

# WATER Gardening

Fernbank Science Center ■ DeKalb County Schools  
Compost Site and Gardens



by Trecia Neal, Instructor, Fernbank Science Center (reprinted from the Fernbank Magazine Volume 24, Issue 2, 1998 -1999)

It is amazing how much a water garden can add to your yard. The addition of a water feature, no matter how simple, will draw wildlife to your yard like a magnet. It is also an opportunity to add some beautiful plants to your landscape. With today's choices of liners and shapes, you can create a water garden for very little cost and a moderate amount of labor.

An informal pool is irregular in shape with a curving outline that gives the appearance of being natural. This type of pool fits best into informal gardens that have irregularly shaped beds and contoured paths. The edging for informal pools can be of more than one type of material and is seldom raised above ground.

Probably the most important decision regarding your water garden should be its placement in your landscape. There are many things to consider. You want your garden to be located where you and the animals can get the maximum pleasure from it.

## In general, a water garden should be located:

- in full sun, or as much sun as possible (Water lilies require 4-6 hours of sunlight in order to produce blooms.)
- at the most level site that is available
- where there is easy access to water and electricity
- where it can be viewed from the house
- where the water can reflect the the surrounding landscape

## A water garden should not be located:

- where it will catch falling leaves and pine straw
- in the lowest spot in your yard where it could flood in heavy rains or become muddy
- in a place where your soil is prone to saturation which can cause your liner to float
- where trees with shallow root systems will be disturbed (elms, willows and maples)

The size of your water garden should be your next consideration. The minimum size for a healthy balanced pond is about 50 square feet of surface area. The depth of your pond is also an important factor. Depth can range anywhere from 18 to 24 inches, but, if you plan to keep fish in your pond, you will need at least 3 square feet of 24-inch depth to protect your fish through the winter. You can calculate the amount of dirt that you will have to remove by determining the number of gallons your pond will hold. To estimate gallons for an irregularly shaped pool, draw a rectangular shape around it and use this formula: length x width x depth; then multiply by 4/5 for the approximate volume in cubic feet. Next multiply the cubic feet by 7.5 to calculate gallons. Soil excavated for your pond can provide an opportunity to contour rough places in your yard or create a new raised bed somewhere in your landscaping.

Now that you've decided on your site and the size, it's time to consider what type of lining to use. This choice should take into account the cost, life expectancy of the material, its availability in your area, installation requirements and how these materials will blend with the existing materials in your landscape.

Everyone has a favorite; I prefer the Butyl liners because you can create just about any shape that you want. Butyl liners are also black and become covered with a thin layer of algae soon after installation. This reduces the light and heat absorption properties of the liner and also makes it look quite natural. One word of caution regarding flexible liners: when preparing the hole, you must make sure that no sharp objects extend beyond the soil. Most people cover the bottom and sides of their holes with thick newspaper, cardboard, sand or old carpeting (be sure to check for carpet tacks). To determine the size of your liner, measure the length and width of your pool at its widest point. Liner length equals: length + (2 x pool depth) + 2 feet for liner edge. Liner width equals: pool width + (2 x pool depth) + 2 feet for liner edge. This formula will work for any shape pool.

## Your choices are:

TYPE	LIFE EXPECTANCY	COST
PVC	30 years	Least expensive
Butyl or Rubber	7-15 years	30' x 30' = \$775

## CONSTRUCTION

### Tasks and Tools needed:

**Digging:** shovels - round point and square point, pickaxes and a crowbar

**Leveling:** carpenter's level, string, stakes and a long 2 x 4

**Packing:** a tamping tool

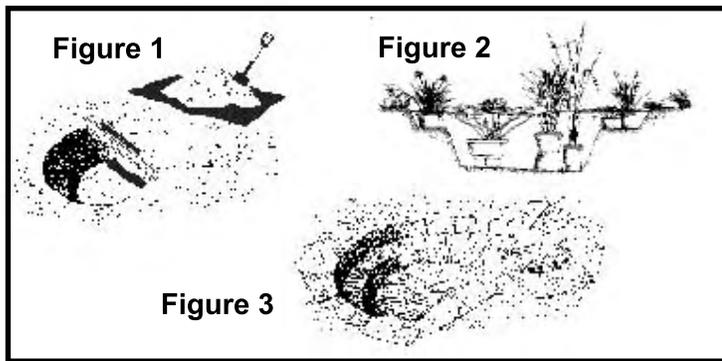
**Hauling materials:** wheelbarrow, large tarp or plastic sheets. If the waste soil is to be used on site, then remove it in a wheelbarrow as it is dug. If it is to be removed from your residence, store it on a large tarp or plastic sheet until it can be removed.

**Edging materials:** rock or concrete blocks (fieldstone is good and flat)

### Step 1 - Determining the Shape of your Pond:

Lay out the shape of your pool with a garden hose or string before beginning to dig. Once you are happy with the shape, use a can of spray paint to mark the inside area of the hose. Remove the turf and any topsoil from the outlined area adding 2 inches to the width for a layer of cushioning material. If any edging will be laid around the pond, remove the turf and soil from this area as well. Then re-mark the actual area of the pond. It is easier to level the edge of the pond now using the soil as you remove it to raise the lower end. Take a long 2 x 4 and lay the board across the pond. Put the level on top of this (Figure 1). Check the pond in all directions to make sure that it is level all the way around. Adjust the level as you go using the soil that you have just removed.

**Step 2 - Earth Removal:** Begin digging from the center of the pond toward the edge. Remember to make shelves for marginal or marsh plants in containers. These can be on one side of the hole or all around the edge. In order to determine the width of your shelves, try to get an idea of what type of plants (and the size of their pots) you'll be using in your pond.



be about 12 inches below the liner's edge. Be sure to include about 2 inches for the cushioning under the liner (Figure 2). It is easier to maintain the shape and monitor the depth of the pond if the entire area is dug out to the depth of the first shelf. The sides of the pond should be slightly sloped to the middle of the pond. Continue digging at a sloping angle and allow for other shelves where desired. It is easiest to dig the major portion of your soil using the round point shovel (spade) and cutting the slopes for the walls with a narrow square shovel. While you are digging is the time to determine if you want a waterfall with your pond. The excavated dirt can be used to build up the area for the waterfall (see waterfall section).

**Step 3 - Smoothing and Cushioning:** Check to make sure that all of the surfaces are as smooth as possible and begin to place your cushioning layer (newspaper, carpet or sand) for the liner.

**Step 4 - Preparing and Positioning your Liner:** Roll out your liner on the driveway or lawn and allow it time to become flexible from the heat of the sun. Once the liner is workable, reroll it and carry it, DO NOT DRAG IT, to the pond. Stretch the entire liner over the hole and center it. Carefully push the liner into the pond; it will not fit perfectly so don't worry about being exact. Place some rocks at the edges of the liner to help hold it in place before adding water (Figure 3).

**Step 5 - Filling your Pond:** Begin adding water to your pond. This will take some time. As your pond fills with water, the weight of the water will cause the liner to sink gradually into your hole. You will have to fold and pleat the excess areas of your liner, both in your hole and around the outside. Don't worry about how bad this looks because you will be burying your outer edge and your plants and water will hide the bottom and sides. After filling the pond with water, you should allow the water to stand for several days before adding any plants or animals to the water. This provides time for the aquatic environment to undergo some physical and chemical changes that will make it a safe environment for plants and animals. This is also a good time to operate your new pump and make sure there are no leaks and everything is working properly.

**Step 6 - Edging your Pond:** When your liner is completely in place, you can cut away any excess from around the edges. (Be sure to leave at least 12 inches beyond the rim of your pond.) Save this excess liner for your waterfall. When using a thick liner, it is sometimes helpful to tack the liner down with 10-inch nails as you are cutting. Your final step is to install your edging. If you plan to use mortar to fix your edging, you'll have to dig your edge an extra 3 inches deep to compensate. Remember that mortar is alkaline and can be dangerous for your fish and plants. When using mortar, rinse everything with a vinegar solution

(1 gallon of vinegar to every 200 gallons of pool water), empty your pool and refill it again before you add plants and fish. If you are using rocks, be sure to place them so that there is a one- or two-inch overhang above your pond. Creating an edging using fieldstones or rock is like putting together a puzzle. Be patient and try your rocks in different locations to achieve a natural look.

## WATERFALLS

Nothing will bring more wildlife to your pond than the sound of moving water. Birds cannot resist the drip and trickle of a waterfall and will stop what they're doing to come and drink and bathe. Also, this soothing sound can drown out a lot of traffic noise if you are located near a street. There are two basic forms for moving water which correspond to the formal and informal type of pond. Fountains are more formal, while waterfalls fit delightfully in an informal pond. In our pond at home we have what we call a 'mountain seep' that provides a very small, but irresistible (to both wildlife and humans!) trickle of water through several large, moss-covered rocks. Waterfalls really must be planned from the very beginning of your pond construction. Pumps need electrical power that will need to be hidden, as will the tubing that carries the water to the top of the waterfall. The height of your waterfall will determine the power of your pump and the site of your waterfall. The most natural place to locate your water would be an inlet where water would naturally enter your pond if it were natural! If this sounds confusing, try to imagine your pond in the middle of a forest, and envision where water would naturally enter it from a stream. If your site has both low and high areas, you would want to site your waterfall on the high side. If your pond is on flat ground, you will want to create a raised area that looks as if it were a stream emptying into a pond. This will create an opportunity for even more landscaping ideas! Two or three levels of water dropping are ideal for most water gardens.

You can build up your waterfall with concrete blocks and then cement rocks together to make it look natural. You can also use some of the dirt from digging your pond to create elevation and "dress" it with rocks over the plastic liner. The excess liner that you saved from your edging can be used to cover your earthen or concrete block elevation to provide a watercourse. This liner does not have to be one continuous piece; you can use overlapping pieces to line the waterfall. After you have lined it, you can stack your stones over the liner to create a natural look.

## WATER GARDEN MAINTENANCE

When we created our first 12' x 8' pond, it required very little maintenance. We didn't even have a filter or a pump until we installed our mountain seep! Now, we have to clear our pump about once a month and sweep the pine straw out that occasionally falls from giant pines that offer desirable evening shade. Water that is clear enough to allow you to view your fish is what every pond owner desires. If your pond is of sufficient depth and you've correctly chosen plants and wildlife, then the only remaining ingredient you need is patience. Naturally occurring single celled algae in water will turn your pond green a few days after first filling. If there is sufficient sunlight, these algae will begin to bloom and cloud your water. The addition or presence of lily pads that will spread out over the surface of your pond and shade the algae will cause their numbers to drop. It is also important to have a sufficient number of submerged plants such as Anacharis spp. Of course, if you insist on having more fish than your pond can hold, their wastes will continue to feed the algae. If this is the case, it is time to turn to a filtration system.

There are two types of filtration systems, biological or mechanical. Mechanical filters are usually box-like, and filled with foam, fiber cylinders or pads that catch debris and hold it until the filters are removed and washed. Depending upon the size of the filter and pond, that could be as often as every three days during the height of summer, to once a month. Biological filters come in a variety of sizes. Basically such a filter is a container which is sealed except for an inlet and an outlet. The container needs to be above the water level so that the freshly filtered water can return to your pond. This arrangement will need disguising. The inside of the filter will be a medium where

millions of microorganisms live and help clean your water. This medium could be foam rubber, pumice or ceramic chips. The water will then filter through an additional layer that could be activated charcoal, gravel or sand. These filters need to be run constantly in order to keep the beneficial bacteria alive. Inactivation for just one day could cause massive bacterial die-off which can cause great harm to your pond. These organisms will develop naturally once the filter is activated.

## PLANTING YOUR WATER GARDEN

Aquatic plants are usually grouped into the zones of water in which they flourish.

**Submerged plants:** There are several different plants that we grow in ponds because they grow underwater and contribute oxygen directly into the water. This oxygen is vital for maintaining fish in your pond. Many of these are also important food sources for fish and make good spawning spots for fish and insects to hide their eggs. These plants also will absorb fish waste and help clean the water by absorbing dissolved mineral salts that algae use as a food source. (Table 1)

**Emersed plants:** Plants from another group are rooted in pots with their leaves floating on the surface. These plants are sometimes referred to as emersed plants, or submerged plants. They are not important as oxygenators, but are valuable aesthetically. They are also effective in reducing the development of submerged algae because of the shade cast by their leaves. Water lilies are the most commonly sold plant in this category. Water lilies belong in the family Nymphaeaceae and require at least four hours of direct sunlight to bloom. There are many beautiful varieties of water lilies, so consult your local water garden store or plant nursery for what grows best in your area. (Table 2)

**Floating plants:** These can cover very large expanses of still water and are very useful when establishing a new pond. These plants help to shade out the sunlight and feed on mineral salts that encourage algae growth. They reproduce rapidly and can quickly become a nuisance. Most can be netted out of the pond quite easily and will serve as a great source of nitrogen for your compost pile. (Table 3)

**Marginal plants or Emergent/Marsh plants:** These plants are not important to the maintenance of clear water and water balance, but are used for many other reasons. They soften the edges of ponds with their vertical growth and provide glorious summer color. They also provide habitat for many insects, frogs and other creatures that need the cover of dense, upright foliage. These plants prefer areas around the pond where the water is shallow. This is an opportunity to use your shelves in your pond, or to consider building a shallow beach area in the pond. Birds cannot immerse themselves in water, but prefer to stand in shallow water to drink and clean themselves. Emergents are prone to spreading so are best confined singly in planting pots. Here are a few examples: (Table 4)

## WILDLIFE FOR YOUR POND - IF YOU BUILD IT, THEY WILL COME!

One of the nicest things about having a water garden is watching the local wildlife discover your wonderful new water resource! Of course fish can't find your pond, but everybody else will! Fish help your pond by eating insects, algae and mosquito larvae.

When considering adding fish to your pond, there are a few guidelines to follow. Most of the ornamental, cold-hardy fish for ponds are carp relatives. This includes regular dime-store goldfish and their cousins. Goldfish are extremely cold hardy and can live for 10-20 years in a healthy pond. Goldfish will grow about one inch per year (up to one foot) and will not outgrow the size of your pond. They are prolific breeders so it helps to have good friends with ponds to help with all the babies! When trying to consider how many fish to put in your pond, a common rule of thumb is one square foot of water surface for every one inch of fish.

If you decide to have more fish, you will need some kind of device for adding oxygen to your water. This can be as simple as an air pump with an air stone from an aquarium store, or as complicated as a waterfall. You may also want to add snails to help control algae growth. When looking at fish in the pet store, choose ones that are brightly colored and active. Make sure that no scales are missing and that the dorsal fin (the one on top) is standing upright. When adding fish to the pond, float the bag on top of the water for 30-60 minutes until the water temperature inside the bag is the same as the water temperature in your pond. Slowly open the bag and carefully add some pond water to the bag, allow it to mix, and then gently pour your fish into your pond. Before adding any fish to a new pond, allow the water to stand at least three weeks to allow the water chemistry to settle down. Some of the more interesting varieties of goldfish follow:

As your pond becomes established, other wildlife such as frogs, birds, lizards, salamanders, chipmunks and squirrels will become regular visitors. Don't be surprised to see an occasional raccoon, great blue heron, green heron or wood duck come to visit. My family loves to sit quietly next to our pond and listen to the male frogs sing while they are trying to impress the females! It is a regular pastime to count them and see how many have taken up residence. It is amusing to watch the chipmunks have a quick drink, and the birds take a bath. And mostly, the pond is a perfect excuse to just sit and listen to the sounds of the water, and imagine that you are next to a rocky waterfall as it gently babbles over pebbles and stones.

Fish for the wildlife pond	
<b>Comet goldfish</b>	An elegant goldfish with long, streamlined fins and flowing tail. A hardy and successful breeder.
<b>Shubunkin</b>	Valued mainly for their coloring, ranging from red to blue, brown, black and white. Developed by the Japanese during this century.
<b>Calico fantail</b>	Similar to comet but more rounded bodies and even larger double tails. Is a multicolored fish with patches of black, red, blue, white and gold.
<b>Japanese fantail</b>	Similar to comet with golden-orange scales with black and white splashes; not as hardy as comets and shubunkins.
<b>Orfe</b>	A sleek, elegant fish that darts around the pond with great speed. Very attractive in schools. Less tolerant of low oxygen levels and pollution than goldfish. There is a golden form and a completely silver form.
<b>Mosquitofish (Gambusia affinis)</b>	If you can find them, the mosquito fish is a wonderful fish to have in your pond. They aren't colorful, but these tiny fish do an effective job of eating mosquito larva.
<b>Koi (Ornamental carp)</b>	The most glamorous, expensive and beautiful fish for the pond. Very long-lived (up to 60 years). This is the Japanese national fish and has been bred since the 1820's for its brilliant colors. These fish require large amounts of oxygen and are bottom feeders. This behavior can contribute to a cloudy pond. Koi will often pull all the gravel off the tops of your underwater potted plants and destroy them.

## Bibliography

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**Table 1 Submerged oxygenators**

<i>Cabomba caroliniana</i> 'Fanwort'	Ferny, deep reddish-green foliage, small white flowers. Too aggressive for earthen ponds
<i>Callitriche heterophylla</i> Starwort	Continues to oxygenate in winter
<i>Ceratophyllum demersum</i> 'hornwort, coontail'	A submersed aquatic herb with finely dissected leaves that are crowded towards the stem tip giving the plant the appearance of a 'coontail.' Unlike most submersed aquatics, coontail is rootless—less attractive to fish that nibble on young plant growth.
<i>Egeria densa</i> 'Brazilian elodea'	An introduced plant that appears as a larger version of <i>Elodea canadensis</i> . The leaves are larger and are in whorls of 4-8. Produces 10mm white flowers that float above the water.
<i>Eleocharis acicularis</i> 'Spike Rush' or 'hair'	Small plant with slender wiry foliage, excellent in tub gardens.
<i>Elodea canadensis</i> var. <i>gigantea</i> 'Anacharis' or 'Pondweed'	Roots at the bottom or floats in water. Very soft leaves in whorls of three.

**Table 2 Emersed Plants**

<i>Myriophyllum verticillatum</i> 'Watermilfoil'	Very attractive oxygenators, with long stems bearing whorls of green leaves that make excellent sites for fish eggs.
<i>Myriophyllum brasiliense</i> 'Parrot Feather'	Rooted to the bottom but may extend 3-12 inches above the water surface. Sometimes called 'never-wet' for its ability to appear dry after being dunked in the water.
<i>Orontium aquaticum</i> 'golden club'	A lovely plant with large, dark velvety green leaves. The white, pencil-like flowers are tipped with yellow and look like golden poker. Planting depth 3-12 inches.
<i>Zantedeschia aethiopica</i> 'arum lily'	<i>Zantedeschia aethiopica</i> 'arum lily' Leaves are arrow-shaped and glossy on long, smooth stems. Inflorescence is a golden-yellow poker-like spadix surrounded by a white spathe or bract.

**Table 3 Floating Plants**

<i>Azolla caroliniana</i> 'water-fern'	A small free floating fern commonly found in ponds and lakes. Young plants are first bright green, but may turn pink, red or dark brown. <i>Azolla</i> is a fern ally with its two spore types encased in special capsules called sporocarps.
<i>Eichhornia crassipes</i> 'water hyacinth'	The showiest of floating plants producing a beautiful light blue to violet flowers. It is not frost hardy and needs to be overwintered indoors. They are a severe environmental and economic problem and banned in many states.
<i>Lemna minor</i> 'common duckweed'	A very vigorous species of floating plant, providing shade and food for fish. It can become a problem because of the rate at which it multiplies.
<i>Pistia stratiotes</i> 'water lettuce'	Another tender plant which should be overwintered indoors. Very attractive rosette of pale green, fan-shaped, velvety leaves.

**Table 4 Marginal and Marsh Plants**

<i>A. gramineus</i> 'Variegatus'	<b>Variegated Japanese Sweet Flag</b> -a spectacular foliage plant; Creamy white and green swords shoot up from the water.
<i>Equisetum</i> spp	<b>Various horsetails</b> - These are ancient plants that come from the times when mosses and ferns covered the earth.
<i>Iris pseudacorus</i>	<b>Yellow flag iris</b> - a vigorous plant with long, wide sword-like leaves that form large clumps with yellow flowers in May
<i>Juncus</i> spp	<b>Rushes</b> - grass-like but with sharp pointed leaves round in cross section
<i>Pontederia cordata</i>	<b>Pickerelweed</b> - leaves similar to many of the spears and arrows that populate water gardens. The flowers are some of the best! Late summer into fall, blue stars are borne on tall spikes above the foliage, extremely easy to grow.
<i>Saururus cernuus</i>	<b>Lizard's tail</b> - leaves shaped like elongated hearts and overlap in a mass, the flower spikes give the plant its tiny white blossoms which form long racemes arching down towards the water, very fragrant