shown to affect waterbird numbers and distribution, with increasing detrimental effect associated with watersport intensity. Effects upon aquatic plant communities are also possible. On rivers, recreational pressure from pleasure boats can cause erosion of riverbanks, increased turbidity and a reduction in water available to associated wetlands through excessive use of locks. In general, intense use of open waters for recreational activities such as watersports or angling suppresses the wildlife value.

It is important to distinguish between *disturbance* and *impact*. *Disturbance* is the immediate effect of the activity in the short term, while *impact* is the long-term effect on species populations. Studies in the Lee Valley have shown that watersports are influencing the distribution of waterbirds but it is unclear whether the existing levels of watersports are having any impact on the total valley population.

Case study – Strategic use of wetlands by waterbirds in the Lee Valley

Waterbirds are mobile and adaptable – up to a certain point. Their distribution through a complex of closely associated waterbodies reflects their continuing requirements. In the Lee Valley a complex series of links exists between sites, varying from species to species, depending on the time of year and even from year to year. This strategic approach by waterbirds to the use of multiple and varied waterbodies within a given area allows them to fully utilize the wetland habitats they live in. The requirements of waterbirds may be summarized as follows:

A feeding site: The principal requirement is a source of food, ultimately this will determine the carrying capacity of a given area.

A roosting site: When not feeding, a safe roosting site is required for resting, sleeping or preening. Large, open waters with undisturbed islands are generally preferred.

A refuge: The refuge is an alternative roost if the usual site is untenable for some reason. This may be through regular disturbance by watersports or natural events such as severe weather.

A moult site: Moulting duck require undisturbed sites with a rich food supply. Large, open waters are usually chosen.

A breeding site: Breeding waterbirds require a secluded nesting site free from disturbance, islands are preferred. A nearby, rich feeding area, usually shallow water, is also essential for successful rearing of the young.

Studies over the last ten years have shown that within the Lee Valley very few waterbird species obtain all their requirements from a single waterbody. Feeding areas, roosting sites and refuges may all be in different locations. Key sites may only be used for short, but critical, periods of time. Natural changes, particularly in food supplies, during the winter and between years will cause shifts in distribution. Patterns of behaviour will vary not only between species but also within a species from year to year.

Resolving conflict: Methods put forward to reduce conflict include both time and spatial zoning, habitat management and the establishment of refuges. Refuges are perhaps the best solution. However, evidence suggests that only very large waterbodies (far larger than any in the Lee Valley Park) are able to be zoned to include an effective on-site refuge. Refuges should ideally be separate waterbodies.

At the present time food supplies in the Lee Valley probably represent the limiting resource and determine the carrying capacity for wintering waterbirds. However, a number of sites have conflicts developing on them and if leisure activities increase without the provision of corresponding waterbird refuges an adverse impact on the waterbird populations of the Lee Valley is inevitable.

5.4 The future for wetlands in Hertfordshire

5.4.1 The value of wetlands to people

The benefits that wetlands provide to people are immensely varied. These benefits may come from wetland functions (e.g. groundwater recharge), the use of wetlands (e.g. recreational activities) or from the products or attributes of the wetland (e.g. aesthetic value). The maintenance of naturally functioning wetlands will ensure these benefits to the community, industry and agriculture are retained. Wetlands are highly productive, often approaching or even exceeding that of intensively managed farmland. For example, the annual production of Reedmace ranges from 30-70 tonnes per hectare while submerged pondweeds can reach 40 tonnes per hectare. The benefits of wetlands to people can be summarised as follows.

Water supply. Wetlands are frequently used as a source of water for domestic, industrial and agricultural use. Wetlands can aid water movement (recharge) into the underlying aquifer system.

Flow regulation. The natural qualities of the 'wetland sponge' can help manage both flooding and drought problems by regulating river flows. They act as storage areas by soaking up excess water during heavy rainfall. Flood water can be stored in soils (peat can be up to 90% porous) or retained as surface water in lakes, marshes etc. This reduces the volume of floodwater downstream. In dry periods river flows are maintained for longer periods as stored water is slowly released from wetland habitats.

Shoreline protection. Wetland vegetation prevents or reduces erosion of riverbanks by trapping sediments and dissipation of wave energy.

Sedimentation, nutrient and pollutant retention. The physical properties of wetlands can slow water flow and therefore increase the deposition of sediments. This deposition is closely linked to the beneficial effects of nutrient and pollutant retention as these substances are often bound to sediment particles. Nutrients from run-off of fertilisers or industrial discharges can be effectively removed. They may be taken up by vegetation or transformed by biological or chemical processes. It has been shown that wetlands can remove 95%+ of all nitrogen and phosphorus from waste water. Pollutants can also be filtered out in the same way.

Recreation and tourism. Wetlands are important for recreation and tourism as evidenced by the increasing demands for use of the remaining areas by all kinds of water-based activities. Wetlands are often key components of landscape, providing diversity and a focal point for views. This combined with their often highly visual and abundant wildlife makes them of great aesthetic value.

The reasons for maintaining and restoring wetlands have been well researched. If wetland restoration is to be widely supported these benefits must be more widely understood. In addition, water as a resource is very much under-valued by the consumer. Increasing awareness of the whole water environment must therefore be a major aim in the future.

5.4.2 Management of key sites – retaining the 'jewels'

Wetland habitats are one of the more re-creatable habitat types so in theory there is the potential for significant increase. However, as in most instances, the species richness of new sites will depend on the ability of less mobile species to colonise. **Thus it is essential that all existing high quality wetlands are retained and managed to maximise their potential. These are the 'jewels' amongst wetland habitats.** To achieve this we must first ensure that we know where all such sites are by continuing the current programmes of survey and assessment.

Case study – Silvermead

Silvermead is 10 ha of relict flood meadows and water-filled ditches to the south of Broxbourne within the Lee Valley Park. The site had remained unmanaged for over 20 years, had inappropriate tree planting and had lowered water levels. However, botanical surveys during the early 1990s highlighted the site's conservation importance, being one of the few areas in the valley to escape gravel extraction or development.

In 1995, the Lee Valley Park Authority embarked on a 10-year restoration plan through the Countryside Stewardship Scheme. The meadows have been fence and grazing re-introduced, with gates maintaining public access. Inappropriate trees have been removed and native ditchside willows are being re-pollarded. In 1997, the Environment Agency restored ditches and installed a sluice to raise water levels. Restoration has revealed the true importance of the site; 14 species of locally rare plant are recorded, 12 species of dragonfly, a good population of Water Voles and possibly the largest willow tree in the county.

Tackling the problems of our existing wetlands must be a priority. Many are suffering from increasingly low water levels, natural succession and fragmentation. The lack of traditional management of marshes and fens (by grazing or cutting) has allowed the growth of scrub and trees, accelerating the rate of desiccation. The management and restoration of our existing sites must therefore be a priority over the coming few years. The targeting of schemes such as Countryside Stewardship has helped in many cases but the current approach to landowners is at best piecemeal and must be expanded, most profitably perhaps by partnership action by involved organisations.

Grazing animals play an irreplaceable role in the maintenance of many wetland habitats. Yet the current fragmentation of sites and the concentration of the beef industry into local areas has lead to neglect of many sites and makes restoration of grazing hard to achieve. However, some recently restored river valley nature reserves now provide good grazing again for cattle. The value of these lush grasslands has been heightened in recent drought summers when many 'improved' pastures were yellow and parched. With the current BSE crisis in the beef industry, the public are more aware than ever about how food is produced. **If considerable tracts of river valleys were restored to damp grasslands, to extend and link remaining wetland habitats, the potential to rear cattle would be increased and there would be significant gains for wildlife conservation.** In addition, the beef produced from such extensively reared, grass-fed cattle could fetch a premium price in an expanding market. Each steak sold could be stamped 'naturally reared in harmony with wildlife'. There is surely an urgent need to promote extensive livestock production and associated quality assurance schemes (see Chapter 9 – Farmland).

Case study – Grazing with longhorn cattle

The search for a grazier for an area of species-rich grassland at Danesbury Park brought Welwyn Hatfield Council in contact with Bob Williams, a farmer based near Hitchin. Bob is passionate about English Longhorn Cattle! He also rears them commercially and before long a small herd was grazing Danesbury Park.

The benefits of grazing Longhorns on conservation areas soon became clear with this old breed easily dealing with the coarse vegetation typical of such sites. Bob Williams was keen to expand the herd and by 1997, Longhorns are also grazing Singlers Marsh, Oughtonhead Common and Tewinbury SSSI; a clear example of how farming, nature conservation and rare breed conservation can have common objectives.

Case study – Restoration of the River Ver

The River Ver was identified by the National Rivers Authority (NRA), now the Environment Agency, as one of the five rivers in the Thames region most seriously affected by low flows. The problem was identified as the pumping station at Friars Wash, abstracting huge amounts of water from the underlying chalk aquifer. Large stretches of the upper reaches were completely dry and previously common species such as Snipe had gone.

The NRA in partnership with Three Valleys Water company, and with ideas and support from the Ver Valley Society, sought to implement a restoration scheme. The £2.5 million scheme involved bringing an additional supply of water to the area from Grafham Water in Cambridgeshire while drastically reducing the amount of water drawn from Friars Wash. This would allow water levels in the underground chalk to gradually rise up through underlying rocks to support the river flows.

The pumps at Friars Wash were shut off in 1993 and the water duly rose over subsequent years. The NRA also carried out further enhancements along the river channel. This excellent scheme has no doubt benefited the river. Unlike some similar schemes it dealt directly with the problem of over-abstraction at the pumping station rather than trying to enhance river flows by bed-lining or water-recycling.

However, early satisfaction is unwise. Surveys of the birds of the river valley between Redbourn and St Albans have not shown a rapid return of breeding populations. After four summers the range of breeding species has almost recovered – but with some notable exceptions such as the Snipe. Populations of most species have only recovered to about half of that in the mid 1980s (which were presumably already in decline). This suggests that although the water has returned much of the habitat quality has been lost. This may take much longer to recover.

Just add water

Although restoration of wetlands is not quite as simple as ‘just adding water’, there can be little doubt that a concerted effort to restore water levels along river corridors will bring major benefits to all wetland habitats. The incidence of flooding should be increased wherever practicable, particularly in parallel with environmentally sensitive farming. At the same time it will be essential to limit further built development within the floodplain. The fluvial processes in rivers are, in many cases, naturally self-righting. By a combination of increased flows and the pulling back of flood defences, structural diversity within the river in the form of pools, riffles and meanders will increase. The Environment Agency (formerly the NRA) is continuing to seek ways of enhancing rivers, for example by removing or ‘notching’ weirs to reinstate the natural fluvial processes. More work of this kind needs to be done, and it needs to be more strategic rather than opportunistic as at present. Enhancing the quality of our chalk rivers, such as the Mimram and Chess, must be a priority, followed by the particularly degraded stretches of other rivers.

The restoration of water levels will need to be through a combination of on-site management measures, including imaginative flood defence schemes using flood pounds, as well as a wider appraisal of water abstraction issues. The protection of sensitive areas such as spring sources and wetland SSSI's will need to be more carefully considered. A number of current abstractions are suspected of causing damage to wetlands. These should be investigated and, where damage is proven, licences amended or revoked. The potential effects of climate change will also need to be assessed. However, the implications of alternative supply and compensation need to be considered. The cost of compensation may be high and it is likely that some additional funding mechanism will need to be found. There is a general assumption that ground water levels are falling over a wide area and yet there is little documented evidence of this on key wetland sites. It is essential that monitoring is instigated on all wetland SSSI's in the near future.

The poor quality of many waters is a major problem. It may be argued that the regulators are not dealing effectively with all forms of water pollution that are damaging to wildlife and that existing regulatory powers are inadequate. Further powers neeed to be gained to secure water quality improvements to enhance biodiversity.

Of particular concern is the continuing pollution of wetland habitats by nutrient enrichment (eutrophication), a process that is leading to major changes in plant and animal communities. As already stated this pollution comes from point (e.g. sewage effluent discharge) or diffuse (agricultural) sources. The nutrient levels in sewage effluent discharged to our rivers will need to be examined and in certain cases reduced. The diffuse source pollution is a result of agricultural land-use, the use of fertilisers and pesticides and soil erosion. It is well known that riparian buffer strips (a vegetated strip of land from five to 50 m in width that is managed separately from the rest of the field) can substantially reduce diffuse pollution. Different forms of buffer strips will perform in various ways but rough grass strips with trees by the watercourse are very effective. However, the benefits of buffer strips are much wider, they:

- reduce pollution;
- provide habitats for wildlife;
- provide corridors for wildlife movement;
- control temperature in the water body through shading; and
- enhance the visual quality and amenity of the landscape.

The return to pastured floodplains urged above will help greatly in this respect. However, the use of buffer strips alongside watercourses that remain in intensively farmed arable areas must become commonplace over the next ten years. Overall, our rivers must again become swathed in grass, marsh and wooded habitats. Such a move will be to the benefit of us all. A partnership between the water industry, agriculture and conservationists should be sought to take this forward.

5.4.3 Expansion and linking – a 'necklace' of wetland habitats

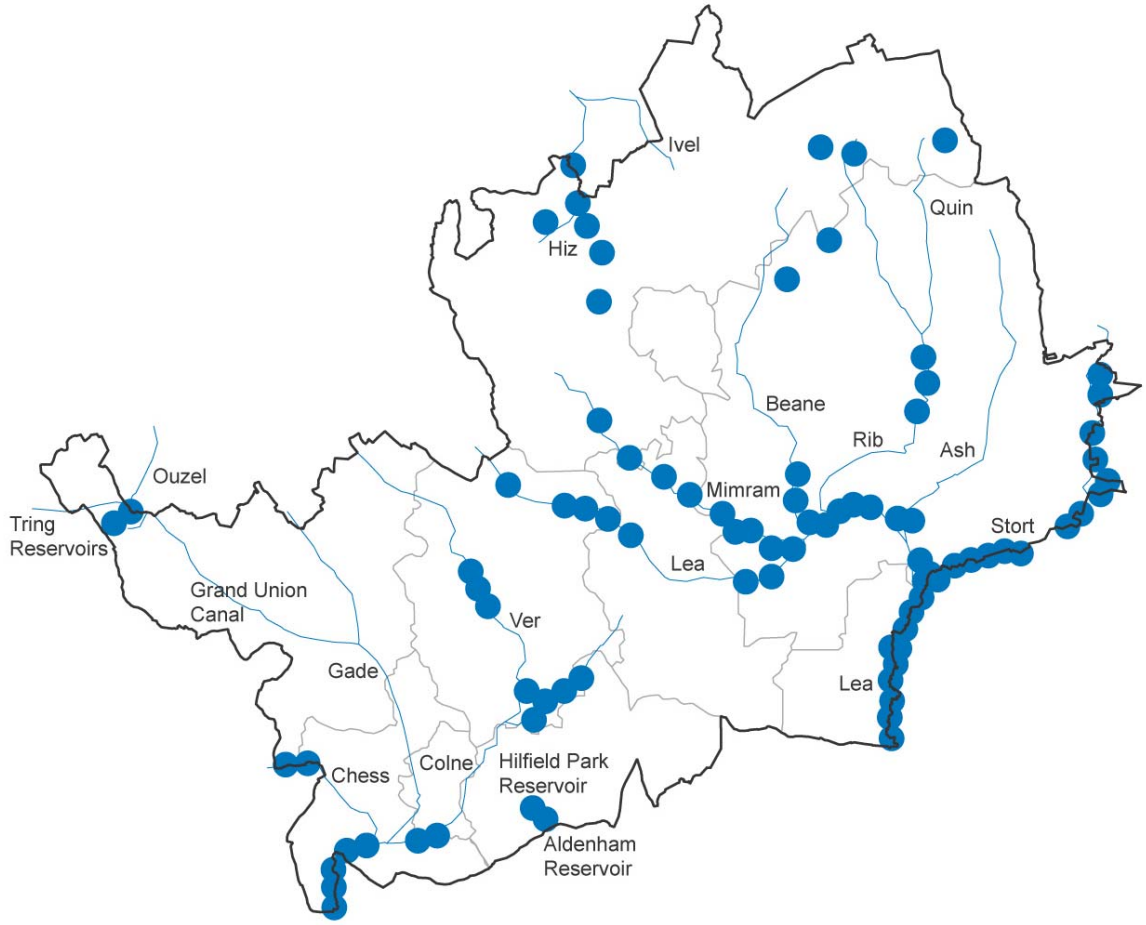
By combining enhanced management of existing wetlands (the 'jewels') with restoration of pasture and the creation of buffer strips, much will have been achieved to restore the integrity of our river valleys. They will again become linked ecologically and hydrologically to form a 'necklace' of wetland habitats through the county (see map 5.1). However, the opportunity remains to increase the wetland resource through habitat creation, particularly where it will allow the expansion of existing sites.

Case study – Partnership action at King's Mead

The meads between Hertford and Ware are owned by a variety of organisations and individuals. As a result of unco-ordinated management this area of remnant floodplain pasture and ditch habitat became progressively degraded. In 1993 The Herts and Middlesex Wildlife Trust and The Countryside Management Service put forward management proposals aiming to restore its ecological and cultural importance. The ideas gained support from the landowners and was then put out for wider consultation to the local community via Ware Town Council.

In 1995 Thames Water Utilities and the National Rivers Authority funded a range of measures such as ditch restoration, fencing, tree planting and sluice installation. A Wildlife Trust local group was established to carry out management tasks such as scrub removal and ditch clearance. Thames Water Utilities also worked with Groundwork Hertfordshire to increase access and interpretation.

Early results are very encouraging. Several species show early signs of recovery and the problems of the area are being resolved. A full management plan to cover the whole area is now being prepared by the Wildlife Trust on behalf of the landowners. Overall the project amply demonstrates how partnership action between a range of organisations can bring substantial benefits.



Map 5.1 – A necklace of wetland habitats

More natural wetlands

Large areas of wetland are more valuable than small fragments, therefore it is important to re-establish links between the fragments where possible. Management of larger sites is easier and more economical. Large sites are more successful at ensuring the survival of threatened species. Control of hydrology may also be more attainable on a large scale. Overall a large wetland habitat mosaic will be more able to function as a natural system under the influence of such factors as water levels and flooding.

There is widespread discussion about the effects of climate change through global warming and it is accepted that it is difficult to predict precisely. However, we can be fairly sure of more extreme conditions including longer, drier summers. Wetlands may well suffer to some extent. It may be pointless trying to retain unsustainable, small wetlands managed in a highly artificial manner. The emphasis should not only be on large systems which will retain water better but also on a flexible management attitude that works with nature rather than against it.

Our aim should therefore be to create a series of large wetland 'refuges' functioning at a more natural level with low intervention management systems. There are no large wetland complexes in Hertfordshire at present so the creation of large sites may at first seem impossible. However, the key is to connect wetlands along the river valleys, expanding where possible at key ecological points, such as river confluences. The following areas may present opportunities:

- The lower Stort from Harlow to the Lee Valley;
- The Stort/Lee confluence at Rye Meads;
- The Lee from Hertford to Ware including the Rib and Beane confluences;
- The Mimram valley
- Parts of the upper Colne valley; and
- Tring Reservoirs.

Each area should contain a mosaic of different wetland types and there will be opportunities to create scarce habitats. The restoration of large expanses of wet grassland within these areas will not only assist wildlife but also bring wider environmental benefits. Creation of washlands on the floodplain to accept water at times of high flows should be explored.

Reedbeds are threatened habitats. All existing sites in Hertfordshire need to be managed appropriately but there is also the potential for expansion. In the Lee Valley it should be possible not only to enhance and link existing patches but also to create new and adjoining reedbeds. Our natural floodplain forests have all gone. However the possibility of re-establishing such a habitat in an appropriately unstable floodplain situation should be explored.

Smaller wetlands – the conservation of ponds

The reasons for pond degradation are clear; pollution, neglect and natural succession. However, the remedies are not always simple. Many ponds have suffered from inappropriate management caused by a poor understanding of their ecology. All stages of pond succession are important to wildlife and it is perhaps as critical to create new ponds as it is to over-manage old ponds and risk damaging existing habitats. However, sensitive pond management should be encouraged as well managed established ponds will support a rich variety of wildlife. New ponds should be allowed to develop naturally but their siting is important. It is all too easy to destroy an important wet hollow by excavating a pond in it. Overall, much emphasis in the future is required on raising awareness on pond management.

5.4.4 A strategic approach

The complex and often extensive nature of wetland systems, from spring source to the sea, demands that we take a wide overview or strategic approach to their conservation and management. Such an approach is already being established.

Catchment management plans/Local Environmental Action Plans

The National Rivers Authority was established in 1989 as the principal agency responsible for safeguarding and improving the water environment in England and Wales. The NRA embarked on a process of preparing Catchment Management Plans for all river catchments. Such plans aim to establish an integrated strategy and plan of action for the water environment of each catchment. In Hertfordshire plans have been prepared for the Upper Lee, Middle Lee and Lower Lee.

In 1996 the Environment Agency came into being, combining the NRA, Her Majesty's Inspectorate of Pollution (HMIP) and the Waste Regulation Authorities. The Agency is to take an integrated approach to providing environmental protection, taking account of impacts on air, water and land. Catchment Management Plans will become Local Environmental Action Plans (LEAPS).

Such plans are central to the conservation of wetlands habitats. They review the condition of each catchment and identify key issues to be tackled. A series of actions are presented and reviewed annually.

Natural areas

English Nature has developed its Natural Areas initiative based on natural characteristics such as climate, geology, landform and the effects of traditional land management of vegetation types. Five such Natural Areas have been identified in Hertfordshire (see Chapter 2). Although all contain stretches of river, the London Basin, has wetlands well represented. These include river valley habitats and standing open waters such as gravel pits and reservoirs. Draft objectives for these areas include maintaining the integrity of river valley corridors and maintaining and enhancing the most important waterbodies as significant sites for waterbirds.

Conservation v recreation

The strategic approach demonstrated by the above initiatives needs to be adopted for other specific issues, most notably to resolve the increasing conflict between conservation and recreation. There is a continuing demand for access to open waters for recreational purposes in a wide range of forms including sailing, water skiing and angling. This demand will continue to increase.

At the same time the importance of these open waters for conservation is increasingly being recognised, for example the proposal to designate parts of the Lee Valley as a Special Protection Area (SPA) under the EU Birds Directive. Hertfordshire supports internationally important numbers of certain waterbirds such as Gadwall and Shoveler. Our wetlands form one link along an extensive migratory fly-way for these species, from northern Europe to the Mediterranean or beyond. We therefore have a wider responsibility to maintain these sites.

A related issue is the extent to which anglers now manipulate fish populations through stocking. It is probably now difficult to find natural fish communities in the county. Overstocking of waters leads to conflict with conservation interests. At the same time the release of non-native fish and other species can have a profound effect. The native White-clawed Crayfish (see Chapter 23) is severely threatened by the increasing spread of the introduced Signal Crayfish, and the crayfish disease it brings with it.

If open water wetlands are to retain their value for both conservation and recreation we have a duty to manage any conflict. It must be recognised by both parties that this is a shared and finite resource. As has already been stated, wetlands that fulfil their natural potential may well also perform recreational functions better and more economically. Therefore sustainable wetlands are to all our benefit. A strategic approach is desperately required, involving wide consultation between all involved.

With such a strategy in place a more positive approach could be taken to wetland creation. In recent years new wetlands in the form of gravel pits have naturally developed wildlife value and also attracted demand for leisure activities. Yet virtually all such sites fail to reach their potential for either due to a lack of forethought. Few new sites are now likely to arise. However, when they do, it is essential that such sites are carefully designed to suit one need or another. Perhaps a new reedbed and shallow water wetland, or a major watersports venue. Such pre-planning will seek to reduce current conflicts.

Raising awareness

Raising public awareness of the value of wetlands is essential. This will need to be undertaken by all involved in the water industry and nature conservation. A first step would be the increased use of interpretation on some of the most heavily visited wetland nature reserves. Increased community involvement in the management of wetlands should also be sought.

5.5 A vision for wetlands

In 50 years time the appreciation of floodplains and wetland systems will have turned full circle. Wetlands will again be valued not only for their wildlife importance but for what this represents – a natural system that reduces pollution through natural purifying qualities and reduces both unwanted flooding and the effects of drought by drawing on the natural qualities of the 'wetland sponge'. Open waters will provide a sustainable recreational resource while lush floodplain grasslands will support summer cattle grazing, extensively managed by low input/low output farming methods.

A 'necklace' of high quality wetlands distributed along ecologically and hydrologically connected river corridors will have been established. The 'jewels' in this necklace will be a series of high quality wetland habitats forming a network of wildlife refuges. A number of the highest quality wetlands, ideally located at key ecological 'cross-roads' such as river confluence's, will have been expanded into large wetland habitat mosaics of fen, swamp, wet grassland, carr and open water. These sites will function more naturally, with low intervention management systems. Likely areas of search for such sites will include:

- the Stort Valley;
- the Lee and Stort confluence – Rye Meads;
- the Lee between Hertford and Ware including the Rib and Beane confluence's;
- the Mimram Valley;
- the Colne Valley; and
- Tring Reservoirs and the Grand Union Canal.

River and wetlands will be buffered from intensive agriculture. All stretches of river with adjacent intensive arable farmland will have a minimum width of 10 m of buffer habitat. This will also aim to ecologically link currently isolated wetland fragments.

Floodplains will be just that. Water abstraction will be reviewed and targeted away from sensitive areas, allowing rivers to fully flow again. The hydrology of wetland sites will be restored wherever possible.

Open waters will be highly valued, managed to a carefully prepared strategy, ensuring their wise use for the benefit of both humans and wildlife. New wetlands, for example mineral sites or river valley restorations, will have been designed to support this strategic approach.

The following wetland types will all be represented;

Free-flowing tufa springs
Free-flowing chalk springs
Free-flowing springs with associated fen peat
Free-flowing flush-line springs
Active watercress beds
Winterbournes, seasonal streams and clay-based brooks
Chalk streams with abundant submerged aquatic vegetation
Slow-flowing lowland rivers with abundant fringing swamp vegetation
Slow-flowing lowland rivers with diverse in-channel structure
Artificial river features such as weir-pools, millstreams and millraces.
Extensive areas of single species swamp e.g. reed, reed sweet-grass and sedge swamp
Grazed fen meadows associated with chalky boulder clay
Tall herb fens of alluvial floodplains
Alder Carr with Tussock Sedge community
Alder/willow carr
Floodplain forest
Seasonally inundated wet grassland
Floodplain meadow and ditch systems
A diversity of pond types
Clear open waters with rich submerged aquatic weed communities
Open waters with diverse breeding, moulting and wintering bird populations
Open waters with rich invertebrate communities
Open waters with natural fish populations

The overall extent of wetland habitat will reach a minimum of 1500 ha. The priority will be to restore hydrological and ecological links, increase appreciation and strategic use and restore sympathetic management.

5.6 Ten year targets

To ensure no further loss of wetland habitats.

To have begun to restore the integrity and hydrology of river valley corridors.

To ensure appropriate water quality and quantity in wetlands.

To ensure that all wetlands of wildlife value are managed appropriately within 10 years.

To have restored 100 ha of seasonally inundated wet grassland from drier, semi-improved or improved sites where ditches and other features remain.

To have begun the re-creation of at least 500 ha of wetland habitat.

To develop and implement a strategic approach to the conservation of wetlands.

To promote the conservation of notable wetland species.

5.7 Wetlands Action Plan

Objectives, actions and targets

Objective 1: To protect Hertfordshire's wetlands

Target: To minimise damage to wetland Wildlife Sites by development

Action code	Action	Target start date	Target end date	Lead partner	Other partners
WE/A/1.1	Through inclusion of protection policies in local plans and the development control process, seek to minimise development adjacent to, or on wetland sites and river corridors	2005	Ongoing Annual report of progress	HMWT	HBRC, EA, EN, BW, LA's, LVRPA
WE/A/1.2	Ensure that protection of wetlands and key BAP wetland species are included in EA and all partner's strategic and local plans	2005	2010 with annual report	EA	All
WE/A/1.3	Ensure conservation and recreation management plans recognise the importance of open water bodies for wintering, roosting, moulting and breeding birds	2005	Ongoing Annual report on progress	HMWT	All members of Wetlands HAP Steering Group
WE/A/1.4	Ensure the significance of wetlands is recognised in all conservation management plans	2005	Ongoing Annual report on progress	HMWT	CMS, LVRPA, RSPB, TW, TVW, minerals companies

WE/A/1.5	Seek to ensure that key wetlands (SPAs, SSSIs, Wildlife Sites) are not adversely affected by low water levels resulting from unsustainable water abstraction	2005	Ongoing Annual report on progress	EA	

Objective 2: To promote the positive conservation management of existing wetland sites

Targets: a) 95% of the area of wetland SSSIs in favourable conservation status by 2010
b) 50% of wetland Wildlife Sites in favourable conservation status by 2008

Action code	Action	Target start date	Target end date	Lead partner	Other partners
WE/A/2.1	Review the criteria for selection of wetland Wildlife Sites	2007	2007	WSO	EN, HBRC, HNHS
WE/A/2.2	Audit the distribution, area and composition of Hertfordshire's wet woodlands	2006	2007	EA	HMWT, HBRC
WE/A/2.3	Monitor and record the condition of three wetland Wildlife Sites annually	2005	Annual report	WSO	WSP
WE/A/2.4	Produce an annual report on the condition of wetland SSSIs	2005	Annual report	EN	
WE/A/2.5	Identify priority wetland areas for positive management and agree a programme of work	2005	Annually	HMWT	Wetlands HAP Working Group
WE/A/2.6	Implement positive management work on priority wetland areas	2006	Annual report	HMWT	Wetlands HAP Working Group
WE/A/2.7	Provide conservation management/grant aid advice to owners of wetland Wildlife Sites	2005	Annual report	WSO	WSP

Objective 3: To undertake targeted enhancement and restoration of priority wetlands and create new wetland habitats where appropriate

Targets: Restore 5 km of chalk rivers and 30 ha of reedbed by 2010
Restore/create five ponds and 1 km of ditches annually

Action code	Action	Target start date	Target end date	Lead partner	Other partners
WE/A/3.1	Identify degraded wetland areas including those adjacent to rivers which are priorities for action as part of the Environment Agency's plans	2006	2007	EA	Wetland HAP Working Group
WE/A/3.2	Implement restoration works on the identified priority degraded areas	2007	2009	EA	Wetland HAP Working Group
WE/A/3.3	Restore 0.5 km of chalk rivers annually.	2006	Annual report	EA	HMWT, EN, CMS, Gwk, LA's

WE/A/3.4	Restore or create five ponds per year (excluding sites restored for Great Crested Newts)	2005	Annually	LVRPA, Lafarge, HMWT, RSPB, CMS	Gwk, RDS
WE/A/3.5	Restore and create a total of 30 ha of reedbed in Hertfordshire	2005	2010	HMWT, RSPB, LVRPA, BW, Lafarge	Cemex, EA
WE/A/3.6	Restore and enhance a minimum of 50 ha of floodplain (wet) grassland at a minimum of three sites	2006	2010	LVRPA, HMWT, Lafarge	
WE/A/3.7	Restore and create 1 km of ditches annually	2005	Annual report	LVRPA, HMWT, Lafarge	CMS, RDS
WE/A/3.8	By 2010, create 100 ha of wetland habitats including wet woodland, floodplain grassland, marsh/fen and open water through mineral restoration works	2006	Annual report on progress	Lafarge, Cemex	HCC minerals
WE/A/3.9	Establish a Wetlands Project Officer post to co-ordinate implementation of the HAP	2005	2008	HMWT	EA, BW, TW, TVW, LVRPA, EN

Objective 4: To raise awareness of wetlands, their need for conservation and to encourage participation in their conservation

Targets: Hold ten public events and a training workshop annually
Provide access to five large wetlands, with interpretation

Action code	Action	Target start date	Target end date	Lead partner	Other partners
WE/A/4.1	Annually, hold ten public events, supported by articles and newsletters, to highlight the importance of wetlands for biodiversity	2005	Annual report on action	HMWT	CCB, CMS, RSPB, EA, HMWT, LVRPA, TW, TVW, BW
WE/A/4.2	Undertake demonstration event of best practice in wetland restoration for landownwers and managers once every five years	2007	Once every five years	EA	HMWT, CCB, CMS, RSPB, EA, HMWT, LVRPA, TW, TVW, BW, Lafarge
WE/A/4.3	Organise a wetland management workshop for practitioners to exchange best practice once every two years	2006	Once every two years	HMWT and CMS	CCB, RSPB, Gwk, EA, HMWT, LVRPA, TW, TVW, BW
WE/A/4.4	Establish a wetlands section on key partner's websites, highlighting wetland habitats and species, conservation and links to this plan	2006	2008	HMWT	CCB, RSPB, EA, HMWT, LVRPA, TW, TVW, BW
WE/A/4.5	Establish managed access, with	2006	2011	HMWT	RSPB, LVRPA,

	interpretation, to five large wetlands (over 4 ha) in Hertfordshire				BW, TVW, English Nature (Natural England), Lafarge, CMS, Gwk
WE/A/4.6	Establish King's Meads as a Dragonfly Sanctuary and Local Nature Reserve, with managed access and interpretation	2007	2007	HMWT	LA's, EA, TW

Relevant Action Plans:

Hertfordshire Plans
Water Vole; Otter; Bittern; Black-necked Grebe; White-clawed Crayfish; River Water-dropwort
Lee Valley Regional Park Authority BAP and Chilterns AONB BAP

National Plans
Eutrophic standing waters; chalk rivers; fens; reedbeds; wet woodland;
Fen, marsh and swamp Habitat Statement; Rivers and streams Habitat Statement; Standing open water and canals Habitat Statement

Abbreviations (Partners)

BW – British Waterways
CCB – Chilterns Conservation Board
CMS – Countryside Management Service
EA – Environment Agency
EN – English Nature
Gwk – Groundwork Hertfordshire
HBRC – Hertfordshire Biological Records Centre
HCC – Hertfordshire County Council
HMWT – Herts & Middlesex Wildlife Trust
LA's – Local Authorities
LVRPA – Lee Valley Regional Park Authority
TVW – Three Valleys Water
TW – Thames Water
WSO – Wildlife Sites Officer
WSP – Wildlife Sites Partnership
(HMWT, HBRC, CMS, FWAG, EA, EN, DEFRA, Chilterns AONB)

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