

HOW-TO Build A Traditional Koi Pond

The peaceful sounds of waterfalls and exotic and colorful fish are not only for enjoyment when on vacation at your favorite resort. More and more, koi keeping is becoming a mainstream and very popular hobby. Recent advances in koi pond filtration along with growing popularity of water gardening have helped in the growth of the koi keeping hobby which was once practiced only between friends and koi clubs. Such growth has spawned many books, videos and magazines dedicated solely to the hobby of koi keeping.

In this section we will build and discuss one of the many ways in which a koi pond can be designed and constructed. It should be noted that there are many different types of designs and construction techniques for both the koi pond and the filtration system. This article is geared to the beginner for a basic koi pond construction and does not cover installation of mid-water drains or jets (TPR's & GPR's) which are used to create a predetermined underwater current to guide debris and waste to a particular location in the pond. These items are illustrated in the Plumbing Diagram of this article for those that choose to install them. For larger or more intricate design that might require professional assistance [Contact Us](#), we will be glad to help. Remember to ALWAYS follow all the manufacturer's instructions and to wear all safety equipment as needed such as gloves, eye wear, etc.

You must first check with local and/or state laws and regulations as to any permits that may be required and for building codes such as depth, set-backs, etc. After a location for the koi pond is chosen you should call the utilities companies to have them locate any pipes, cables or wires that might be buried and in the way. Most cities have a service that will locate these possible obstructions for free or for a nominal fee.

When choosing a design for your koi pond you must determine if the pond will have a natural "in ground" appearance with stone waterfalls and a natural stone pond edging or a more traditional design which tend to be more geometric in shape, are usually built using concrete and are above ground in design. In this article we will follow along in the construction of a traditional koi pond which will be built in ground using [.45 mil EPDM liner](#) and designed to have a natural look with a waterfall and natural stone edging.

Next you must decide on the overall size in feet and in gallons as these measurements will determine the size and type of the filtration system that will be required. **Gil Soto is the Construction Manager at Florida Water Gardens, has a BA in Environmental Technology and is also the Director of Research & Development for [PondmanUSA™ Pond Products](#) warns new hobbyists and contractors alike, "This is the most important part of the project because if the wrong type and size of filtration system is selected the**

project is doomed for failure before the first shovel hits the ground.” To determine the gallons of your koi pond multiply the dimensions of the pond in feet by 7.48 to convert from feet to gallons (Length x Width x Depth x 7.48 = Gallons). Example: If your pond has the measurements of 10 feet long by 7 feet wide by 4 feet deep. The formula would be $10 \times 7 \times 4 \times 7.48 = 2094.4$ gallons. Gil recommends that the filtration system you choose will filter the amount of water in the koi pond and also the amount of fish you plan to put in the koi pond. **“I always design my filtration systems to have the ability to filter a minimum of 30% more than the pond will need”** said Gil. Using a larger filtration system than required allows for future growth into the hobby by the customer, in other words, adding more fish than it was designed for. **Gil adds, “I would highly recommend getting assistance from a professional who is knowledgeable in traditional koi pond building when designing a filtration system for your koi pond. It is important that the professional giving the advice know the difference in building koi ponds and building water gardens with koi in it because there is a HUGE difference between the two!”** Have photos of the area and a sketch with dimensions of the koi pond and the distance between the location of the koi pond and the location where the filtration system will be located. Be prepared to spend significantly more on filtration equipment when building a traditional koi pond than when building a water garden. This is partially due to there being more equipment and parts needed and that traditional koi ponds do not come in a kit form as those that are available when building a water garden.

The first step will be to spray paint the design of the koi pond onto the ground. Spray the design one foot larger than the dimensions of the actual pond dimensions. This additional foot will be used as a shelf area for placing the natural stones which will create the pond's edging. Remove the sod as needed using a sod-cutter which can be rented for the day at your local tool rental shop. Once the sod has been removed check that the area where the pond will be installed is level. You can do this by using a transit or line level. You can raise any of the pond edges that might be low with the dirt you will be removing when digging the pond.

Start by digging the whole pond area 10 inches deep while throwing the dirt to the area where the waterfall will be located. While creating the dirt mound for the waterfall make sure to use a hand tamper or a vibratory tamper to compact the dirt every 6 inches to 8 inches. Now leave 12 inches from the edge and spray paint the actual pond dimensions inside the area that you just dug. The 10 inch area will become the shelf area for the natural stone that will create the pond's edging. Leaving the 10 inch area alone you can start to dig to the desired depth. Make sure to dig the pond's walls as vertical as possible. Repeat these steps until you reach your desired depth.

Once the pond is completely dug it is time to install the bottom drains. The [bottom drains](#) will be responsible for removing the solid fish waste and other

debris that sink to the pond's bottom and send it to the settling chamber where it can be removed when backwashing the system. The pond's size and design determines where and how many bottom drains you will need. For this pond we will install two bottom drains. Place the bottom drains to be equidistant from all sides and each other. Once you have decided where to install them in the pond, pitch or grade the bottom of the pond towards the bottom drains so that the drains are the lowest point. A grade of 2 to 3 inches of pitch for every 5 to 6 feet of length works well. **“This is very important in creating a flow that will be more conducive for the fish waste & debris to enter into the bottom drains” Gil points out.**

Dig a trench wide enough to fit 4 inch PVC from the location where the filtration system will be installed to the edge of the pond. Continue the trench into the pond by carving a “notch” on the pond's wall down to the pond's bottom and then continue to the location in between the two drains and glue a PVC “Tee” fitting on that end. Make sure that the drains are level and at the correct depth in relation to the bottom of the pond then connect them to the 4 inch PVC pipe and then connect each drain to each side of the PVC “Tee” fitting. Run the PVC through the trench at the pond's bottom, up the wall and to the location where the filtration will be installed. Once that's done backfill and compact firmly the hole around the drain.

At this point you want to install the [mechanical skimmer](#). Place the mechanical skimmer at the opposite end of the pond to the waterfalls so that the surface debris can easily float towards the skimmer without having to fight the waterfall current. Measure the skimmer from its bottom to the area of the skimmer that will be at ground level. From inside the pond carve out the area where the skimmer is to be located that is as deep as your measurement and as wide (side to side and front to back) as your skimmer. Once you have it in place run a string level from 1 inch below the skimmer's opening to different points of the pond. Any adjustment can be done by adding or removing dirt from the area where the skimmer rests on. Dig a trench large enough to accommodate 2 inch PVC pipe from the opening at the back of the skimmer to the location of the filtration system. Inside the skimmer connect a piece of 2 inch PVC that is 3 inches shorter than the skimmer bottom to a PVC 90 degree fitting. Now connect the 90 degree PVC fitting to the 2 inch pipe at the back of the skimmer. This is where the pump will draw water from at the skimmer. Finish by backfilling around the skimmer making sure to keep the skimmer level in all directions.

To install the liner you might want to get some help. Unfold the liner completely inside the pond being careful not to step on the bottom drains. Pull as needed to remove as many of the folds in the liner as possible. Later, when the pond starts to get filled with water, you will have another opportunity to remove those smaller folds.

Next install the upper portion of the bottom drain unit and attach the skimmer to the liner. These are both simple installations that usually only require a screwdriver, silicone and a razor knife. ALWAYS refer to the manufacturer's instructions for more detail on your actual equipment and installation. (NOTE: Do not cut the excess liner yet, all the trimming should be done once the system is completed and operational as to make sure there are no leaks or need for extra liner in any one certain area.)

To create a natural looking pond edging by randomly placing varying size and shape rocks and boulders on the 10 inch shelf that borders the pond. When placing the stones make sure that they are stable and do not shift or wobble.

“When building a waterfall it is important to create a feature that will be in scale to the pond and overall appearance. Too small of a waterfall will disappear from view while too large of a waterfall will look unreal and out of place,” cautions Gil. Take the compacted mound and carve steps at varying heights and widths. These will become your waterfall's “drops” or spillways. At the top of the waterfalls carve an area to recess what is called a [waterfall weir unit](#). Waterfall weirs are units that make it easy to plumb, attach the liner and create the initial spillway for the waterfall. Make sure the waterfall weir is level from side to side and have a very small pitch towards the pond. Prime & glue Flex-PVC to the back of the weir and run it to where the filtration will be installed. Backfill around the waterfall weir and install the waterfall liner next.

Install the waterfall liner by placing the liner at least 1 foot into the pond and up towards the waterfall weir following the contour of the steps you carved for the waterfall drops. Next, attach the liner to the waterfall weir as per manufacturer's instructions. Most waterfall weirs are easily installed using a screwdriver, silicone and a razor knife. Once the silicone dries you can start to stack your waterfall stones. Do not cut the excess liner yet, all the trimming should be done once the system is completed and operational as to make sure there are no leaks or need for extra liner in any one certain area.

Now it's time to connect all the pipes to and from the pond to the filtration system and pump. **“You don't have to become a Biological Engineer but it is important to understand and familiarize yourself with the capability and function of each piece of equipment that composes your filtration system,” Gil suggests.** This filtration system consists of a [settling chamber](#), an [external pump](#), a [pressurized media biological filter](#) and an [ultraviolet sterilization unit](#). **“The settling chamber will collect most of the debris and waste from the water that passes through the bottom drains and skimmer before it can reach and clog the biological filter. Settling chambers are routinely backwashed to remove the collected debris and waste. The pump takes water from the pond via the bottom drains, skimmer and settling chamber then passes it through the pressurized biological filter and UV light and returns the water to the pond through any combination of ways such as**

waterfalls, jets (TPRs & GPRs) and/or fountains. The biological filter removes the chemical waste from the pond water and creates a healthy and safe environment for koi and other aquatic life by creating an environment conducive for beneficial bacteria (Nitrosomonas & Nitrobacter) to grow. Pressurized biological filters must also be routinely backwashed. From the pressurized biological filter the water is passed through an ultraviolet sterilization unit (commonly referred to as UV lights),” Gil explains. An ultraviolet sterilization unit alters the DNA of organisms, bacteria, algae and viruses thus rendering them sterile and ending the reproduction cycle.

Before beginning the filtration system installation you need to lay out all the equipment as they will be placed to make sure you have enough room. Pour a concrete base or use concrete pavers to stabilize the area for the filtration equipment (pump, filter and UV sterilizer). Place the equipment on the concrete base spaced accordingly. First install the plumbing for the RETURN portion of the filtration system which runs from the pump back to the pond. (NOTE: The size of the PVC pipe to be used will be according to the size of the system being installed.) Using PVC pipe, plumb the RETURN side of the pump (fitting on top of pump) to the INTAKE side (should be marked) of the biological filter. Next, plumb the RETURN side of the biological filter to one end of the UV sterilizer (preferably the bottom if installed vertically). Now attach the pipe going to the waterfalls (or jet, fountain, etc) to the other end of the UV sterilizer. The RETURN portion of your pond’s filtration system is now complete!

The INTAKE side of the pond is a little more complex. First dig a hole large enough to sink the settling chamber into the ground. Install the waste plumbing at the bottom of the chamber as per the manufacturer’s instructions. Then place the chamber in the hole. The depth that the chamber has to be buried is determined by the water level in the pond. You might need to rent a transit if your yard is not perfectly level. The water level from the pond should be approximately 4 inches to 6 inches from the top of the chamber. Once this is achieved attach the 4 inch pipe from the bottom drains to the inlet located on the side and towards the bottom of the chamber.

Using a holesaw, cut a hole approximately half way down the chamber on the side that is closest to the pump. Install a bulkhead fitting and screw a 2 inch male threaded adapter to each side of the [bulkhead fitting](#). In the inside of the chamber install a piece of 2 inch pipe and a 90 degree fitting, as you did in the skimmer, but this time you want it to face upwards and be approximately 12 inches beneath the water level. Now run a piece of 2 inch PVC pipe from the outside of the chamber to just in front of the pump. Install a 90 degree fitting and a piece of 2 inch PVC pipe to go from underground to a [3-port valve](#)’s INTAKE side. Then attach the 3-port valve’s RETURN side to the pump’s INTAKE (fitting on the front of the pump). The final step is to attach the PVC pipe from the skimmer to the other INTAKE side of the 3-port valve. **“Installing a 3-port valve allows you to adjust between how much water will be drawn from the**

bottom drains/settling chamber and skimmer to the external pump. In the fall you might want to have your skimmer doing most of the suction in order to get most of the leaves so you adjust (turn) the 3-port valve to open the skimmer suction port more while partially closing the bottom drains port. By-passing the skimmer water from the settling chamber directly to the external pump is not as efficient in removing small particles that pass through the skimmer but is a good trade-off when installing a pond in a location that will have a high amount of leaves going into the pond,” Gil points out.

Final steps are to add water, fire up the filtration system and check for leaks. Let the system run until it cycles, use a [water quality test kit](#) to check the water quality (ammonia, nitrites, nitrates, etc.) and if all is okay.....add koi. Then sit back, RELAX and ENJOY!

If you need assistance with your traditional koi pond design and/or help in designing and selecting the proper traditional koi pond filtration equipment do not hesitate to [Contact Us](#).