Ponds

New Pond Construction

Building a pond is a practical way to supply water for work or play. Many ponds built in the early years of conservation were constructed for a particular job on the farm, often as a water source for livestock. Now ponds are built for a variety of purposes including storing water for irrigation, recreation, aesthetics, and fire protection. Ponds also trap sediment that would otherwise pollute our streams.

So You Want to Build a Pond

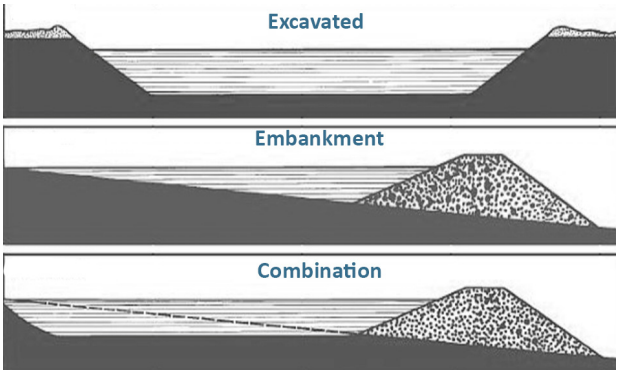
There are several things you will need to consider if you plan to construct a pond on your property:

- If you want a crystal clear swimming area, you will be much better building a swimming pool. The price may be comparable.
- If you are worried about the safety of your household or neighbors while they are in or around your pond, we recommend that you teach them about water safety before you develop your pond.
- To build a minimum sized pond (1/4 acre) we recommend a minimum 1/2 acre (21,780 square feet) of stock piling and turnaround area.
- The State of Ohio has a dam safety law governing the impounding of water. The Ohio Department of Natural Resources, Division of Soil and Water has a book explaining the law. Many communities also have laws pertaining to ponds, so be sure that you and your engineer comply with them.
- Check the laws regarding your liability in case of injury or death resulting from the use of your pond. You may find that you will need to protect yourself with insurance.

Types of Constructed Pond

Excavated Ponds or dugout ponds, are mostly used where the existing ground is relatively flat. They are normally built where the demand for water is small, and are constructed simply by digging a pit below the surrounding ground level. Surface runoff or groundwater (water table) maintains the water supply.

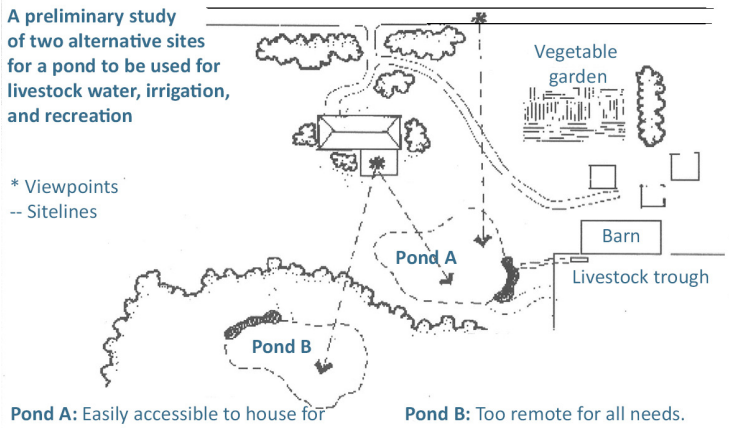
Embankment ponds are the most commonly built ponds in this area. They are suited to areas where the surrounding topography is moderately steep and the bottom is relatively flat. They consist of constructing a fill (dam) across a small watercourse so that the water is impounded behind it. In general, the cost of constructing an embankment pond is less then an excavated pond of equal size due to the amount of soil removed.



Site Selection

Selecting a suitable site for your pond is important. Preliminary studies of any site are needed before making a final decision on a specific site. If you are considering more than one location, study each one in order to select the most practical and economical site on which to build.

For ponds where surface runoff is the main source of water, an ideal site would be one where an earthen dam could be constructed between two moderately steep slopes and where the reservoir is wide and flat. Avoid sites where the pond area would have large shallow areas. Such areas pose problems resulting in plant growth and evaporation losses.



Pond A: Easily accessible to house for recreation, to barn for livestock water, and to garden for irrigation. Visible from house and road.

Pond B: Too remote for all needs. Vegetation must be removed for construction and for view from house.

If there is **excessive erosion** taking place within the watershed, your pond will probably be filled with sediment in a short period of time. If erosion is severe, it is advisable to delay building the pond until the needed soil and water conservation measures to control upstream erosion have been installed.

Do not locate the pond where **failure of the dam** could cause loss of life and injury to persons, property, livestock, railroads, highways, or interrupt the use of service of public utilities. If the only suitable pond site presents one or more of these hazards, employ a registered engineer to reduce the possibility of failure from improper design, construction or maintenance. Cross your t' and dot your i's when it comes to researching your liability and insurance.

Pollution of pond water is always a possibility. This may be minimized by selecting a site where drainage of septic systems, farmsteads, corrals, dumps and similar areas do not reach the pond.

Be sure that no buried pipelines, cable or other utilities cross a proposed pond site. Contact the Ohio Utilities Protection Service two working days before digging at 800-362-2764. If it is necessary to use a site crossed by pipelines or cables, notify the utility company before seriously considering construction. The company's permission must be obtained. This is the landowners responsibility.

Avoid sites under power lines. Wires may cause a hazard to all uses of a pond. If live wires were to fall in the pond or if fishing poles, ropes, etc. were to contact the power lines, severe electrical shock could result.

Avoid building a pond on a site that is too small. The minimum surface area should be 1/4 acre (10,890 square feet). A pond that is too small will probably be an eyesore filled with a growth of unwanted aquatic plants. The area must be large enough to allow proper construction equipment room to work and, in the case of an excavated pond, disposal of excavated materials. The soil removed from a small pond can easily exceed the size in volume of a small three bedroom house. Just imagine a mound of soil

Watershed Area

The size of the watershed, the area that drains into a pond, is very important in site selection. If the watershed is too large, you may have difficulty in preventing erosion and an expensive overflow structure will be needed to bypass excess runoff.

If the watershed is too small, runoff may not be adequate to fill and keep the pond full. In SW Ohio, in order to maintain the recommended depth with one surface acre of water you will need a minimum drainage area of approximately six acres and a maximum of 40 acres.

Sometimes drainage areas can be larger or smaller; however state laws do exist making the practice of diverting or changing natural drainage ways illegal.

Soils

The engineering characteristics of the soils present play a major part in the construction of a pond. Suitability depends upon the ability of the soils in the pond area to hold water. Sites where the soils are fine-textured clays or silty clays that extend well below the proposed pond depth are desirable. Sites where soils are course-textured sands and gravels are generally unsatisfactory. Outcroppings of rock or limestone usually are poor locations due to cracks and seeps which permit water to escape.

Soil Surveys can give you a general idea of the materials you might encounter. You can access the survey by searching online for the **Web Soil Survey**, or time permitting, the staff at the Butler SWCD can assist you with looking up this information.

The best way to determine if the soil is suitable would be to bore or dig test holes over the proposed site. When creating these test holes, make sure you dig deeper than the depth of the proposed pond. In many cases a backhoe should be used to dig test holes, this will allow you to see and determine depths of different geologic materials you encounter and their suitability for pond construction. Butler SWCD can provide assistance in the interpretation of the test holes if appointments are scheduled ahead of excavation.

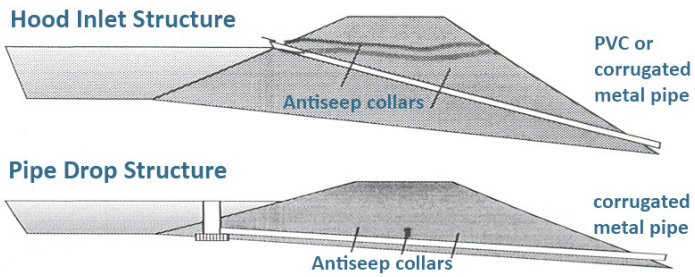
Spillway Requirements

For most ponds, both a principal spillway and an emergency spillway are needed.

The **principal** spillway generally is a type of drop inlet or hooded inlet.

A **hooded inlet** consists of a pipe layered through the fill from the downstream toe of the dam to the waterline on the upstream slope. Once again, the size of the pipe depends upon the required discharge.

Drop Inlets consist of a pipe located under the dam and a riser connected to the upstream end of the pipe. The size of the pipe depends upon the discharge capacity. The size of the riser must be somewhat larger if the pipe is to flow full.



On both of these principal spillways, antiseep collars should extend into the fill a minimum of 24 inches perpendicular to the pipe. These antiseep collars decrease the flow of water along the outside of the pipe through the fill, preventing seeps, dam wetness, and possible failure.

Proper construction and design of principal spillways cannot be over emphasized. Two-thirds of pond failures involve principal spillways.

On both types of ponds, an earthen emergency spillway should be constructed to pass excess storm runoff around the dam. And excess water that cannot pass through the principal spillway would outlet by this method. The emergency spillway is lower in elevation than the top of the dam. Usually located at the end of fill, the emergency spillway allows water to flow freely through this bypass and not over the top of the dam.

Pond Safety

It is very likely that your pond will be used for swimming or boating regardless of the intended main use. Be sure to remove all trees, stumps and brush from the ponded area that is likely to be used for swimming. Also, remove all rubbish, wire, discarded machinery, and old fences. Eliminate drop-offs and holes in the swimming area.

Mark the swimming area with a float line and place warning signs of all danger points. It is also recommended to place lifesaving equipment such as a rung buoys, ropes, planks, and long poles near the swimming area. If ice skating is likely, place a long plank or ladder near the skating area for rescue operations.

Design

Following the initial investigation, and after soil tests have determined a probable location for the pond, an engineering survey or design should be made to determine the dam spillway and other features.

Pond designs usually consist of a profile of the dam, location and size of the spillways, and measurements that provide an accurate estimate of the pond capacity. The plan should show all elevations, dimensions, earthwork estimates, and kinds of building materials required. Consulting engineers can provide you with these types of plans.

Depth: In order to ensure a permanent water supply, the water must be deep enough to meet intended use requirements and to offset the probable seepage and evaporation losses. Ideally, ponds in these areas should have at least one-fourth of the pond with a depth of eight feet or more. Deeper ponds are possible where soils and topography allow it.

Top Width: For dams less than 15 feet in height, recommended top width should be a minimum of 8 feet. When the height exceeds 15 feet, the top should also increase. See table for recommendations.

Height of Dam (ft)	Minimum Top Width (ft)
Under 15	8
15-19.9	10
20-24.9	12
25-34.9	14
35-40	15

Side Slopes: Slopes must be sufficiently flat to ensure a stable embankment, however, in all cases the combined upstream and downstream side slopes of the settled embankment should not be less than five horizontal to one vertical with neither slope steeper than 2:1

Water Color

Very few ponds are crystal clear. Under ideal conditions, a pond is a uniform greenish color with visibility of one to two feet. This color is caused by tiny free-floating plants which indirectly serve as food for fish. Remember that you can swim in a fish pond, but you can't expect fish to live in a swimming pool. Anyone who wants a crystal clean pond should strongly consider a swimming pool.

A pond that looks like 'pea soup' is often caused by an algal bloom. An algal bloom occurs when single cell green algae reproduce at a fast rate, fueled by both sunlight and excess nutrients in the water. Algae that causes green water is not to be confused with string algae (also called blanket weed), which look like a stringy weed that bunches together and often clogs filters and rains.

Construction

Constructing the pond correctly is as important as the initial investigation itself. Careless and shoddy construction can make an entirely safe and adequate design worthless and cause failure of the dam. Good construction is important regardless of the size of the pond and will generally cost less in the long run than trying to repair dams built carelessly.

The **foundation of the dam** is among the most important parts of pond construction. If the dam's foundation is underlain by sands or gravel, a pond failure may occur due to seepage or piping. On most embankment ponds, a core trench or cutoff will be needed to join the foundation with the base of the dam. The trench is cut along the centerline of the dam deep enough to extend into a layer that eliminates seepage. The trench should have a width of eight feet with sides sloped no steeper than 1:1. The trench is then backfilled and compacted into thin layers, 4-6 inches at a time, with good clean clay materials. The fill above the core trench should also be compacted in this way. If poor materials are encountered during excavation of the pond area, some type of sealing may be required.

When placing the principal (pipe) spillway through the fill, the materials around the pipe must be hand or mechanically tamped until it has two feet of cover. The importance of the soil material and soil compaction on the dam and around the pipe cannot be overemphasized. The pond's life expectancy depends largely on this part of construction.

Soon after construction, **vegetative cover** should be established on bare areas to prevent erosion from occurring. Grasses such as fescue are quick growers and easily established. Trees or other woody plants should not be planted or allowed to grow on the dam. They eventually die and water can flow through the channels left by their roots, resulting in a leaky pond. Butler SWCD can provide a list of native, non-invasive plants.

Complete fencing of areas on which embankment ponds are built is recommended **if livestock grazed or fed** in adjacent fields. Fencing ensures clean drinking water and eliminates drainage damage or pollution by livestock. If the pond is to be used for watering, you will either need to install a gravity-fed watering trough just below the dam and outside the fenced area, or have one designated location where the animals can gain access to the pond so the degradation of the banks is minimized.

Sealing Your Pond

Excessive seepage of a pond is usually due to a poor pond site or improper construction techniques. Sites where inadequate soils are encountered should be sealed by "clay blankets" which consist of well graded material containing at least 20 percent clay. The thickness of the blanket depends upon the final depth of the water. The minimum thickness is 12 inches for all depths of water up to 10 feet. Increase this thickness by two inches for each foot of water over 10 feet. Compact the clay materials in layers of 6-8". Existing ponds that have excessive leaks may also need clay blankets.

Other materials used for sealing leaky ponds are:

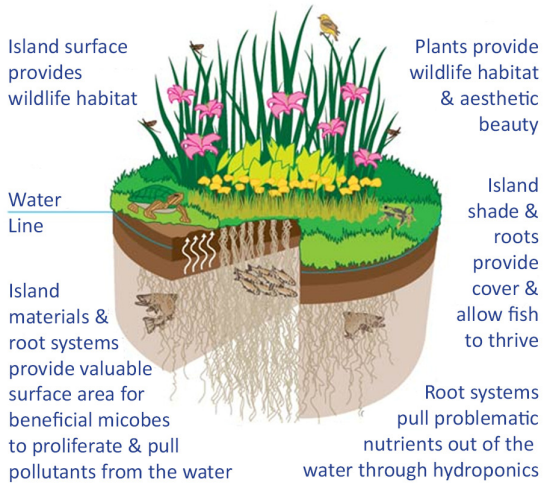
Bentonite is a fine textured colloidal clay. When saturated, it swells to many times its original volume. If mixed with well graded course-grained materials, then thoroughly compacted and saturated, the materials tends to fill pores and blanket the leaking areas.

Chemical treatments can be added to fine-grained clay soils to help in sealing seepage areas. This method can be quite complicated and a laboratory analysis of the soil is essential to determine which type and rate of chemical additives would be most effective.

Waterproof Liners such as polyethylene, butyl-rubber, and vinyl membranes are commonly used. They can virtually eliminate seepage if properly installed. A cover of earth may be needed for some linings to protect against punctures.

Floating Treatment Wetlands

Floating Treatment Wetlands (FTWs) are a newer method of reducing nutrients in your pond, and therefore reducing algal growth. They consist of a buoyant structure, or raft, which supports plants in the water column. They filter and process nutrients, suspended solids, metals, and other pollutants.



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The information contained in this publication was obtained from the US Dept of Agriculture, Natural Resources Conservation Service; the National Association of Conservation Districts; and the Cuyahoga, Lake and Warren Soil and Water Conservation Districts.