PEOPLE enjoy water features for different reasons. Some people find the sound of trickling water relaxing. Other people like aquatic plants and fish that live in water features. Whatever the reasons, landscapers are receiving more and more requests to incorporate water features into residential landscapes.

Objective:

- Describe the installation of water features.

Key Terms:

- floating plants
- ground fault circuit interrupter
- gunite
- marginal plants
- oxygenator plants
- pond liners
- preformed pools
- recirculating pump
- reglet
Water Features in the Landscape

Water features come in many sizes and shapes. Some are natural features of the landscape, such as streams or ponds. Others are completely artificial. Artificial water features may appear human-made or may look natural. The materials needed to create a water feature depend on what the designer is trying to accomplish and the size of the desired feature. A tiny formal pool will require different supplies than a large pond with a waterfall.

The landscape site usually dictates many of the requirements of a water feature. The water garden should receive six to eight hours of direct sunlight if flowering water plants are desired. The site should be level. It should not be in a low spot, since surface drainage could run into it, creating a pollution or overflow problem. Unless the property owner is willing to put a great deal of time into cleaning, the water garden should be located away from trees that would drop leaves in autumn. The water feature should be located where it can be enjoyed from the house, patio, or other vista.

PONDS

A pond is the most common human-made water feature. Ponds can be any size or shape, although larger bodies of water are preferred for the health of the system. Since a pond is a closed ecosystem, each aspect of the environment must be carefully maintained and balanced. This is more easily accomplished with a larger body of water.

Types of Ponds

Several practices can be used to install a pond in the landscape. The materials most commonly used are preformed pools, pond liners, concrete, and clay.

Preformed pools are ready-made pond shells composed of fiberglass or molded polyethylene. They come in a variety of sizes and shapes but are generally smaller since they are stiff and unwieldy. Most shells are between 18 and 24 inches deep, making them unsuitable for overwintering fish in colder climates. A preformed pool needs a good substrate of sand or gravel because it can warp out of shape if not supported properly.

Pond liners are flexible, waterproof barriers used to line the inside of ponds. Liners are made of a variety of materials, such as PVC or EPDM (ethylene propylene diene monomer) rubber membrane. PVC liners are not as durable or desirable as the other options. Some newer brands of PVC have some UV resistance and come with warranties of up to 10 years. EPDM liners are heavier and more expensive but are much more resistant to weather and UV radiation. EPDM liners can be bought with warranties of up to 30 years.

Gunite, concrete poured over a mesh grid, can be an extremely durable pond material. It is, however, quite expensive and requires outside contracting by a business that specializes in this type of construction. Sometimes waterproof tile or brick can also be used to create a water feature.
The use of concrete and liners for large ponds can be cost prohibitive. A good option for a large pond is high-quality clay, which can waterproof the soil. The clay is graded to create a 3- to 6-inch layer at the bottom of the pond, effectively forming a waterproof basin.

**Water Circulation**

Water circulation is vital to pond health. If no filter device is in use, the water turnover, or circulation rate, should be once every one to two hours. If a filter device is in use, the turnover should be once every four to six hours. Circulation improves the oxygen content of the water, keeps the water cleaner by allowing better biological filtration, and helps reduce the collection of debris on the water’s surface. Water circulation can be created by using a fountain or waterfall or by using a filtration system. Both require pumps.

A **recirculating pump** is a small motor that moves water in a closed system. It can be used to power a fountain or waterfall, or it can be used to move water through a filter. A pump should be sized to circulate the entire water volume once every one to two hours. If water must be lifted, as in a fountain, jet, or waterfall, a larger pump is needed.

Pumps are rated by gph (gallons per hour). A 200-gallon pond needs a pump with a gph rating of at least 100. The pump should be 12 inches or more below the surface of the water for optimal circulation. Additionally, the intake should be placed away from the outtake for proper turnover of the water. If a fountain or waterfall is part of the system, the pump needs to be increased in power and size for each foot of height, based on the manufacturer’s directions. Some fountain pumps are rated in gallons per minute.
Filters

Filters may be necessary to keep a pond clean. This is especially true if the pond has a high biomass of fish or other wildlife or if leaves and other debris are allowed to accumulate in the pond. Filters can be mechanical, biological, or both.

Mechanical filters use inert materials, such as sponges, fabric, or paper, to filter physical debris out of the water. Most also use activated carbon to absorb harmful chemicals. Mechanical filters need regular cleaning and maintenance to work properly. These filters can be internal (placed on the bottom of the pond) or external (located outside the water, connected by pumps).

Biological filters use bacteria growing on a substrate such as gravel or a special medium to decompose organic wastes and chemicals in the water. A properly set up biological filter requires very little upkeep. Some biological filters are external, and some are internal. A biological filter usually has some sort of strainer to trap large detritus before it can clog the living filter bed.

Aquatic Plants

Plants define the very nature of a water “garden.” Most water plants require full sun to thrive and flower. Plants have many purposes. They are beautiful and add to the health of a pond. They aerate the water. They provide food and protection for aquatic animals. They shade the water, thereby cooling it in the summer. Aquatic plants can be divided into three groups: oxygenator plants, floating plants, and marginal plants.

**Oxygenator plants** live completely in the water or are just barely emergent. They may or may not be anchored to the bottom. The primary purpose of oxygenator plants is to increase the oxygen levels available for pond animals. Good oxygenator plants include *Cabomba* sp., elodea/anacharis, water milfoil, and *Vallisneria* sp. Oxygenator plants should number one plant for every two square feet of pond surface.

**Floating plants** are aquatic plants that float on the surface of the water with their roots dangling below them. They may take root into the bottom, but their leaves float on the water surface. Floating plants should cover 60 to 75 percent of the water surface to reduce problems with algae. This is especially important if fish or other animals live in the pond. Duckweed, water clover, parrot feather, water lily, and lotus are all floating plants. Floating plants not anchored to the pond bottom can migrate over the surface of the pond, depending on water currents and wind direction.

![FIGURE 2. Water lily is a good floating plant for a pond.](image)
**Marginal plants**, also called bog plants or marsh plants, are species that like their feet wet but their tops growing above water. Some are planted beside the water feature with their leaves weeping into it; others prefer shallow submersion of their roots along the edges of the pond. Marginal plants include sweet flag, jack-in-the-pulpit, *Canna* sp., *Equisetum* sp., *Sagittaria*, and *Primula* sp. Marginal plants should number one plant for every two square feet of pond surface.

**Fish and Snails**

Fish are an attractive and functional addition to a pond. One function they serve is to eat mosquito larvae, thereby keeping mosquito populations in check. There should be no more than 1 inch of fish for every 5 gallons of water in the pond. If you want four 6-inch-long koi in your pond, you will need at least 120 gallons of water \((4 \times 6 = 24; 24 \times 5 = 120)\). Adding more fish than recommended puts a serious strain on the ecological balance established in the pond.

Snails are another important pond addition. They help to reduce problems with algae growth since they are algae feeders. It is easy to have too many snails. Aim to have 1 inch of snail for every square foot of bottom surface in the pond.
CREATE A SMALL POND

Once the decision has been made to have a water feature, the installation process can begin.

**Liner-Size Determination**

The size of the liner needs to be determined if you are not using a preformed pool. Use the following formula to calculate the proper liner size: Add twice the pool’s depth to its width, and add an extra 2 feet. Do the same for the length of the pool. This will give the liner’s needed dimensions.

Example: An oval pool 4 feet wide, 7 feet long, and 2 feet deep

Width: \(2 \times (2 \text{ ft.}) + 4 \text{ ft.} + 2 \text{ ft.} = 10 \text{ ft.}\)

Length: \(2 \times (2 \text{ ft.}) + 7 \text{ ft.} + 2 \text{ ft.} = 13 \text{ ft.}\)

Note: If fish are desired in the pond, the minimum water depth should be 24 inches, with 32 inches or deeper preferable.

**Pond Layout**

Once the liner is obtained, mark the pool’s layout with a garden hose or piece of rope, allowing an extra 2 inches all the way around. In general, simpler shapes work best. Stand back and observe the layout from all angles. If possible, observe it from above as well. Once the desired outline is obtained, place stakes to mark the corners or to hold the hose or rope in place.

**Excavation**

Remove the turf. Be sure to remove enough for any planned edging material, too. Begin to dig the hole, being sure the sides are angled at about 20 degrees to prevent their caving in and to keep the liner in place. If shelves are desired for marginal plants or rock landscaping, take these into account with your digging. Plant shelves are generally 10 inches deep by 10 inches wide. Dig an extra 2 inches deep to account for a substrate layer of sand. Excavating can be done by hand or with a small Bobcat™ digger. If a waterfall or cascade is planned, dig a hole for a foundation of brick, compacted gravel, or cinder blocks.

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Water seeks its own level. Any discrepancy in the height of the pond’s rim will be very obvious and can shorten the life of the liner by exposing it to UV light. Check for level by using a long, straight \(2 \times 4\) and a carpenter’s level. For a small pool, simply bridge the span with the \(2 \times 4\). For a larger body of water, drive a stake into the center and use it as a pivot. If the pool is out of alignment, shave excess soil from the high side until level is reached.
**Electrical Work**

Rough-in electrical work should be done at this time. A **ground fault circuit interrupter** (GFCI) is a special device that cuts a circuit if either moisture or a short is detected. A GFCI is required. Since any electrical work near water is potentially dangerous, only a qualified electrician should do installation work. If a waterfall is planned, the foundation or footing should be laid at this time.

**Liner Placement**

To protect the liner from damage, remove any rocks, debris, or roots. Smooth out lumps and holes by tamping in loose soil. Add a 2-inch layer of fine, damp sand over all surfaces. Use a concrete float or a board to smooth the surfaces.

Lay the liner out in the sun to warm it up a bit and make it more flexible. Using a helper, center the liner over the hole, draping excess over the sides. Temporarily hold edges in place with stones or bricks. Add about 2 inches of water into the bottom to settle the liner. Begin smoothing the liner, making small pleats if necessary to negotiate curves. Add more water. Continue working the liner into place, adding a few inches of water at a time, until the pond is full.

Trim excess liner from the sides, leaving about a 6-inch margin to be tucked under the selected edging material, such as tiles, bricks, or stone. If mortar is used, the pool will need to be drained using a siphon or submersible pump to remove any chemical impurities.

**CONSTRUCT A WATERFALL FEATURE**

Waterfalls and cascades add life to a garden. They are attractive to both people and wildlife, they are relaxing, and they mask noise pollution.

Building a waterfall requires some designing. First, a catch basin needs to be created. Often this will be a pond or fountain base, but it can also be a rock pool, a flower pot, a half barrel, or even a stream. It is important to design the fall so that the water will hit the catch basin far enough out to avoid too much being lost from splashing.

Decide how the water is to be supplied to the waterfall. Most falls will run recirculated pond water pumped from below. Before construction of the upper basin, a good idea is to run...
some 2-inch-diameter PVC pipe from the bottom of the fall to the future top. This can be hidden in construction, since it will be used only to run the plumbing tubes. Use of PVC pipe allows the flexible hose to be easily replaced if it springs a leak. If the waterfall demands a high volume of flow, rigid piping is best.

Build the upper basin or cascade port out of solid materials. Even if the waterfall is only a few inches in height, it can still be a safety hazard if it is unstable. Water should flow in a natural fashion down the falls or should be directed through a channel in a more formal installation. The projection channel should be tilted slightly downward to encourage the flow of water. If water is clinging to the end of the projection channel, a reglet should be cut. A reglet is a small groove cut all the way across on the underside of the channel to break the surface tension of the water. It allows the water to fall rather than stick to the wall or channel.

If the waterfall or cascade is not formed of gunite, it should be lined with EPDM liner for the entire length. Otherwise, water will be lost, significantly lowering water levels in the pond or basin.

**Summary:**

Ponds are the most common human-made water feature. A pond can be made of concrete, clay, preformed fiberglass or polyethylene, or a flexible liner.

Water circulation is vital to pond health. If no filter device is in use, the water circulation rate should be once every one to two hours. Water circulation can be created by using a fountain or waterfall to oxygenate the water or by using a filtration system. Filters can be mechanical, biological, or both.

Oxygenator plants, floating plants, and marginal plants are the three main categories of pond plants.

There should be no more than 1 inch of fish for every 5 gallons of water in a pond.

Installation of a small pond involves liner-size determination, pond layout, excavation, electrical work, and liner placement.

Waterfalls and cascades are attractive to both people and wildlife, they are relaxing, and they mask noise pollution. Building a waterfall requires some designing.
Checking Your Knowledge:

1. What materials are used to make ponds?
2. How is water circulation in a pond achieved?
3. How do the different filtration systems compare?
4. What considerations need to be addressed when working with aquatic plants and fish?
5. What steps are taken to install a small pond?

Expanding Your Knowledge:

Conduct research to install a water feature at your school or home. Determine the materials needed. Think through the process of installing the feature.

Web Links:

Water Features
http://www.water-features-online.com/Site_Map.html

Creating Water Features in the Landscape
http://msucares.com/lawn/landscape/types/water.html

Water Features: Ponds, Fountains, and Waterfalls
http://www.landscapenetwork.com/topics/water.shtml

Backyard Pond
http://www.nrcs.usda.gov/Feature/backyard/bkpond.html

Agricultural Career Profiles
http://www.mycaert.com/career-profiles