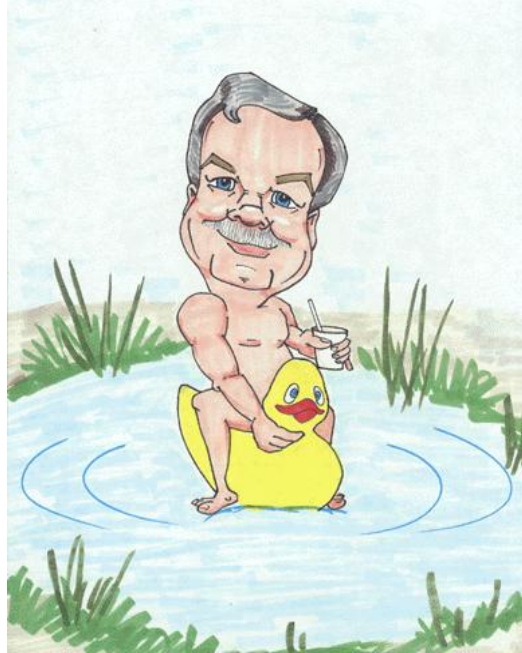




## Chapter 13

# How To Build A Lake Or Pond

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## **Your own swimmin' hole**

A pond or small lake can be a fun and attractive addition to your rural property. Ours is used as a combination swimming pool, fishing pond, and scenic element. Adding a reliable source of water increases the usability of your land for wildlife. A correctly built pond is essentially maintenance free so is an ideal project for retirement property.

We find that we enjoy our pond much more than the swimming pool we had behind a suburban house we once lived in. There is continuous fish, turtle, bird, and animal activity. There is so much interesting stuff happening in and around our pond that it is fun and relaxing to just sit and watch. Even covered with ice and snow, our pond provides a lovely scene from our living room windows.

## **Get expert help**

Ponds and small lakes are an interesting subject. Around our area in Missouri, I would guess that less than half of all ponds built hold water as intended. Surprisingly, I believe most of the mistakes made in their design and construction are pretty obvious to anyone who spends a little time studying the subject.

It is not really necessary for you to become an expert on pond and lake construction. You will be relying on other experts for most of the work. You should, however, become familiar enough with the subject to be able to know when you are

talking to an expert or an amateur. Also, it may help evaluating properties to have a feel for pond location and watershed issues.

## Getting started

A good place to start is to read a good book. So far, the best non-technical book I have come across is "Earth Ponds" by Tim Matson. It is published by Countryman Press and is available through many sources including amazon.com.

Tim Matson's book is easy reading and will give you some basic technical knowledge. There are more technical books and documents available from universities and various government agencies. Missouri has a nice basic pamphlet on ponds. No doubt other states have similar documents.

The Missouri Conservation Department document "Pond Handbook" is available on line at <http://www.conservation.mo.gov> in their "Private Land" section.

When it comes time to get serious about designing your pond, the USDA document listed below is what you want. It would probably be worth printing this one out or ordering a hard copy. It is:

"Ponds - Planning, Design, Construction"  
United States Department of Agriculture  
Soil Conservation Service  
Agriculture Handbook Number 590

It is also available on-line from Alabama Cooperative Extension System:

<http://www.aces.edu/dept/fisheries/aquaculture/docs/AgHandbook.pdf>

This USDA book covers the subject of pond construction well with extensive watershed runoff calculations, and pond layout and dam construction graphics. It is, however a technical manual that you use for reference. The Matson book above gives a better feel for the subject.

Now, instead of making you read through all that stuff above, I'll summarize below things I found helpful in building and maintaining a pond.

## **Watershed**

For most of the Midwestern states (with heavy clay soil), watershed area should be eight to ten times the surface area of your pond. There are lots of factors that effect that ratio but that is a good starting value. I've seen good ponds with watershed ratios from two up to over one hundred times the pond surface area.

An optimum watershed is a large, gently sloped, un-mowed forest area. The least desirable would be a steeply sloped bare grass or pavement area. The issue is peak runoff rate compared to average runoff rate. USDA 590 above quantifies this quite well. Average runoff rate effects how full a pond will stay. Peak runoff rate determines how fast it will fill and how bad the erosion potential is for your spillway once it is full.

Another issue is runoff water quality. Muddy runoff produces excessively cloudy water and gradually fills the pond in. Fertilizer or animal waste runoff from agriculture increases weed and algae growth.

## **Pond size**

It is possible for a pond to be too small or too large for its watershed. Too small and it will silt in quickly or perhaps be overwhelmed and the dam washed away in a heavy rainstorm. If it is too large, it may fill only infrequently and the water level will vary.

Agricultural ponds tend to be built toward the too-large end of the scale. They are sized to capture maximum runoff and a varying water level isn't very important as long as water is available for use.

Recreational ponds are built toward the small-end of the scale. They are sized to remain full or close to full most of the time and allow excess water to spill away. We get about forty inches of rain per year in the Ozarks. About twelve inches falls in spring, twelve inches in summer, twelve inches in fall, and six inches in winter. Having the rainfall spread out over the warm time of the year like this makes it easier to have a relatively constant level in the pond.

If you know the watershed size and slope, what kind of foliage it has, and soil information, you can use USDA 590 to make a pretty good guess about runoff totals and maximum rates. Even that will still be an estimate. Any number of things could throw the calculations off. There is a significant element of luck in building a pond.

For size calculation purposes, the number you need is called Transpiration Rate. This is the sum of the rate at which water evaporates from the surface of the pond and the rate at which it soaks into the bottom of the pond. The number is in fractions of an inch per day.

Evaporation rate depends, of course, on water surface temperature, relative humidity, and wind speed. How fast the water soaks in depends upon soil conditions and ground water content around and below the pond. I never did nail down an accurate value for our pond. I ended up guessing at about one half inch per day annual average. That indicated that we would need the runoff from three or four acres per acre of watershed per acre of pond surface. Doubling that to six to eight to allow for other losses put us close to the eight to ten ratio mentioned above so I left it at that. The subsequent survey by the state soils department came up with approximately the same number.

Once our pond was built I was able to measure the actual water loss during hot dry weather. It turned out that the water level dropped only about one quarter inch per day. That is an exceptionally good number. Most ponds around us tend to the one half inch or greater range. Our pond does spill after a heavy rain but losing water over the spillway is much less important to us than having a full pond most of the year.

## **Pond depth**

Optimum maximum pond depth is eight to twelve feet. Less than eight feet can allow waterweeds to take over the entire pond. Unless the pond is several acres in size, oxygenation in water deeper than about twelve feet will be too low for fish so may add unnecessary construction cost.

A couple articles I read indicated that about twenty percent of the surface area of the pond should be covered with water plants and weeds. This is supposed to provide good oxygenation and also shelter for young fish. You can establish a twenty percent maximum coverage value by how you slope the underwater part of the pond. Most weeds do not grow deeper than about three feet. Five feet is the typical maximum for even obnoxious plants like Cattails. Allow some area for water plants to grow but keep most of the pond deeper than five feet. An easy way to do this is to make the pond shape irregular with some shallow fingers.

Even though we have adequate shallow areas to allow a twenty percent plant cover, the fish and turtles keep things trimmed back so we probably have only about two percent cover. So far that has worked out OK for us.

## **Site survey**

We contacted the local state soils office. They came out and surveyed the pond area and designed a dam for us...for free. That was really great. That service is available in many states. The dam they designed called for eleven hundred cubic yards of fill. It produced a pond with about one acre surface area.

## **Finding construction contractor**

Finding someone to build your pond is difficult because everyone you talk to will have a friend, neighbor, or relative that owns a tractor that they would like you to hire. You will have to locate an experienced and successful pond builder. He will probably not be the cheapest bidder. I would recommend against going cheap on this job. Check with local farmers, ranchers, and construction contractors for a recommendation.

## **Dam construction details**

Construction of the dam should be held off until soil conditions are correct. If the soil is too dry, it will not pack properly. If it is too wet, it will not hold its shape as the dozer tries to work it. The dam base will be scraped bare to subsoil level. An eight foot wide, two foot deep core trench will be dug along the center of the dam base. The dam will then be built up in layers, several inches at a time. A layer will be spread and the dozer will walk back and forth on it with its cleats or it will drag a sheep's foot roller over it. That process is repeated until the dam is completed. It is critically important that heavy machinery, such as a dozer be used to pack each layer. A backhoe is not heavy enough for the job.

## **Spillway**

Another important part of the dam is the spillway. Every dam must have a spillway to protect it from overflow washout. This is especially critical with recreational ponds that are more likely to overflow during heavy rainstorms. The spillway exit slope must be shallow to minimize erosion. Erosion increases rapidly with water velocity. On ours, the spillway ended up being curled around behind the dam. The spillway should be cut in undisturbed native soil. It is never run over filled soil unless it is very carefully and thoroughly lined with rock or concrete. Ours is now completely lined with rock but we did that work ourselves over the years since the pond was built. It was a handy place to get rid of rock dug up during house construction and landscaping.

Many pond plans call for drainpipe installation. They are supposed to be a handy thing to have but from what I have been able to determine, they are also a major cause of dam failures. It is very difficult to get the soil packed properly around a drainpipe and leak collar. You can't just drive the dozer back and forth over them. Given a choice, experienced dam builders will leave them out. We rely on our spillway for level control. It will be a pain if we ever have to drain the pond but that is not very likely in our lifetimes.



## **Pond break-in**

New ponds are usually muddy and ugly. It takes a couple years for a big one to normalize. You can help the process along by getting a bucket of water and mud from a nearby mature pond that has a good biological balance. Dump that into your pond to seed it with the proper algae and bacteria. Most mud bottom ponds never become very clear. Optimum visibility is actually only about three feet. Clearer water will allow too much sunlight to reach the bottom of the pond and allow weeds to grow there. Visibility is measured with a gadget that looks like a pie tin with alternating white and black quarters nailed onto the end of long stick. You just shove the thing down into the water until you can't make out the white and black disk. Spreading grass seed around the pond will help stabilize the local soil to reduce the muddiness of runoff.

## **Pond maintenance**

There is usually a lot less maintenance with a pond than with a concrete swimming pool. Mowing and weed-eating the grass and weeds around the pond is most of it. The water in a pond with good biological balance normally needs no monitoring or care. A Pond that doesn't spill often may need to have a spray aerator (\$750 to \$1500) floated in it. Once you get above about half an acre in size, ponds tend to take care of themselves pretty well.

Trees should never be allowed to grow on dams. When trees on dams die, their roots rot out and channels for leakage are opened. Those channels will enlarge from water flow, sometimes destroying the dam. Around here people usually mow the grass on their dams on a regular basis. This keeps the woody plants from getting started. It is just a bit tricky if you are using a riding mower.

Part of good biological balance is fish, turtles, and frogs. They take care of many of the potential insect problems you might encounter, such as mosquitoes. You will have to stock the fish but the turtles and frogs will likely come on their own. We stocked ours with Bluegill not long after the pond was built. A couple years later we, after the Bluegill had chance to get established, we added Bass.

You should never allow Cattails or Duckweed to become established in your pond. Cattails will aggressively fill the pond in. Duckweed can quickly cover the entire surface of the water, shutting off oxygen production in the pond.

As for adding decorative plants like Water Lilies, they are supposed to be just fine since they have limits as to how deep they will go. They do, however require the water level to not vary more than a foot or so under normal conditions. We haven't had much luck with Water Lilies because the turtles eat them before they can become established. We have had better luck with marginal (margin of pond) plants like Water Iris and Pickerel.

## **Swimming**

The biggest problem with pond recreation is how much mud is stirred up. Since the bottom of our pond is almost pure clay, this was a problem for us. What we did was buy a truckload of Pea Gravel (three eighths inch clean limestone gravel). Pea Gravel is heavy enough that it does not wash away in the rain or with the mild wave action in a pond but is small enough to not be too bad to walk on. We spread a thin layer around a small area next to the pond as a play beach. Grass eventually grows through it but the gravel keeps the wet ground firm. We then put a six or eight inch



layer of Pea Gravel on the mud in the pond next to that beach. We stomped the Pea Gravel into the mud. The gravel firmed up the bottom so we can walk into the water without sinking in or stirring up large clouds of mud.

One thing to keep in mind with pond swimming is the water is not chlorinated. Try to avoid swallowing the water. You probably won't catch any major diseases but you should be careful.

## **Swimming with fish and other water critters**

You generally don't need to worry about disturbing or being attacked by wildlife in the pond. Other than an occasional tickle from a small fish giving you a curious nibble, you won't even know there are lots of other critters in the water with you.

Even Snapping Turtles are not a problem in the water. They are very aggressive and dangerous if confronted out of the water. In the water they are very timid. They swim away and hide if bumped or stepped on while in the water.

## **Fishing**

Once a stable population is established, feel free to catch and eat pond fish. Removing some of the larger fish can actually help the overall health of the pond. For the most part, it is OK to remove the larger fish versus throwing them back. Larger fish are predators on smaller fish so it is possible to reach a state called 'stockpiled' where there are no medium size fish. The larger ones eat all the smaller ones before they can grow.

Anyway, that is probably enough to get you started. Don't let the volume of information bother you. What you are shooting for right now is a feel for the technology, not in-depth knowledge. Enjoy the process.

