Locating ponds and finding a water source

MILLION PONDS PROJECT

A 50-YEAR PROJECT TO CREATE A NETWORK OF CLEAN WATER PONDS FOR FRESHWATER WILDLIFE

1. Clean water

The Million Ponds Project aims to create clean water ponds that will provide exceptional wildlife habitats, now and long into the future.

The critical step that will achieve this is making sure that ponds have clean water. If ponds have *poor* water quality this:

- Significantly reduces the pond's wildlife value
- Often creates long-term management problems
- Means that ponds silt up faster

What's in this factsheet?

What is clean water?

'Clean' water is water that is as near to 'natural' as possible. It has *low* levels of pollutants, particularly:

- nutrients like nitrate and phosphate
- heavy metals like copper and zinc
- residues of man-made compounds like pesticides

Pollutants can get into a pond from many places, including stream and ditch inflows, runoff from agricultural land, and roads and tracks. Once in a pond, these pollutants accumulate in water and sediments, and can move between the two. This degrades the pond and its wildlife potential for the long term. Polluted ponds have fewer plant and animal species and rarely have uncommon species. For around 85% of our rarest freshwater species, clean water is vital (see *Factsheet 10*).

How to find clean water?

To ensure ponds stay clean throughout their lifetime, locate ponds in catchments that are 'natural' – areas like woodland, scrub, rough grassland or unimproved permanent pasture. This type of habitat can be found in many corners of the countryside: on farmland, golf courses and commons as well as in more extensive natural areas, including nature reserves.

If there are concerns about water quality, try to move your pond to another location or check whether water quality can be improved by, for example, de-intensifying the pond catchment.

If these remedies are not viable, do the best you can with the site and water sources you have. Unfortunately, if a new pond does not have a sufficiently clean catchment and water source, it cannot be counted towards the Million Ponds Project target. This is because clean water ponds are now exceptionally rare, and creating them will do most to protect freshwater wildlife.

This said, even ponds that are not 'pristine' can still be valuable for many freshwater species, and will support the freshwater network as a whole. You can use design techniques (e.g. keeping ponds shallow), to maximise the wildlife potential of a pond even if water quality is compromised.

2. Water sources for ponds

Apart from rainwater, there are three main sources of water for ponds (Figure 1):

(i) surface water

(ii) groundwater

(iii) inflow streams, ditches or springs

Ponds may be fed by a combination of these water types and their relative importance can vary during the year.

In general, the cleanest water sources are (i) groundwater, and (ii) surface water that drains from un-polluted areas.

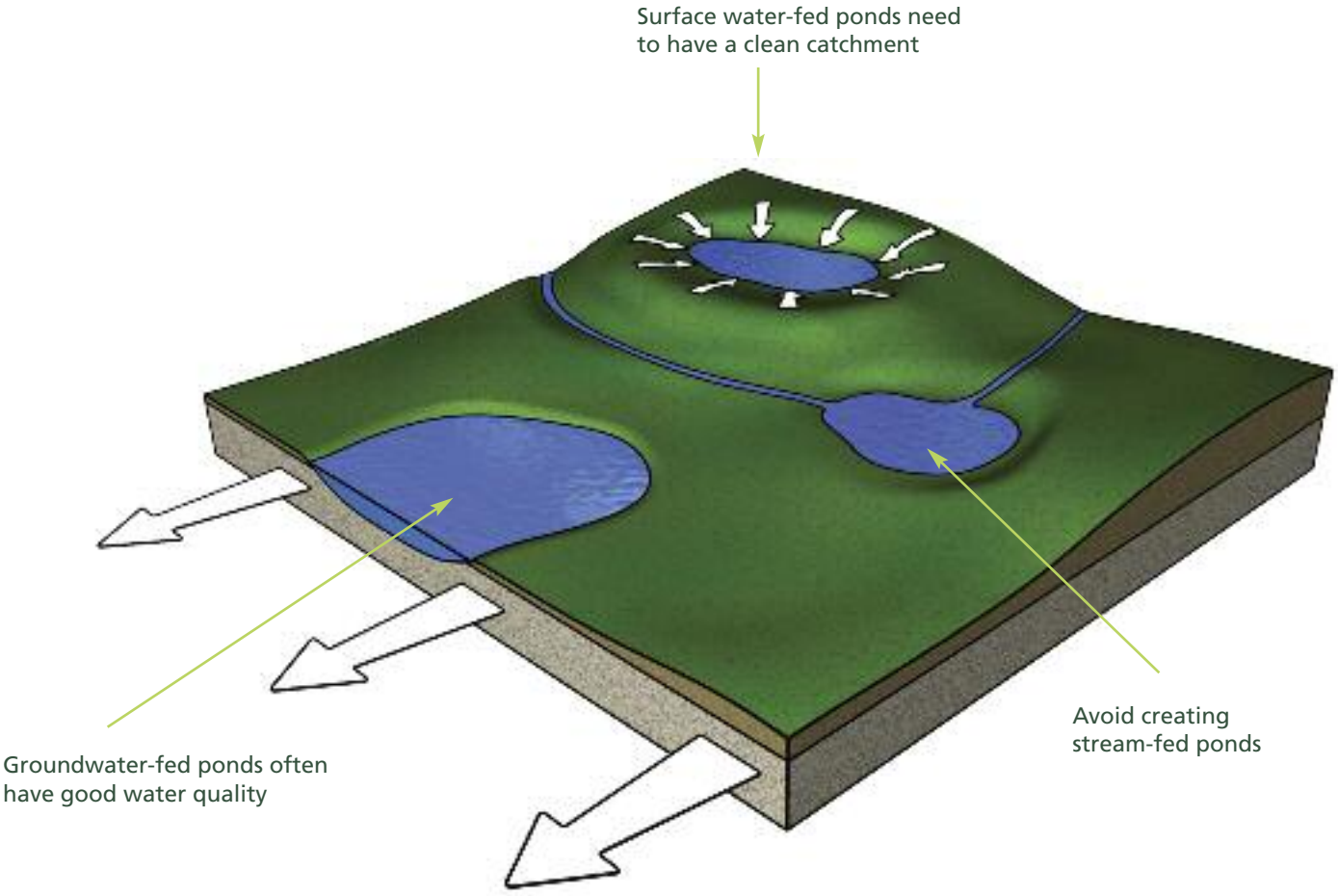

Figure 1. Water sources for ponds.

Surface water

Surface water is rain water that runs into the pond from higher ground. The water flows either across the land surface through the vegetation or, more often, through the soil and subsurface. Surface water is a surprisingly important water source for many ponds and will often be the main source of water where ponds are created in clay soils.

Surface run-off can provide some of the best and some of the worst quality water for ponds depending on the pond's catchment (see box). In intensive agricultural land and urban areas, surface waters are often of poor quality with high levels of water pollutants.

Surface water ponds are at their best where the whole catchment (big or small), is as natural as possible. This means ensuring that the pond's catchment has no intensive agricultural or urban land and that water does not run into the pond from tracks, roads, yards, spoil heaps, or other polluting surfaces.

What is a pond's surface water catchment?

A pond's catchment is the land area that lies above the pond, and from which water will drain into the pond. A pond on top of a hill will have a small catchment – maybe just the pond banks. Ponds at the base of a slope may have a large catchment, of thousands of square metres or more – sometimes a whole hillside.

For a new pond it is important to identify the pond's catchment area, because this is the area that will supply the pond with surface water, and will profoundly affect the pond's quality – for good or bad.

Groundwater

Groundwater is water that is present as a saturated layer in the ground (Figure 2). Groundwater levels rise and fall during the year, sometimes by a few centimetres, sometimes by a metre or more.

If groundwater lies near to the surface, and you dig a hole, it rapidly fills with water to the level of the groundwater table. In sands and gravels, a new hole will begin to fill immediately. In clays, it may take a day or so for the water to begin to seep out from the small pores in the clay.

Because groundwater has been partly filtered by passing through the ground, it is often one of the cleanest water sources for ponds. It is particularly low in pollutants like phosphates and metals which generally get into ponds attached to silt.

However, in intensive agricultural areas groundwater may still contain high levels of soluble nutrients like nitrate. Particular care needs to be taken with springs issuing from the base of chalk or limestone, where there is arable cultivation of the hillsides above.

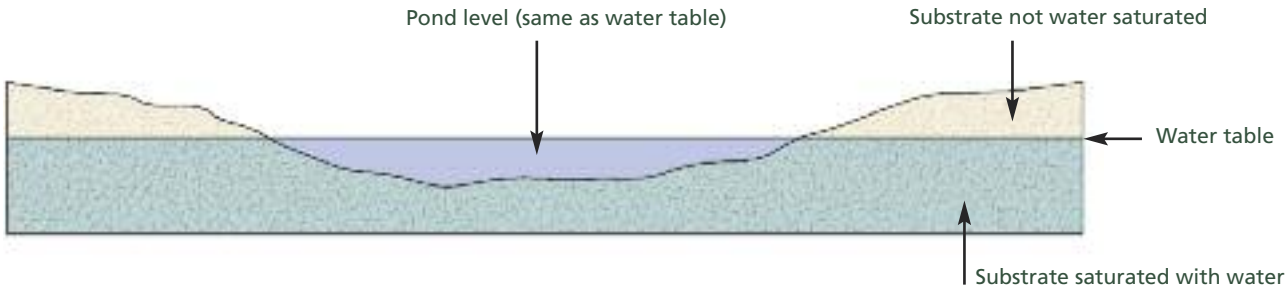

Figure 2. What is groundwater?

Inflows and drains

Modern ponds are often fed by inflows: streams, agricultural ditches or urban drains. This may seem an easy and simple water supply for a pond, but it causes many problems for ponds and their wildlife.

Ponds with ditch or stream inflows have higher pollutant levels, significantly fewer plant and animal species, and many more management problems than other pond types. Stream-fed ponds also fill up much more quickly: often they fill completely within a decade or two (see Figure 3).

For all of these reasons, one of the main stipulations of the Million Ponds Project is that contributing ponds should not have inflows. This rule may seem severe, but such problems have long been recognised in countries like Denmark, where planning permission is not given to ponds with inflows.

3. How do you make sure your pond will hold water?

One of the main concerns when digging any pond is 'will it hold water?' Ponds don't have to hold water all year round: seasonal ponds are an important pond type in their own right. And in general quality is more important than quantity. However, for a hollow to deserve the name pond, it needs to hold water long enough for wetland plants and animals to live in it. This means that water should persist into spring.

Ponds can be dug into just about any substrate: clay, sand, gravel, peat or rock. The trick is to choose locations where water is naturally retained in these substrates. If the location is not naturally suitable, then the pond basin can be lined (see *Factsheet 7*).

For the Million Ponds Project the ideal is to dig unlined ponds. There is nothing intrinsically wrong with lined ponds – they can make great wildlife habitats. Their main disadvantage is a lack of flexibility: you can't easily modify or extend lined ponds, they are more expensive to make, and there is always a worry that you may puncture the lining if management is undertaken. Because lined ponds need to have the liner covered with spoil, there is also the potential for unwanted nutrients to be introduced at this stage.

So how do you dig an unlined pond without an inflow? Sometimes it's easy. If you know that groundwater lies near to the soil surface, you just dig a hole.

If not, there are a series of steps that will tell you what kind of pond is right for your area. In summary:

1. Identify the local geology: are you in a clay area where ponds are likely to fill with surface water? Or in sand/gravels which may have an aquifer?
2. Look at the water levels in nearby ponds, springs, ditches or streams. How do water levels vary between these waterbodies and during the year?
3. Dig test holes across your site. Check first to ensure that service pipes, cables etc do not run across the site (see below). Ensure test hole locations reflect any differences in the landscape where you might dig the pond (e.g. valleys, hill tops, base of slopes, areas where water accumulates, edge of any wet bits).
4. Ideally, dig test holes to at least 0.5 m deeper than the maximum depth you expect for the final pond. When digging the test holes, note the depths at which the geology changes, or at which you meet water.
    - If you dig into sand, gravel or peat (sometimes clay) which is waterlogged, a groundwater pond will usually be possible.
    - If you dig into sediments with a very high proportion of clay (and little sand, rock or gravel), surface water ponds will often be possible.
    - If there are major changes in geology in the test holes i.e. different layers of clay and sand or peat, dig additional holes of shallower depth to see if the capacity for water-holding varies in the different layers.

5. Leave the test holes open and monitor water level fluctuations for as long as possible, ideally through both wet and dry seasons. This will help provide an idea of water level variation in the final pond.
6. If the test holes do not hold water for more than a few days after wet weather, then either find another location, or consider using a pond liner.

More detail is given in *Factsheet 10*.

Can a pond last for 10,000 years?

Ponds with an inflow stream usually fill up quickly (Figure 3). Even a crystal clear stream or a drain that only runs in wet weather will dump large amounts of sediment in a pond. A 60 m^2 pond can fill-up completely within 5 years – just by the sediment brought in by a spring 50 m upstream of the pond.

In contrast ponds without inflows fill very slowly. The permanent water phase of a 1 m deep pond can last well over 100 years. Once the pond begins to dry up in summer, the rate of infill slows even further (because the organic sediments are oxidised during the summer dry phase). As a result temporary ponds are very stable habitats, and they can be exceptionally long-lived. Many can far outlive lakes. There are many post-glacial temporary ponds in Britain which are over 10,000 years old, and will probably survive 10,000 years more.

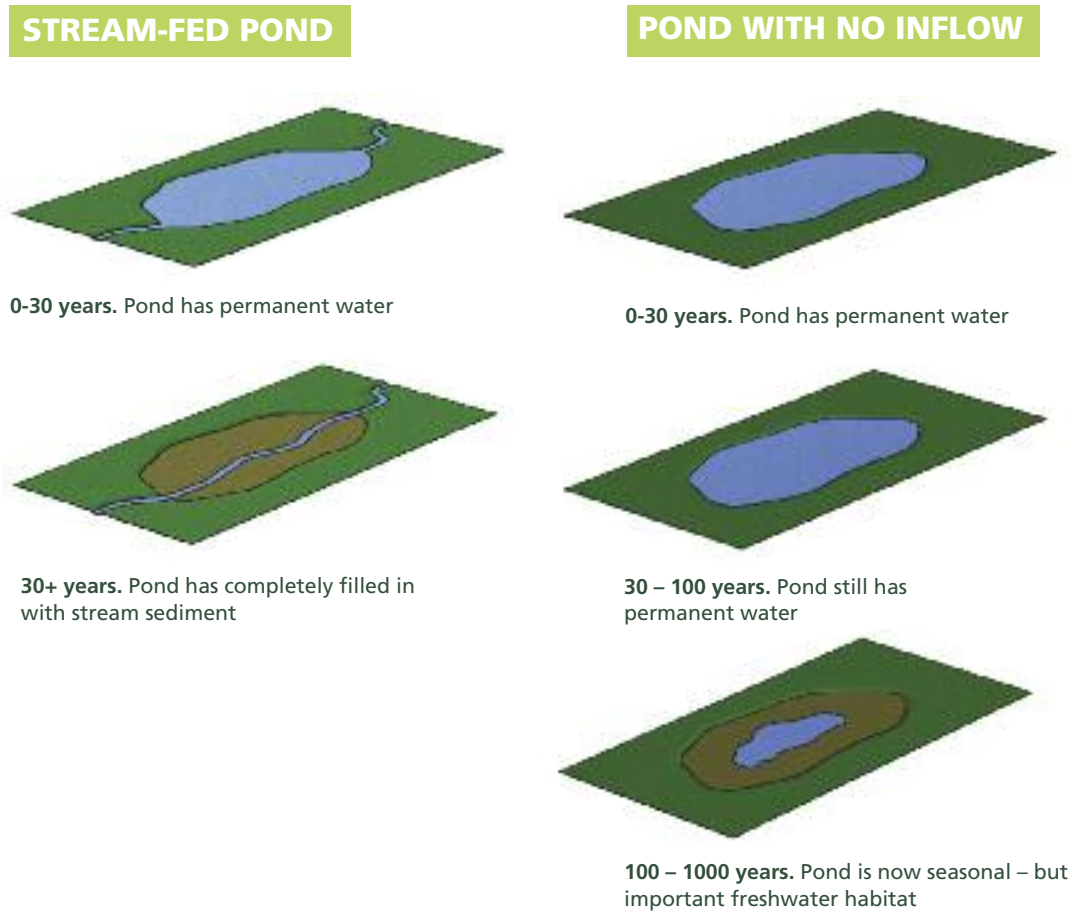

Figure 3. Stream-fed ponds are short-lived compared to ponds with no inflow.

4. Strategic locations for new ponds

Across the UK as a whole, it is important that clean water ponds are spread around and dug in a wide range of landscape types, such as woodlands and meadows, in valleys and on hilltops. It is this mix of locations that will protect the widest range of freshwater biodiversity.

This said, it can be useful to locate some new ponds more strategically:

- Dig ponds near other wetlands to improve connectivity.
- Dig ponds where uncommon species occur to help strengthen their populations.

Or it can also be important not to dig at all:

- Don't dig ponds where there are existing wetland habitats.
- Don't dig ponds where this might damage existing species.
- Don't dig up peat.
- Don't dig up our archaeological heritage.

Connectivity – linking ponds and other wetlands

In natural landscapes ponds rarely occur in isolation: usually they form part of a complex together with other wet habitats like rivers, wet woodlands, springs, mires and other ponds and pools.

Mimicking this natural connectedness can have benefits. We now know that pond plant and animal populations often fluctuate widely at a site, and that local extinctions are relatively common as part of natural processes. If there are many waterbodies in an area, there is a much greater chance that, after a natural extinction, the species can recolonise from another nearby waterbody. If not it will be lost forever, and gradually pond richness will decline.

Creating protective pond networks is very valuable: we know that it helps to maintains wildlife-rich ponds and is particularly important for uncommon pond species like great crested newt. As our climate changes, in ways that are not always predictable, such networks are likely to be even more important.

Ponds for rare species

We are currently developing support tools to identify species and areas which will benefit most from strategic pond creation. This includes:

- **Identifying Important Areas for Ponds (IAPs):** these are geographic areas with large numbers of high quality ponds, many supporting rare species. Creating new ponds within IAPs can help protect networks of the most important ponds for biodiversity. An IAP assessment is currently available for Wales, and will soon also be for other parts of the UK. Check *www.pondconservation.org.uk* for details.
- **Species dossiers:** these provide accounts of where and how to dig new ponds for some of the UK's most uncommon pond animals and plants. The aim is to develop dossiers for around 40 of the 80+ priority species associated with ponds.

5. Places not to dig new ponds

Creating new ponds has many benefits, but it shouldn't be at the expense of valuable existing wetland habitats (Figure 4). A particular trap to avoid is digging up existing wet bits. Make sure you carry out a risk assessment before digging (see *Factsheet 6*). Although it might seem logical to put new ponds in a place that is already damp, like seepages, springs or damp hollows, these areas may already have considerable value in their own right, particularly if there are few other wet places in the area.

Take particular care with dried up ponds. If the pond still holds water in winter and spring – it is a seasonal pond. Many seasonal ponds have uncommon plants and animals, so it is best to leave them alone. Even if the pond is now completely dry all year through, it may still contain seeds or spores from uncommon plants that grew there in the past. This is one of the rare occasions where it may be valuable to spread a little of the excavated spoil (the old pond's sediment) into the new pond to see what comes up.

This field looks like a good place to dig ponds: there is water around near to the surface and ponds have been dug in the past. **But** don't dig up the existing wet bits – places like springs, flushes and temporary ponds are important and of value in their own right.

Figure 4. Take care not to damage existing wetlands.

Avoid damage to existing pond species

There are a very few occasions where digging a new pond may actively damage existing pond wildlife. The risk is greatest where very old ponds of considerable value are present, and a new pond might encourage colonisation from unwanted species, threatening existing communities. The ancient pingo ponds of Norfolk are a case in point. These 10,000 years old ponds have very special wildlife communities with rare species found at few other sites in Britain. We don't know if new ponds would cause damage, but it is not a risk worth taking.

Don't dig up peat

In these climate-aware days, it's generally considered bad practice to dig up peat, because its subsequent decay produces the greenhouse gas carbon dioxide (CO_2). Overall, high quality pond creation may benefit the global carbon budget, because the carbon rich sediments that accumulate in the ponds will lock up CO_2. Nevertheless, when creating ponds for the Million Ponds Project, peat areas should generally be avoided. The main exceptions are small ponds created specifically for some of the very rare plants and animals that live in fen and peatland pools. Because the pools are tiny, the scale of CO_2 release is very small and is warranted by the considerable benefits of rare species protection.

6. Avoiding later problems

If the pond is going to be located close to a public path or in an area of open public access, think carefully about the impact this may have on the pond. The main issues are: dogs, ducks, fish, invasive species and people.

If necessary, consider relocating the pond, or use a design that will minimise the impact of these factor (see the *Design Bank* for example of designs). Or make a pond for people, not wildlife. (Though note that this may not count for the Million Ponds Project).

Dogs and ducks

The impact of dogs may seem a trivial concern, but their effect on ponds can be very significant (Figure 5). Many dogs love water, and most of us enjoy watching them plunge in to splash or swim for sticks. There are many places where dogs can swim with few problems – many of the UK's rivers, streams and ponds are already very damaged, and a bit more disturbance is unlikely to have much impact.

Figure 5. dogs enjoying themselves in a New Forest pond.

This is not true of clean water ponds, however. The occasional dog swimming will not damage a pristine pond, but regular disturbance churns up the bottom sediment. This makes the water cloudy; aquatic plants cannot grow, and pond animal diversity declines. A pond on a regular dog-walking path where dogs may swim every day will be permanently damaged. You can see this effect widely in the countryside, from the New Forest to small Lake District Tarns.

A small number of ducks on a pond is natural, but as soon as ducks are fed, their numbers rise. And anyone who has pond-dipped in a duck pond will know how impoverished they are in anything except ducks. Duck ponds are an important amenity for people, and especially children, but the presence of ducks in unnatural numbers is not compatible with the creation of clean water ponds.

There are pond designs you can use to minimize dog and duck impacts such as having sacrificial ponds (where dogs or duck feeding are allowed), leaving shallow seasonal ponds near the path and deeper pools further away, or reducing access. However the easiest treatment may be prevention: move the pond, or perhaps, the path.

Alien and invasive species

Countryside ponds located in public areas, beside paths, and especially near to roads or car parks are much more likely to contain invasive non-native species than other ponds. Invasive plants like new zealand pigmyweed (*Crassula helmsii*) are widespread in these easy to access ponds, and there is evidence that their presence continues to damage the populations of some of our rarest plants. Other invasive plants like water ferns (*Azolla filiculoides* and *A. caroliniana*), parrot's feather (*Myriophyllum aquaticum*), floating pennywort (*Hydrocotlyle ranunculoides*) and least duckweed (*Lemna minuta*) are spreading too (Figure 6).

Figure 6. A pond completely covered with water fern.

Many exotic amphibians, like green frogs and midwife toads, have been released into British ponds. Goldfish are common in many roadside ponds, and in some places this threatens one of our few native pond fish – the crucian carp, which interbreeds with the non-native goldfish.

The implication is clear – many people introduce garden plants and animals into the wild. This may be because their ponds are being cleared out and pond owners don't want wildlife to die, or just because it seems like 'a good thing to do'.

There have been many campaigns by wildlife organisations to stop such introductions happening. But a significant risk still exists. New ponds are often particularly vulnerable, because their bare soils are a perfect place for invasive plant species.

To avoid problems:

1. Check other waterbodies in the area before making new ponds. If invasive plants are present and it is not possible to get rid of them, locate ponds as far as possible away from any existing sources. When the new pond is made, check regularly for signs of unwanted species, until other vegetation has developed and covered the bare ground.
2. As noted above, prepare in advance - avoid locating new ponds near to areas of regular public access, particularly close to car parks or roads, from which it is easy to unload unwanted pond plants and animals.

People

Having people (without uncontrolled dogs) around ponds is not a problem. People really like ponds, and ponds play an important role as a link between people and wildlife, so this should be encouraged. People around ponds can also be useful for keeping down vegetation and making patches of bare ground – adding to the natural variations in bank type.

Occasionally, in very public places, rubbish dumping may be an issue, or paths develop all around a pond, completely eroding all natural vegetation. In most cases, there are usually simple things that can be done to reduce damage, such as use of trenches, banking or provision of alternative routes.

For further information about the Million Ponds Project please visit *www.freshwaterhabitats.org.uk/projects/million-ponds* or email enquiries to *info@freshwaterhabitats.org.uk*