Biodiversity Survey of the Integrated Constructed Wetland at Tolka Valley Park, Finglas, Co. Dublin

for Dublin City Council

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Above: The ICW in May
Cover illustration: A Banded jewelwing damselfly rests on vegetation at the ICW.

Introduction

The Integrated Constructed Wetland (ICW) at Tolka Valley Park in Finglas, Dublin, was created in 1999 as a novel way of treating the polluted Finglaswood Stream that was polluted by misconnected domestic drains. This project was jointly initiated by Dublin City Council Parks and Landscape Services Division, Drainage division and National Parks and Wildlife Service. Wastewater from dishwashers, showers, washing machines, kitchen waste, oils, car washings together with surface water runoff from roads and houses was flowing to an artificial pond in the park, via the now culverted Finglaswood Stream, before ultimately discharging into the nearby Tolka river. Pollutants from the surface water sewers were resulting in algal growths, floating greases and milky scum, foul odours, and a total loss of any amenity value that the pond may have had (Collins, 2007). Phosphates and Ammonia were also contributing to eutrophication, a term used to describe the excess application of nutrients, in the Tolka river. This phenomenon results in reduced oxygen concentrations in the river and accelerates 'weedy' plant and algal growth that blocks light and chokes streams – thereby creating a hostile environment for salmonid fish, including Salmon *Salmo salar* and Trout *Salmo trutta* (Giller, 1998).

The subsequent construction of the ICW has been a success on many fronts: attenuating pollutants, reducing malodours, enhancement of the pond's amenity value, and creation of new wetland habitat for local biodiversity. This study focuses on the biodiversity of the ICW and aims to quantify how successful the project has been in creating new habitats.

The term 'biodiversity' is a contraction of the words 'biological diversity' and is used to describe the enormous variety of life on Earth, including variations between species, habitats and genes. All life depends on biodiversity for its support systems and humans particularly rely on it for 'eco-system services', such as purifying air and water, waste disposal, pollination, flood alleviation, food, building and clothing materials, as well as maintaining soil fertility and preventing erosion. In fact the total value of these services was placed at €2.6 billion per annum in Ireland by a recent study (Bullock et al., 2008). Not included in this cost is the aesthetic and spiritual value that we derive from biodiversity.

The ICW provides an excellent example of how biodiversity provides these ecosystem services, in this case attenuating pollutants and purifying water. The reeds and sedges that were planted in the wetland remove particulate matter by physically filtering the wastewater, pathogens quickly die in its cooler waters, while chemical pollutants such as phosphates, nitrates and ammonia are absorbed by micro-organisms that adhere to the plants' surfaces (USEPA, 2000), creating nutrients that are in turn taken up by the growing mass of vegetation.

The ecology of a constructed wetland can be expected to be similar to that of a natural wetland. Upon construction, a small number of selected species are chosen as the pioneer species. These include Common reed *Phragmites*

australis, Bulrushes *Typha sp.*, Yellow iris *Iris pseudacorus*, and Sedges *Carex sp*. However, from these small beginnings, the wetland gradually becomes colonised with numerous other species. Some of these will be wetland specialists and not only plants, but animals too, including invertebrates, mammals, birds, fish and amphibians. This invasion is to be welcomed as increased biodiversity has been proven to result in greater ecosystem functioning and consequently higher performance in terms of its capacity to remove pollutants (Otte, 2003).

The Wetland Habitat

The wetland presents a unique habitat to which an array of specialist species are adapted. The constant presence of water is the greatest contributing factor to the ability of certain species to colonise the ICW. However other factors are also important, particularly the flow regime, the wetland shape and volume, and the type and nature of the vegetation (van der Valk, 2006). The flow of water is slow to stagnant in many places and this reduces physical friction so that animals and plants do not need to 'hold on' in the way that they do in a river system. Slow flow also results in a low level of dissolved oxygen in the water as there is little interaction between the water body and the atmosphere above. Dissolved oxygen principally comes from passive diffusion and this occurs slowly and will influence water near the surface much more than at deeper levels since there is very little mixing. This is a major limiting factor for many aquatic organisms so that only those that are specially adapted can survive. Unlike in a lake, where the deep, still water results in a temperature profile from warm to cold, the shallow water of the ICW is more uniform.

The shape of the wetland is designed to be broad and shallow. The relatively small volume to surface area ratio means that water can be close to ambient temperature with little buffering capacity. Increases in temperature reduce water's capacity to dissolve oxygen and so places extra stress on aquatic organisms.

Another important factor for biodiversity in the ICW is the nature of the vegetation. Different species of tall reeds and sedges influence light levels, water temperatures, oxygen concentrations and water chemistry in their own way. This results in a complex mosaic of conditions across the wetland that increases the diversity of microhabitats to the benefit of biodiversity. The ICW in Tolka Valley Park, which has distinct patches of different species of vegetation, will therefore result in greater biodiversity than one which relies on only one species. This is good not only for nature, but also its functioning capacity.

Left: Yellow Iris

Methodology and Constraints

Any biodiversity survey is limited by a number of factors. A wetland, like all natural habitats, is a dynamic system. Species come and go with the passing of the seasons. Certain organisms are nocturnal or prefer particular times of the day (birds for instance). Some are only obvious when the sun is shining, such as butterflies, dragonflies and damselflies, while over the years different species will colonise new ground and other will become extinct. Consequently, there is no one perfect time for which to do a survey.

At a global level biodiversity is nowhere near being fully catalogued, and new species are being discovered all the time. However, even at a local level it is practically impossible to fully inventory the biodiversity of a site, no matter how small. One experiment in Norway found that the number of different types of bacteria in a single gram of soil from a Beech forest could be between 4,000 and 5,000 species! (Wilson, 2001). Even if each species was laid out before the observer it would take a great deal of taxonomic expertise to identify the many types of ant, spider, hoverfly, or moth that may be present. For instance, there are 929 *known* species of aquatic flies in Ireland and the group is so vast that specialists in the subject tend to confine themselves to smaller families within the group (Ashe et al., 1998).

Despite these constraints it is possible to assess the level of biodiversity on a site by using indicator species. These are groups of species that are obvious, relatively easy to identify and about which a lot is known. In Ireland, as elsewhere, the principle group of indicators for assessing habitat type and function is the vascular (or higher) plants[1] (as opposed to the bryophytes: mosses and liverworts). They are easily recognisable, stationary, and a lot of data has been gathered about them over the decades. Other groups can, and are, frequently used. These include the birds, excellent environmental indicators as not only do they fulfil the criteria above but their populations are extremely dynamic and sensitive to change. Butterflies and Odonates (the family of Dragonflies and Damselflies) are also useful as they are colourful, popular and their diversity is not so bewildering that anyone could learn to identify the commoner species without any specialist equipment.

This survey therefore concentrated on the vascular plants and notes were made of other distinctive species as and when they were encountered. Two site visits were made on May 15th and June 11th 2008. These dates are well within the optimal time periods for conducting vegetation surveys (NRA, 2006). All species of vascular plant were identified. Other terrestrial species were not specifically surveyed for but were noted when encountered including: birds; butterflies; dragonflies and damselflies. Sampling for aquatic invertebrates was carried out using a standard net and were studied on the bank side before being returned to the water.

[1] Vascular plants are those with dedicated organs for the transport of water and food and include trees, flowers, grasses & rushes, ferns and horsetails.

Because the surveys took place during the day, the presence of bats was not recorded. While the site does not contain any suitable roosting sites for bats, it could well provide a foraging ground where these mammals could hunt for moths and other night-flying insects. Indeed the wetland could provide a diversity of habitats for moths but again, being nocturnal, these were not surveyed for this report.

Above: Mute swan on the pond

Results

Flora

The presence of different species of flora is particularly dependant on the depth of water at different areas of the site. The cells of the ICW are designed to be shallow so that a continuous stand of tall reeds and sedges will predominate. In contrast, the pond is too deep for most of its area to support these plants. These 'reedy' areas are species-poor, being dominated by homogenous patches of single species. Around the edges the water levels are less consistent, being drier in many places, and here a much wider diversity of species can be found. There are also some small patches of disturbed ground and this has prompted its own community of plants. For the purposes of this survey, the plant communities can be divided into two groups: those in the centre of the cells; and those around the edge. Because the pond is artificial it has quite steeply sloping edges. This feature means that there is a thin band of wetland vegetation which comprises elements of both the centre and the edge.

The Centre
It is this part of the ICW that does the 'heavy lifting' in terms of pollutant attenuation in the wetland. Here the reeds and sedges that were originally planted have established themselves and are comprised of the following species:

Yellow iris *Iris pseudacorus* is a very distinctive wetland plant with its broad green leaves and brilliant yellow flowers.

Sedges *Carex sp.* A variety of sedges were planted including **Greater pond sedge** *Carex riparia,* **Bottle sedge** *Carex rostrata* and **Greater tussock sedge** *Carex paniculata.* These are among the most abundant plants to be found in the wetland and are dominant at early in the year when the taller reeds are still emergent.

Bulrush *Typha sp.* can be distinguished by its distinctive brown, velvety seed-heads.

Common reed *Phragmites australis* is one of the more common species in the wetland and is the one most commonly used for the construction of Reed Bed Wetlands in Europe (they are avoided in the US where they are considered to be an invasive species). Their stems can grow to enormous heights, up to 3.5 meters, which grow anew every year. In winter, the seemingly dead stalks, are home to a multitude of grubs and insects that hibernate in their hollow interiors.

Marsh-marigold *Caltha palustris* is a relation of the buttercup and is conspicuous with its bright yellow flowers and shiny green leaves.

Great fen-sedge *Cladium mariscus.* This giant sedge is also known as the Saw sedge and it is easy to see why by running a finger along its sharp leaves. This sedge is not recorded from the surrounding area (Preston et al., 2001) and so it may have been planted as part of the ICW construction.

The following plants have not been planted and so have colonised the site through natural means. They are all typical wetland specialists.

Duckweed *Lemna sp.* This is one of Ireland's smallest flowering plants and is most familiar as it can form continuous green mats on still or stagnant water.

Water mint *Mentha aquatica.* While not a conspicuous plant, it has a strong mint fragrance that is unmistakable.

Water-starwort *Callitriche sp.* This entirely aquatic plant can be recognised by its leaf structure, which is in whorls of four, hence its name.

The Edge

Plants that are characteristic of wet places that have colonised the ICW include:

Common nettle *Urtica dioica* is a common plant known for its stinging leaves. Its benefits to biodiversity are often underestimated – particularly as host plants for the eggs and caterpillars of many of our butterflies.

Cleavers *Galium aparine* are common plants with tiny white flowers, probably best known among school children for their ability to stick to clothing when thrown.

Cuckooflower *Cardamine pratensis* is well known as the host plant for the Orange-tip butterfly. Its name comes from the dubious assertion that its flowers coincide with the arrival of the Cuckoo.

Giant-rhubarb *Gunnera tinctoria.* This is an alien invasive species that originally came from Patagonia. It leaves can grow to enormous proportions and the heavy shade this produces will prevent other riparian species from gaining a foot-hold. Gunnera should be treated with herbicide to stop its spread. It is currently only located in small clusters around the pond.

Hairy sedge *Carex hirta*

Hard rush *Juncus inflexus*

Meadow buttercup *Ranunculus acris*

Soft rush *Juncus effuses*

Rosebay willow *Epilobium angustifolium*

Silverweed *Potentilla anserina*

Timothy *Phleum pratense* is a meadow grass sometimes known as Cat's-tail.

Water-cress *Nasturtium officinale* grows in shallow water just in from the edge of the inlet cell and is most conspicuous by its mats of leafy green shoots, as its white flowers are rather small

Willow *Salix sp.* Willow trees are always characteristic of wet places and are most familiar along the banks of rivers and ponds. There are many species and they frequently cross-breed, making identification difficult.

A variety of other plants were found at the drier spots and where the ground had been disturbed. These are all typical of hedgerows and riparian margins:

Alexanders *Smyrnium olusatrum*
Bramble *Rubus fruticosus*
Cock's-foot *Dactylis glomerata*
Common chick-weed *Stellaria media*
Common sorrel *Rumex acetosa*
Cow parsley *Anthriscus sylvestris*
Creeping buttercup *Ranunculus repens*
Curled dock *Rumex crispus*
False oat-grass *Arrhenatherum elatius*
Hairy-brome *Bromus ramosus*
Hedge bindweed *Calystegia sepium*
Hogweed *Heracleum sphondylium*
Lesser burdock *Arctium minus agg.*
Lesser Celandine *Ranunculus ficaria*
Meadow thistle *Cirsium dissectum*
Oxeye daisy *Leucanthemum vulgare*
Perennial rye-grass *Lolium perenne*
Perennial sow-thistle *Sonchus arvensis*
Red fescue *Festuca rubra*
Ribwort Plantain *Plantago lanceolata*
Weld *Reseda luteola*
White poplar *Populus alba*
Yarrow *Achillea millefolium*
Yorkshire-fog *Holcus lanatus*

Of particular interest at this site is the presence of wetland plants that are not to be found along the nearby river bank. These include many of the sedges and tall reeds and are good for biodiversity as they represent a habitat that would not have otherwise existed. This in turn will provide niches for a range of associated fauna.

While not to be found within the ICW itself, there are a number of alien invasive species along the nearby Tolka river that would be of concern were they to colonise the site. These include the **Japanese knotweed** *Reynoutria*

japonica and the **Giant hogweed** *Heracleum mantegazzianum.* The former can cover vast areas of land and is known to cause structural damage, while the latter can cause burns to the skin when exposed to its sap and sunlight. These species should be controlled before they get further out of hand.

Mammals

A tall reed wetland does not provide suitable habitat for most of Ireland's mammals. The one exception is the Otter, although signs of its presence was not uncovered it is known from the nearby Tolka river and it is possible that foraging occurs in the ICW. Rats are omnipresent while the abundance of invertebrates may encourage feeding bats.

Birds

Although the site is small, it does provide a number of habitats for nesting birds.

Moorhen *Gallinula chloropus* is a common bird in Irish freshwater systems and a number of pairs were noted to be nesting in the open water cell. Sometimes called a Water hen, they are conspicuous by their dark plumage and yellow and red beak. At least two nests were noted and one chick was observed.

Reed Bunting *Emberiza schoeniclus* is a sparrow sized bird but the male can be distinguished by its black head and throat. A male was observed singing while perched on a Giant fen sedge in the central cell – indicating the presence of a breeding pair. This is especially interesting as it is a species that would not be present were it not for the reed bed.

Wren *Troglodytes troglodytes* is one of the smallest birds in Ireland and can often be distinguished by its upright pointing tail. They are adaptable birds and a pair were nesting in the low, dense vegetation along the margin of the central cells as well as the pond, but it is not known if they were nesting there or merely foraging.

A male **Robin** *Erthacus rubecula* was holding territory on a Hawthorn tree beside the inlet cell and was seen darting into a patch of Iris. This was a wet spot near the inflow pipe and would be an unusual place for a nest.

A pair of **Mute swans** *Cygnus olor* hold court on the open water cell making a beautiful addition to this area. They were not accompanied by cygnets however, perhaps being too early in the season, and no nest was observed.

Other species were observed flying over the site, or nearby and these include:

House sparrow *Passer domesticus*. While surely one of the most familiar birds in Ireland this species is now listed on BirdWatch Ireland's Amber list of birds of conservation concern (Lynas et al., 2007). This is due to a decline in its breeding population.

The **Swallow** *Hirundo rustica* is of conservation concern across Europe and for this reason is also Amber listed.

Heron *Ardea cinerea*.
Hooded crow *Corvus corone*
Mallard *Anas platyrhynchos*

Fish

The presence of fish in the pond was not determined. Due to its isolated location it would be difficult for fish to establish themselves naturally and given its small size it would be hard to sustain even an introduced population. It was of surprise therefore to discover the presence of in the cells of the ICW. These were very small fish, probably juveniles, measuring only 15 mm in length. How they got there is a mystery but it is possible that their eggs were transferred while stuck to the feet of a duck or a heron, or that they swam from the river up the discharge pipe and through the pond (unlikely), or they may have been put there deliberately.

Amphibians

Perhaps the most exciting discovery on the site was the presence of the **Common Frog** *Rana temporaria*. The frog is one of only three amphibian species in Ireland while it is one of Ireland's most familiar animals its fortunes have declined in recent times. It is listed as 'Internationally Important' in the Red Data Book (Whilde, 1993) and more recently was determined to have a poor conservation status due to a contraction in both its range and population (NPWS, 2008). This is primarily due to the loss of habitat as a result of the widespread drainage of wetlands in recent times. It is protected under Annex V of the EU's Habitats Directive and as such the ICW can be seen to be making a valuable contribution to the conservation status of this important species. Frogs and fish do not cohabitate as tadpoles are quickly preyed upon (the exception being Minnows are they are too small to prey on tadpoles). The ICW however provides the perfect habitat, with a consistently wet environment that is too shallow for all but the smallest of fish.

Invertebrates

Wetlands are rich habitats for invertebrates. Typically these are aquatic species that spend at least part of their lives submerged. Others include the spiders, butterflies, ants, beetles and hoverflies – all of which take advantage of microhabitats within the vegetation. Little is known about the biology of many of these groups in Ireland and their diversity is so great that few have the taxonomic skills to correctly identify them. This is unfortunate as size is no indication of complexity and many 'eco-system services' are occurring at this

level. They are particularly responsible for pollination, waste decomposition and nutrient recycling.

The invertebrates in the ICW can be divided into three arbitrary groupings: those that are entirely aquatic; those that spend part of their lives in water, emerging only to breed; and those that are entirely terrestrial.

Aquatic Invertebrates

Pond dipping in a number of locations revealed an enormous quantity of snails and molluscs. These included the the **Great pond snail** *Lymnea stagnalis* (large, with a pointed shell), the **Great ramshorn** *Planorbarius corneus,* the **Common bithynia** *Bithynia tentaculata* and the **Wandering pond snail** *Lymnea peregra*. Also present was a great number of **Freshwater cockles** *Sphaerium spp.,* looking just like their salt water cousins, but in miniature. The large biomass of these species is indicative of a high nutrient content, as would be expected in the ICW. They are passive grazers, feeding on thin layers of micro-organisms that build up on plant surfaces, known as periphyton.

The still, muddy conditions are ideal for a variety of worms, including the thread worms *Tubificus sp.* while the adaptable **Water hog-louse** or **Water slater** *Asellus aquaticus* can be found in large numbers. This is a type of crustacean, related to lobsters and crabs, but is most recognisable as an aquatic version of the Woodlouse.

Areas of the ICW, as well as the pond, are home to a variety of aquatic beetles including the **Great diving beetle** *Dytiscus sp.,* a predator with suitably long and sharp jaws. Also present are the **Pond skaters** *Gerris sp.,* a group of insects that can be seen ‘skating’ across the water surface. They depend on surface tension, that unique property of water that occurs when the uppermost cells scrunch together to minimise contact with air. Finally the **Water boatman** *Callicorixa sp.* have specially adapted hind legs that are just like the oars of a boat.

The slow moving, or stagnant water of the ICW is an ideal habitat for **Leeches** and **Flatworms**. These are huge groups of invertebrates that can look similar. Flatworms can be distinguished by their slow gliding movement, while the leeches are more bottle shaped and move by reaching with their head and dragging their bodies behind them.

Partially Aquatic Invertebrates

This group includes the flies, of which there are a great number of species. One group that was identified was the **Non-biting midge** *Chironomus sp.* While they look rather like mosquitoes they do not feed as adults and cannot bite as they have no mouth. There are over 400 species recognised in northern Europe alone.

Of the most colourful and recognisable of the wetland insects are the Dragonflies and Damselflies. They are one of the oldest groups of insects still surviving and play no part in the pollination of flowers since flowers were not around at the time they first evolved. Their larvae are ferocious predators and some of the bigger species are known to prey on small fish. Because of their link with the water, they are synonymous with wetland ecosystems. Two species were found around the ICW. In large numbers was the **Common bluetip** *Ischnura elegans.* It is perhaps the most common species of Damselfly in Ireland and is known to be tolerant of nutrient enriched water (Nelson & Thomson, 2004). The other species is the **Banded jewelwing** *Calopteryx splendens,* in this case a female (pictured on the cover of this report). It is a beautiful insect with a metallic green body and gentle flight. Its preferred habitat is slow moving water and is dependant on stands of green vegetation, just like those that are present in the ICW.

A remarkable group of insects is the **Caddisflies**. In their adult form they are drab and easily overlooked, but in their larval state they construct elaborate cases out of available debris. They can be made out of small stones or wood and serve to camouflage, anchor and protect the insect's soft body. In flowing water systems, different species can be used as indicators of water pollution (Toner et al., 2005). The pond was found to be the home of *Limnephilus binotatus,* which was distinguished by its case made from strips of fresh green leaves.

Terrestrial invertebrates

A number of different types of **Hoverflies** and **Ants** were noted around the ICW although identification of individual species was not possible. These often ignored insects are responsible for a great deal of the pollination and waste disposal taking place in nature.

Of the invertebrates that were identified, the colourful **Large jawed orb web spider** *Tetrahnatha montana* is frequently associated with water and was observed in a number of locations around the site. Its long pairs of fore and rear legs give it a slender, oval appearance.

The most charismatic of all invertebrates are the butterflies. Three species were recorded during the survey.

The **Small tortoishell** *Aglais urticae* is one of Ireland's most common butterflies and can be identified by its orange and black wings fringed with blue dots. It is one of a number of butterflies that lays its eggs on Common nettle, showing how this often disregarded weed has important biodiversity value.

The **Orange-tip** *Anthocharis cardamines* is another widespread species and while it lays eggs on a number of plants, it is most closely associated with the

Cuckoo flower – a plant that grows in small clusters along the fringe of the ICW.

The **Small white** *Pieris rapae* occurs in a wide variety of habitats and was seen in good numbers as the temperature rose in the late morning sunshine.

This review of invertebrates can only be the tip of the ice-berg as an abundance of other species are bound to be present.

Above: Moorhen nest on the pond fringe

Conclusion

The establishment of the ICW at Tolka Valley Park is an excellent example of how the forces of biodiversity can be harnessed for the benefit of people – in this case transforming a foetid quagmire into a water purification unit with amenity value. It should be remembered that enhanced biodiversity is not a side benefit of establishing the ICW, it is the reason the ICW works in the first place. While only a small number of species were planted at the onset of the project, this survey has revealed that many other species have since colonised the site. Of particular interest is how the wetland has attracted species that would not otherwise be found in the area, even from the banks of the Tolka. These include the Reed Bunting, the Common frog, a variety of flowers and sedges, and the Banded jewelwing damselfly. These colonisers are indicators of the success of the ICW and their variety in turn enhances its capacity to remove pollutants.

The presence of alien invasive species, Giant rhubarb, and nearby Giant hogweed and Japanese knotweed, is a threat to the ICW and its biodiversity. Where these species are present they should be controlled using appropriate spot-application of herbicide.

A potential looming threat is the necessary dredging works that will need to be carried out on the ICW as the levels of sediment accumulate. However, if this is done sensitively, particularly with regard to the time of year in which it occurs, the impact on biodiversity can be minimised.

One suggested enhancement measure would be to remove the steep banks of the pond (perhaps on one side) to allow for the establishment of a wider margin of aquatic vegetation. This would not only benefit the plants but would also provide greater cover for nesting birds. This could be achieved by adding earth to create a gently sloping bank, ensuring that works are only carried out outside of the nesting season (1st of March – 31st of August).

It may also be worthwhile removing the *Cladophora* algae that forms mats on the surface of the water. This is a product of the nutrient enriched water but can create an unsightly appearance. The removed material should then be disposed of correctly, preferably through composting.

The presence of such a wide range of species in the ICW has created a locally valuable site for biodiversity in the Finglas area. It is a model of its kind, and one which it is hoped will encourage similar projects elsewhere.

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Appendix 1 – List of species confirmed from the site

1. Flora. Species nomenclature is taken from the *Census Catalogue of the Flora of Ireland* (Scannell & Synnott, 1987). Species though to be alien are indicated by the symbol §, while those that are known to be alien are indicated by an asterix, *.

Iris pseudacorus	**Yellow iris**
Achillea millefolium	**Yarrow**
Anthriscus sylvestris	**Cow parsley**
Arctium minus	**Lesser burdock**
Bromus ramosus	**Hairy-brome**
Callitriche sp.	**Water-starwort**
Caltha palustris	**Marsh-marigold**
Calystegia sepium	**Hedge bindweed**
Cardamine pratensis	**Cuckooflower**
Carex hirta	**Hairy sedge**
Carex paniculata	**Greater tussock-sedge**
Carex riparia	**Greater pond-sedge**
Carex rostrata	**Bottle sedge**
Cirsium arvense	**Creeping thistle**
Cladium mariscus	**Great fen-sedge**
Cladophora sp.	**Green algae**
Epilobium angustifolium	**Rosebay willowherb**
Galium aparine	**Cleavers**
*Gunnera tinctoria**	**Giant-rhubarb**
Holcus lanatus	**Yorkshire-fog**
Juncus inflexus	**Hard rush**
Lemna sp.	**Duckweed**
Mentha aquatica	**Water mint**
Nasturtium officinale	**Water-cress**
Phleum pratense	**Timothy**
Phragmites australis	**Common reed**
Plantago lanceolata	**Ribwort Plantain**
Populus alba	**White poplar**
Ranunculus acris	**Meadow buttercup**
Ranunculus ficaria	**Lesser Celandine**
Ranunculus repens	**Creeping buttercup**
Rubus fruticosus	**Bramble**
Rumex acetosa	**Common sorrel**
Rumex crispus	**Curled dock**
Salix sp.	**Willow**
Sinapis arvensis§	**Charlock**
Sonchus arvensis	**Perennial sow-thistle**
Stellaria media	**Common chick-weed**
Taraxacum sp.	**Dandelion**
Typha sp.	**Bulrush**
Urtica dioica	**Common nettle**
Vicia cracca	**Tufted vetch**

2. Birds

Scientific Name	Common Name	Conservation Status
Anas platyrhynchos	**Mallard**	-
Ardea cinerea	**Heron**	-
Corvus corone	**Hooded crow**	-
Cygnus olor	**Mute swan**	-
Emberiza schoeniclus	**Reed Bunting**	-
Erthacus rubecula	**Robin**	-
Gallinula chloropus	**Moorhen**	-
Hirundo rustica	**Swallow**	BWI Amber list
Passer domesticus	**House sparrow**	BWI Amber list
Troglodytes troglodytes	**Wren**	-

3. Fish

Phoxinus phoxinus **Minnow**

4. Amphibians

Rana Temporaria **Common frog**

Protected under the Wildlife (Amendment) Act, 2000; Annex IV of the EU's Habitats Directive; and listed as Internationally

5. Invertebrates

Those aquatic, or semi-aquatic invertebrates that are known to be tolerant of high nutrient concentrations are indicated with an asterix, *.

Aglais urticae	**Small tortoisehell butterfly**
Anthocharis cardamines	**Orange-tip butterfly**
*Asellus aquaticus**	**Water slater or Water hog-louse**
*Bithynia tentaculata**	**Common bithynia snail**
Callicorixa sp	**Water boatman**
Calopteryx splendens	**Banded jewelwing damselfly**
*Chironomus sp**	**Non-biting midge**
Dytiscus sp	**Great diving beetle**
Family *Formicoidea*	**Ants**
Gerris sp	**Pond skaters**
Class *Hirudinae**	**Leeches**
*Ischnura elegans**	**Common bluetip damselfly**
Limnephilus binotatus	**Cased caddisfly**
*Lymnea peregra**	**Wandering pond snail**
*Lymnea stagnalis**	**Great pond snail**
Pieris rapae	**Small white butterfly**
Planorbarius corneus	**Great ramshorn snail**
Phylum *Platyhelminthes**	**Flatworms**
*Sphaerium spp**	**Freshwater cockle**
Family *Syrphidae*	**Hoverflies**
Tetrahnatha montana	**Large jawed orb web spider**
*Tubificus sp**	**Sludge worm**